

[0175]<Production of photosensitive materials> Photograph forming layers of a presentation shown below were painted one by one on an undercoating finishing transparent PEN base (85 micrometers in thickness) using a silver halide emulsion emulsion and poorly soluble metal salt compound dispersion liquid which were produced by doing in this way, and photosensitive materials of multilayered constitution were produced. A unit of mg/m^2 showed an addition of each raw material as an amount of painting of per 1 m^2 . However, a silver halide was converted and displayed on silver.

[0176]

The 1st layer (antihalation layer)

gelatin 800 ultraviolet ray absorbent (UV-1) -- 200 high boiling point solvent (OIL-2) -- 200 color (A.I. Artificial Intelligence-1) -- 280 color (A.I. Artificial Intelligence-2) -- 240 color (A.I. Artificial Intelligence-3) -- 400 zinc-oxide dispersion-liquid 200 -- the 2nd layer (cyanogen layers color)
Gelatin 1000 Red-sensitive silver halide emulsion-1. 700 Red-sensitive silver halide emulsion-2 580.
a color development chief remedy (A-64) -- 520 cyan coupler (C-1) -- 230 cyan coupler (C-2) -- 160 -- high boiling point solvent (OIL-1) 460 high boiling point solvent (OIL-2) -- the 130 fogging inhibitor (AF-6) 1 -- the 3rd layer (intermediate layer)
gelatin 1200 color (A.I. Artificial Intelligence-2) -- 160 additive agent (HQ-2) -- 20 high boiling point

solvent (OIL-2) -- 60 water-solubility polymer (PS-1) -- 60 zinc-oxide dispersion-liquid 400 -- the 4th layer (magenta layers color)

Gelatin 1800 Green sensibility silver halide emulsion-1. 700 Green sensibility silver halide emulsion-2 580. a color development chief remedy (CD-1) -- 520 magenta coupler (M-1) -- 400 high boiling point solvent (OIL-1) -- 460 high boiling point solvent (OIL-2) -- 90 fogging inhibitor (AF-6) -- 1 water-solubility polymer (PS-1) -- 20 -- the 5th layer (intermediate layer)

gelatin 1200 color (A.I. Artificial Intelligence-1) -- 320 additive agent (HQ-1) -- 6 additive-agent (HQ-2) 20 high boiling point solvent (OIL-1) -- 75 zinc-oxide dispersion-liquid 640 -- the 6th layer (yellow layers color)

Gelatin 3200 Blue-sensitive silver halide emulsion-1. 1340 Blue-sensitive silver halide emulsion-2 1100. a color development chief remedy (CD-1) -- 1040 yellow coupler (Y-1) -- 1060 high boiling point solvent (OIL-1) -- 150 high boiling point solvent (OIL-2) -- a 480 fogging inhibitor (AF-6) -- 2 water-solubility polymer (PS-1) -- 40 -- the 7th layer (intermediate layer)

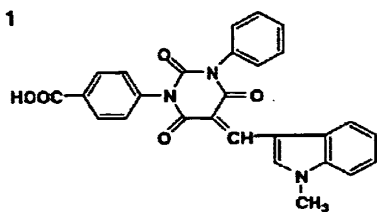
gelatin 2000 water-solubility polymer (PS-1) -- 60 zinc-oxide dispersion-liquid 1200 -- the 8th layer (protective layer)

gelatin 500 mat agent (WAX-1) -- 200 water-solubility polymer (PS-1) -- 120 -- in addition, Spreading auxiliary agent SU-1, SU-2, SU-3, distributed auxiliary agent SU-4, stabilizer ST-1, ST-2, fogging inhibitor AF-1, AF-2, AF-3, AF-4, AF-5, the hardening agent H-1, H-2, H-3, and H-4 other than the above-mentioned constituent were added. It distributed to each layer and F-2, F-3, F-4, and F-5 were added so that the whole quantity might become 15.0mg/m^2 , 60.0mg/m^2 , 50.0mg/m^2 , and 10.0mg/m^2 , respectively. The raw material which used [above-mentioned] it is as follows.

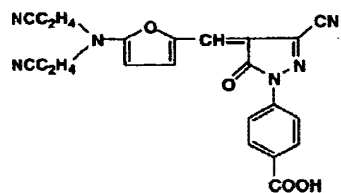
[0177]

[Chemical formula 10]

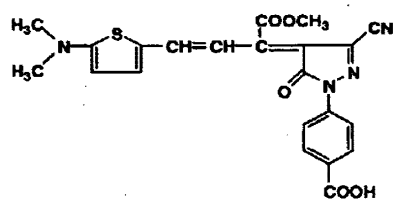
AI-1



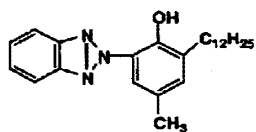
AI-2



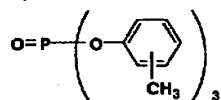
AI-3



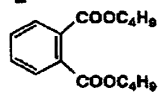
UV-1



OIL-1



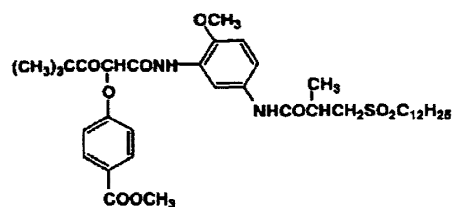
OIL-2



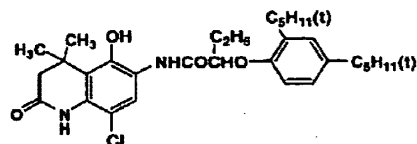
[0178]

[Chemical formula 11]

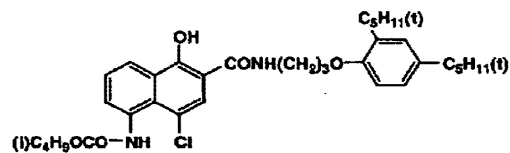
Y-1(イエローカブラー)



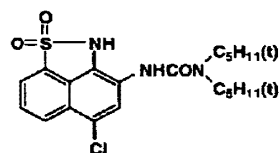
M-1(マゼンタカブラー)



C-1(シアンカブラー)



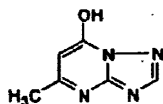
C-2(シアンカブラー)



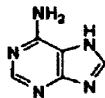
[0179]

[Chemical formula 12]

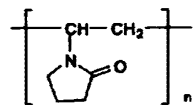
ST-1



ST-2



AF-1,2

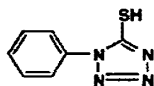


AF-1 Mw=10,000

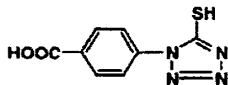
AF-2 Mw=1,100,000

n:重合度

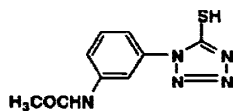
AF-3



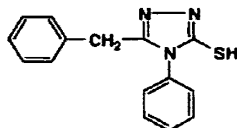
AF-4



AF-5



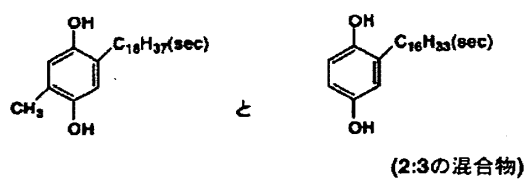
AF-6



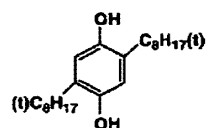
[0180]

[Chemical formula 13]

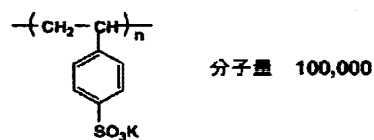
HQ-1



HQ-2



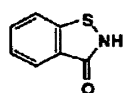
PS-1



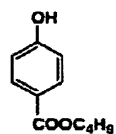
[0181]

[Chemical formula 14]

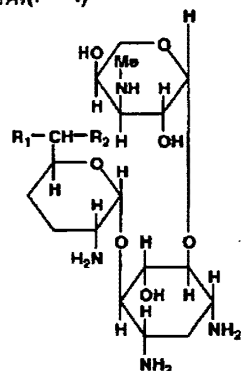
防腐剤(F-2)



防腐剤(F-3)



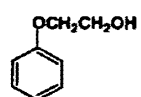
防腐剤(F-4)



	R ₁	R ₂
a	—Me	—NHMe
b	—Me	—NH ₂
c	—H	—NH ₂
d	—H	—NHMe

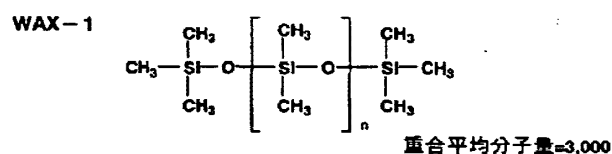
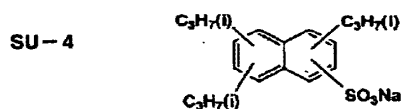
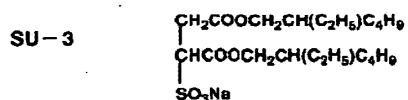
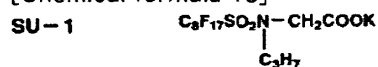
a,b,c,dの1:1:1:1混合物

防腐剤(F-5)



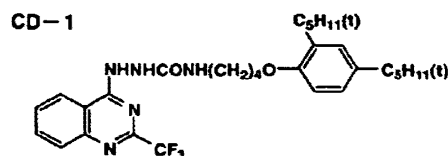
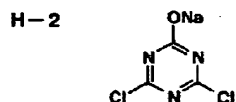
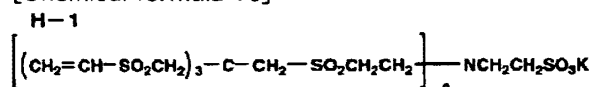
[0182]

[Chemical formula 15]



[0183]

[Chemical formula 16]



[0184][Adjustment of zinc oxide dispersion liquid] 15 g of zinc oxide powder (the Sakai Chemical Industry Co. Ltd. make, FINEX-50) with a mean particle diameter of 0.02 micrometer, As a dispersing agent, TRITON X-200 (product made from 28% of solids concentration; UNION CARBIDE CHEMICALS AND PLASTICS COMPANY INC.) 5.4g, 4 g of ossein gelatin and 75 ml of distilled water were mixed,

and a mill using a glass bead distributed this mixture for 3 hours.

[0185]The glass bead was filtered after distribution and zinc oxide pre dispersion liquid were obtained. These pre dispersion liquid were further distributed by the pressure of 500bars using ultra-high pressure homogenizer GM-1 (product made from S Em TE), and zinc oxide dispersion liquid (1) were obtained.

[0186]When electron microscope observation of the section of the photosensitive materials applied using these dispersion liquid was carried out, it was checked that the zinc oxide particulate with a mean particle diameter of 0.02 micrometer is distributed uniformly.

[0187]<Production of the processing sheet P-1> The layer of the presentation shown below was painted one by one on the undercoating finishing transparent PEN base (85 micrometers in thickness), and the processing sheet P-1 was produced. The unit of mg/m^2 showed the addition of each raw material as an amount of painting of per 1 m^2 . What is not in the aforementioned thing and there about a use raw material was shown below.

[0188]

The 1st layer Addition (mg/m^2)

Gelatin 460 Water-soluble polymer (PS-2). 20 a surface-active agent (SU-3) -- 23 -- a hardening agent (H-5). 360 -- the 2nd layer gelatin 2400 water-solubility polymer (PS-3) -- 360 water-solubility polymer (PS-1) -- 700 water-solubility polymer (PS-4) -- 600 -- high boiling point solvent (OIL-3) 2000 guanidine picolinate 2400. a surface-active agent (SU-3) -- 24 -- the 3rd layer gelatin . 2400 water-soluble polymer (PS-1) 700. Surface-active agent (SU-3) 24 guanidine picolinate . 2150 water-solubility polymer (PS-3) 360. The water-soluble polymer (PS-4) 600 4th layer . gelatin 220 water-solubility polymer (PS-2) -- 60 -- water-soluble polymer (PS-3) 200 potassium-nitrate 12 mat agent (PM-2) -- 10 surface-active agent (SU-3) -- 7 surface-active agent (SU-5) -- 7 surface-active agent (SU-6) -- 10 hardening agent (H-5) -- 370[0189]

[Chemical formula 17]

PS-2

 κ -カラギーナン(和光純薬製)

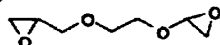
PS-3

デキストラン(分子量7万)

PS-4

MPポリマーMP120(クラレ社製)

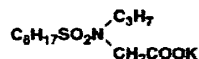
H-5



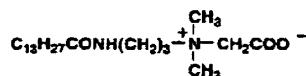
OIL-3

流動パラフィン(関東化学製)

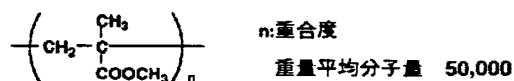
SU-5



SU-6



PM-2



[0190]It set to the disposable camera, after having judged in 35-mm negative film size, punching it and processing into a cartridge the photosensitive materials of which <creation of sample 201> (processing) creation was done.

[0191](Photography) All the 10 scenes were photoed for different scenery and person using the created disposable camera.

[0192](Processing) After doing 15 ml/m² grant of 40 ** warm water and laying the processing sheet P-1 and mutual film surfaces on top of the surface of the photosensitive materials which photography ended, heat developing was carried out for 30 seconds at 80 ** using the heat drum.

[0193](Reading) The color separation picture of three sorts of R-G-B was read using the color separation filter of the absorption maximum of the coloring coupler of each layer, using three waves of fluorescent lamps for a light source using a monochrome CCD camera. The valid pixel number of CCD which assumed the resolution at the time of L plate size print to about 300 dpi, and the relation of the reading surface product of a film were adjusted at the time of reading.

[0194](Image Processing Division) The compositing process was performed for the picture of three sorts of read R-G-B after NEGAPOJI reversal using the Photoshop by Adobe, and the color picture was reproduced. Image Processing Division by the conditions shown in the above-mentioned table 2 was performed.

[0195](Print creation) The film photo sample print of L plate size was created using Konica Corp. make digital mini-laboratory QD-21.

[0196]The <creation of samples 202-204> sample 202 was set to the camera with a lens like the sample 201, it is photograph recording area use of half size (17x24 mm), it adjusted conditions so that

it might become the almost same composition as the sample 201, and it performed the same 10 scene photography as the sample 201.

[0197]The sample 203 processed photosensitive materials into the cartridge for 110 cameras, are the conditions which become the almost same composition as the sample 201 with 110 cameras, and photoed the ten same scenes as the sample 201.

[0198]After the sample 204 carried out MINOX size (to 8x11 mm) decision using the film cutter for exclusive use, it was processed into the cartridge for exclusive use, is the same composition mostly with the sample 201 with a MINOX camera, and performed the same 10 scene photography as the sample 201.

[0199]A development, reading, and Image Processing Division were performed like the sample 201. The optical system was adjusted so that the resolution at the time of reading (= data volume) might become almost equal in the samples 202-204 and the sample 201.

[0200]To the <creation of samples 205-208> samples 201-204, Image Processing Division based on the scene discrimination processing using the Mahalanobis distance of this invention shown below was performed, and the sample print of the samples 205-208 was obtained in them.

[0201](Creation of the Mahalanobis space) Reference space was created using the image data (100 sheets each) of two photographing scenes shown below.

[0202]1) Person A Scene of the whole scene which contains flesh color in a half area about.

[0203]2) Person B Scene which contains flesh color in 25% of area of the whole scene.

[0204]3) Person C Scene which contains flesh color in 5 to 10% of area of the whole scene.

[0205]4) Scenery A Scene which contains flesh color in scenery and less than 5% of area of the whole scene.

[0206]5) Scenery B Landscape scene containing many green.

[0207]6) Scenery C Landscape scene containing many buildings.

[0208]a screen -- length -- 6 ****, it divided width 10 and the all the 60 pieces small area area was obtained. When arriving at the right and a right end from the upper left of a screen, it shifts under one step and the numbers from 1 to 60 are again given in order of the right. And it distinguished whether the color gamut shown in the above-mentioned table 1 would be contained by a $L^*a^*b^*$ color system in these each [that carried out numbering] small area area, and the number to identify was given to it.

[0209]An area selection function of a Photoshop by Adobe according to a resolution change function and color-gamut specification respectively was used for a screen separation and area selection which the above-mentioned color gamut occupies. Preservation of color-information identification number data of each area was performed by creating plug-in software and including in a Photoshop. It carried out automatically by registering with a system file auto-save function of a Photoshop of a series of *****. Plug-in software for Excel by Microsoft Corp. (made by an oaken company) was used for calculation of MTS.

[0210](Calculation of the Mahalanobis distance) Mahalanobis's distance was calculated about common photographing scene all 10 scenes of the samples 201-204.

[0211]It represented as well as the above and reference space creation, and weighted solidity was acquired by the following procedures about each of a total of ten photographed image data of the sample 201.

[0212]a screen -- length -- 6 ****, it divided width 10 and an all the 60 pieces small area area was obtained. When arriving at the right and a right end from the upper left of a screen, it shifts under one step and numbers from 1 to 60 are again given in order of the right. And it distinguished whether a color gamut shown in the above-mentioned table 1 would be contained by a L*a*b* color system in these each [that carried out numbering] small area area, and a number to identify was given to it.

[0213]The area selection function of the Photoshop by Adobe according to a resolution change function and color-gamut specification respectively was used for a screen separation and the area selection which the above-mentioned color gamut occupies. Preservation of the color-information identification number data of each area was performed by creating plug-in software and including in a Photoshop. It carried out automatically by registering with the system file auto-save function of the Photoshop of a series of *****. The plug-in software for Excel by Microsoft Corp. (made by an oaken company) was used for calculation of Mahalanobis's distance. A result is shown in Table 6.

[0214]

[Table 6]

マハラノビスの距離

基準空間	1	2	3	4	5	6	7	8	9	10
人物 A	6.8	3.5	15.2	8.4	13.6	28.2	3.4	32.2	24.4	5.7
人物 B	4.3	4.7	13.8	5.6	12.3	18.4	5.6	23.4	18.5	3.4
人物 C	2.8	8.7	10.4	10.5	10.3	15.6	7.8	13.5	14.3	5.7
風景 A	6.9	7.1	6.5	15.3	8.2	10.5	13.4	5.6	10.3	10.5
風景 B	13.8	10.4	8.7	16.7	6.4	6.5	25.6	3.2	5.4	24.3
風景 C	16.1	25.3	10.1	17.6	3.4	10.9	30.1	1.9	10.5	38.1

[0215]Scene discrimination Result 1:person 2: -- a person's rise 3: -- the scenery 4:person 5:scenery (building) that a person exists small

6: Scenery (green)

7: A person's rise 8 : scenery (building)

9: Scenery (green)

10: About person (Image Processing Division) Image Processing Division, it carried out on the conditions shown in Table 2.

[0216]Observation of combination processing (matrix processing) of sharp-ized processing and noise rejection processing performed near setting out of the image processing parameter. The noise rejection function of Photoshop plug-in software (made by Konica [Corp.] Corp.) was used for noise rejection. Other Image Processing Division was performed using the various filters of a Photoshop. It is shown below.

[0217] Processing (A)

sharp -- emphasis:unsharp mask noise rejection: -- plug-in software (made by Konica [Corp.] Corp.)

(Print creation) The film photo sample print of L plate size was created using Konica Corp. make

digital mini-laboratory system QD-21.

[0218]To the image processing data of the <creation of samples 209-212> samples 205-208, Image Processing Division B of further the following was performed, and the sample print of the samples 209-212 was obtained to it.

[0219](Image Processing Division) About Image Processing Division, it carried out on the conditions shown in Table 2.

[0220]Processing was applied to the Mahalanobis reference space, the person A, and the person B only to the scene which was near as for distance.

[0221] Processing (B)

Granulation: Noise (equal)

gray-level-correction: -- tone curve color correction: -- the silver-rimmed photoprint of L plate size was created using hue and chroma saturation (print creation) Konica Corp. make digital mini-laboratory system QD-21.

[0222](Organic-functions evaluation) Organic-functions evaluation of a total of 80 created sample prints was requested from ten persons' panelist. organic-functions evaluation was performed by five-step evaluation (5: -- very good 4: -- good 3 -- usually -- 2: -- bad 1: -- dramatically bad). A result is shown in Table 7.

[0223]

[Table 7]

試料 No.		フォーマット *1	サイズ (mm)	面積 (mm ²)	面積比 *2	拡大倍率 *3	官能評価 平均点	判定 *4	比 *5	判定 *6
比較	201	135	24X36	864	1.00	3.7	3.68	○	—	—
比較	202	ハーフ	17X24	408	0.47	5.2	2.40	×	—	—
比較	203	110	13X17	221	0.26	6.9	2.35	×	—	—
比較	204	MINOX	8X11	88	0.10	11.1	1.40	×	—	—
本発明	205	135	24X36	864	1.00	3.7	4.20	○	1.14	△
本発明	206	ハーフ	17X24	408	0.47	5.2	3.45	○	1.44	△
本発明	207	110	13X17	221	0.26	6.9	3.68	○	1.57	○
本発明	208	MINOX	8X11	88	0.10	11.1	2.40	×	1.71	○
本発明	209	135	24X36	864	1.00	3.7	4.30	○	1.17	△
本発明	210	ハーフ	17X24	408	0.47	5.2	3.80	○	1.58	○
本発明	211	110	13X17	221	0.26	6.9	4.20	○	1.79	○
本発明	212	MINOX	8X11	88	0.10	11.1	3.25	○	2.32	◎

[0224]*1 The general name of the existing photograph recording area size which doubled the format.

[0225]*2 When surface ratio sets photograph recording area of 35-mm film 1 top to 1.

[0226]*3 Line magnification which converted magnifying power from the negative at the time of the print to L plate size (89x127 mm).

[0227]

*4 O: organic-functions evaluation average mark 3 -- above x: organic-functions evaluation average mark 3 -- following *5 -- organic-functions evaluation average mark *6 of the organic-functions evaluation average mark / MTS-processing-less print of a print with formula MTS processing -- a ratio -- less than [more than **:1 1.5] (being a little effective)

O : less than [1.5 or more] 2.0 (being effective)

O : 2.0 (effect size) or more

Although the big difference to the organic-functions evaluation average mark is not seen by the comparison sample 201 and photograph recording area is smaller in all this invention samples 205-208 than in Table 7, The large improvement in the organic-functions evaluation average of Image Processing Division which exists, and makes and comes out was found, and it has checked that this invention was effective in the image quality improvement of photosensitive materials with a small photograph recording area. The effective thing is clear, in order that the effect of Image Processing Division may be checked in all this invention samples 209-212 and this invention may raise more desirable [than " "] image quality.

[0228]

[Effect of the Invention]Even if it used the photosensitive materials for photography which expand reduction or a part and use photography screen area, it excelled in image quality, and the more desirable print was obtained efficiently, and the method of simplifying a photographing system as a result was able to be provided.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a mimetic diagram showing one form of the picture information reading part of the image processing system of this invention, and an image processing portion.

[Drawing 2]It is a flow chart of Image Processing Division of this invention.

[Drawing 3]It is an explanation graph of the gray level correction in this invention.

[Drawing 4]It is a flow chart until it obtains a photographing scene discriminated result from the Mahalanobis space creation in this invention.

[Drawing 5]The step for creating the Mahalanobis space in this invention is shown.

[Drawing 6]It is a key map of the feature extraction by Image Processing Division of this invention.

[Drawing 7]It is a key map showing the relation of the Mahalanobis distance of the Mahalanobis reference space in this invention, and a scene discrimination sample.

[Drawing 8]It is a display example of the matrix processing in this invention.

[Drawing 9]It is a figure showing an example of the mask M used in Image Processing Division of this enforcement.

[Drawing 10]It is the graph which showed the relation between the pixel value of the noticed picture element in this invention, and the size of the mask M.

[Drawing 11]It is the graph which showed the relation between the pixel value of the noticed picture element in this invention, and a threshold value.

[Drawing 12]It is a figure showing the mask M1 into which the form in this invention was changed, M2, and M3.

[Explanations of letters or numerals]

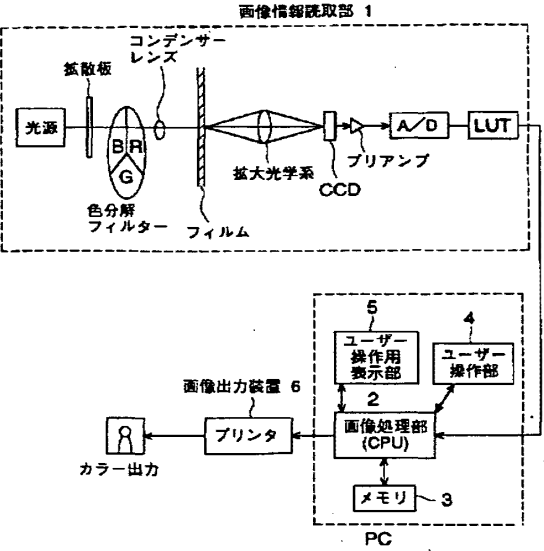
1 Picture information read station

2 Image processing portion

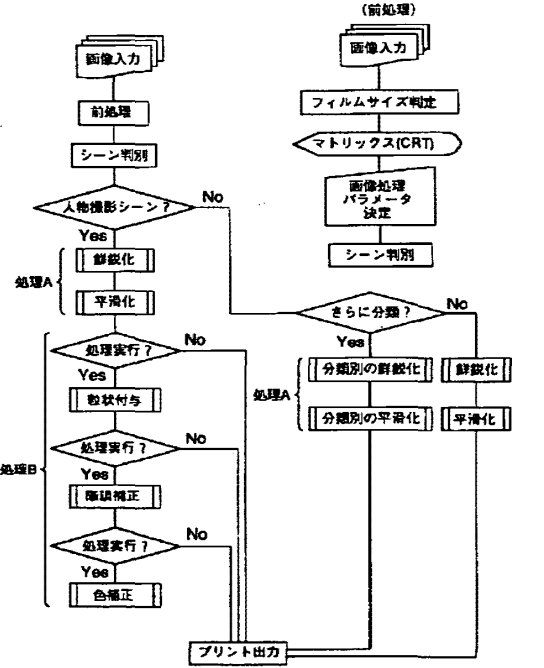
- 3 Memory
- 4 User final controlling element
- 5 The display for user's operation

DRAWINGS

[Drawing 1]

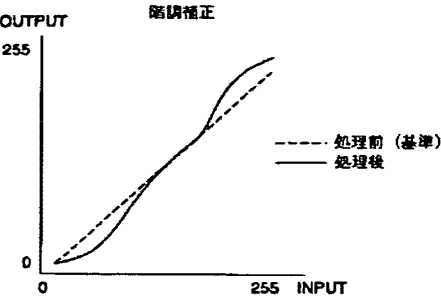


[Drawing 2]

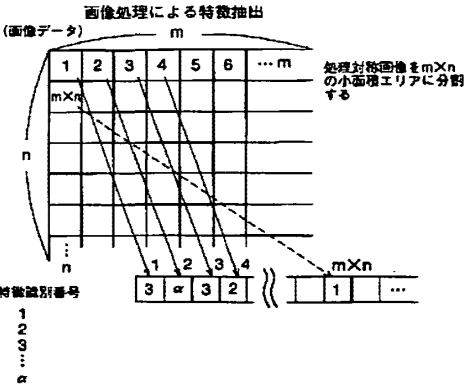


処理Aは、画質を向上させる処理。
処理Bは、人物の顔の描写をより好ましい画質にする。

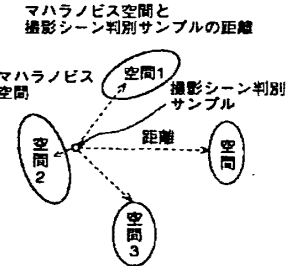
[Drawing 3]



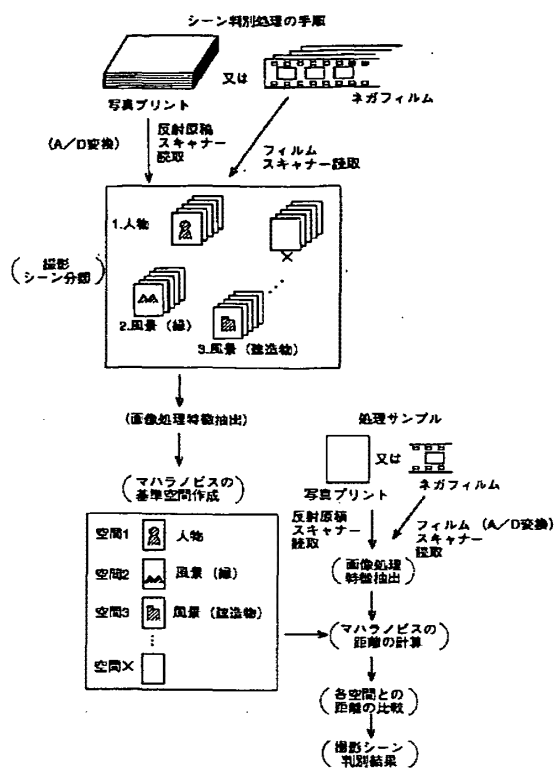
[Drawing 6]



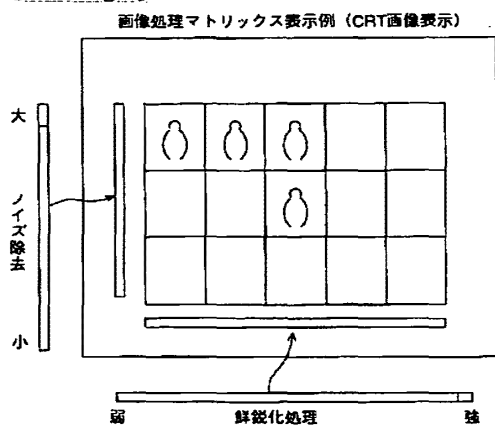
[Drawing 7]



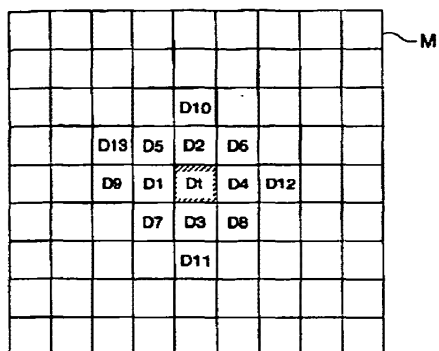
[Drawing 4]



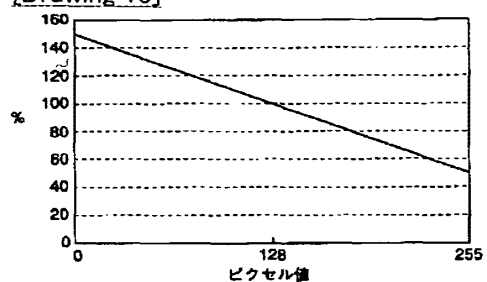
[Drawing 8]



[Drawing 9]



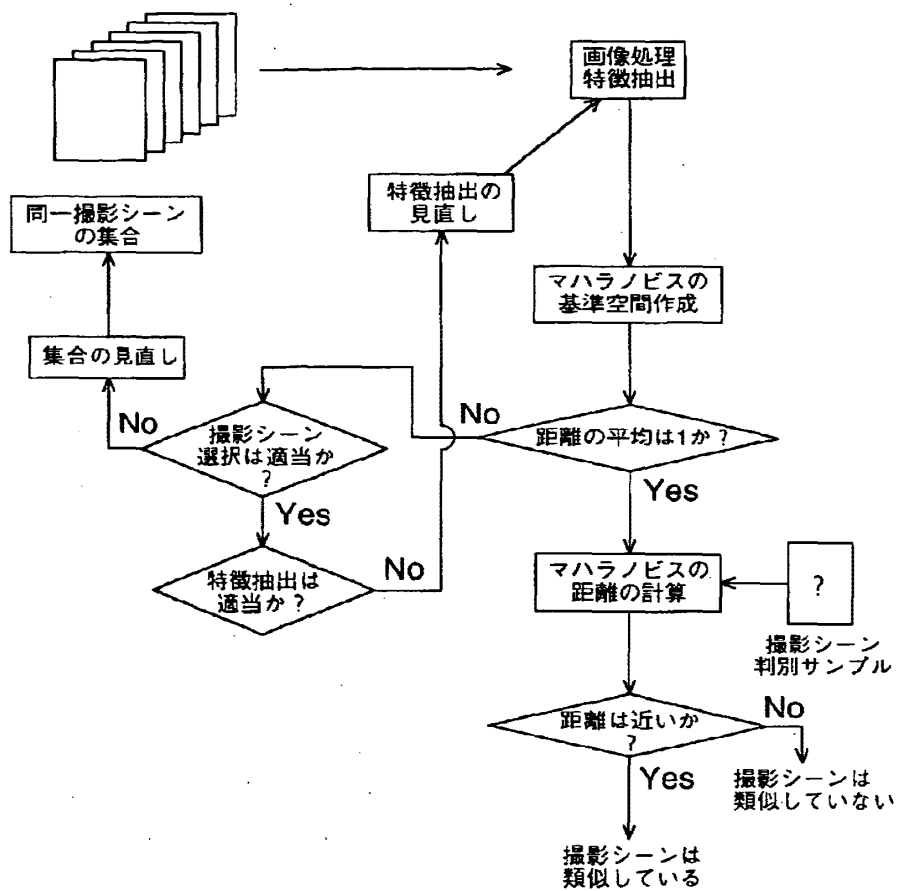
[Drawing 10]



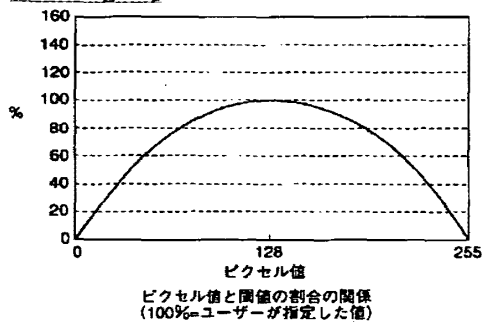
ピクセル値とマスクサイズの割合の関係
(100%=ユーザーが指定した値)

[Drawing 5]

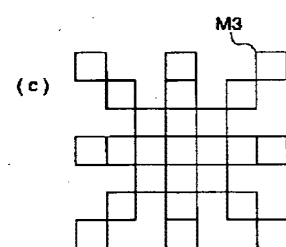
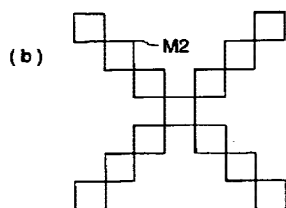
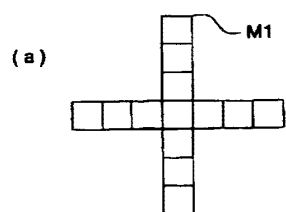
マハラノビス基準空間作成処理の手順



[Drawing 11]



[Drawing 12]



マスクの形の例

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-248825

(43)Date of publication of application : 05.09.2003

(51)Int.Cl.

G06T 7/00

(21)Application number : 2002-046541

(71)Applicant : FUJI XEROX CO LTD

(22)Date of filing : 22.02.2002

(72)Inventor : HIBI YOSHIHARU
OKUTSU MASARU

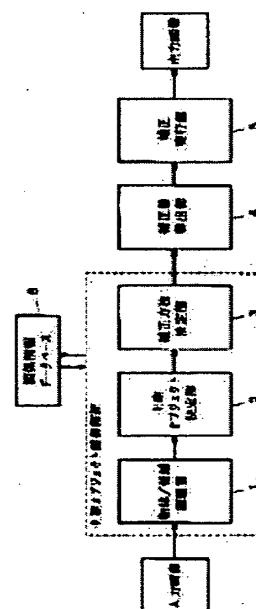
(54) DEVICE AND METHOD FOR IMAGE PROCESSING, IMAGE PROCESSING PROGRAM, AND STORAGE MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device and a method for image processing which can perform more precise image correction.

SOLUTION: A body/area recognition part 1 recognizes objects in an inputted image and a main/sub object determination part 2 determines a main object and a sub object among the recognized objects. According to the relation between the determined main object and sub object, a correcting method determination part 3 determines a correcting method for correcting a target object by using feature quantity of the object. A correction quantity calculation part 4 determines a correction quantity for the correction and a correction execution part 5 actually performs determined correction processing for the respective objects or the whole image.

Consequently, different optimum corrections can be made for an image of a 'person' according to the scene, e.g. whether the background is the sea or mountains and the sky.



(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2003-248825

(P2003-248825A)

(43) 公開日 平成15年9月5日(2003.9.5)

(51) Int.Cl.

G 0 6 T 7/00

識別記号

3 0 0

F I

G 0 6 T 7/00

テ-マコ-ト*(参考)

3 0 0 F 5 L 0 9 6

審査請求 未請求 請求項の数30 O L (全 12 頁)

(21) 出願番号 特願2002-46541(P2002-46541)

(22) 出願日 平成14年2月22日(2002.2.22)

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弁理士 柳澤 正夫

Fターム(参考) 5L096 AA02 AA06 FA06 FA15 FA69

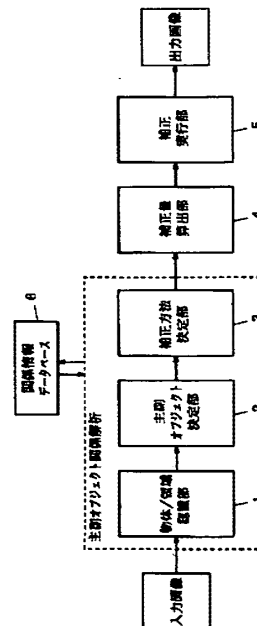
GA38 JA11 JA18

(54) 【発明の名称】 画像処理装置及び画像処理方法、画像処理プログラム、記憶媒体

(57) 【要約】

【課題】 画像に対してより好ましい補正を実現することが可能な画像処理装置及び画像処理方法を提供する。

【解決手段】 入力された画像から物体／領域認識部1でオブジェクトを認識し、認識したオブジェクトから主要オブジェクトと副オブジェクトを主副オブジェクト決定部2で決定する。そして、決定された主要オブジェクトと副オブジェクトの関係から、補正方法決定部3において、どのオブジェクトの特徴量を用いてどのオブジェクトにどのような補正を施すかという補正方法を決定する。また補正量算出部4で補正を施す際の補正量を決定し、これらを基に補正実行部5で実際に各オブジェクトあるいは画像全体に対して決定された補正処理を施す。これにより、シーンに応じて、例えば同じ「人物」の画像であっても背景が海の場合と、山、空の場合とで、それぞれ最適な補正を施すといったことが可能になる。



【特許請求の範囲】

【請求項1】 画像を補正する画像処理装置において、前記画像から複数のオブジェクトを認識する認識手段と、前記画像のシーンを認識して該認識結果に基づいてそれぞれの前記オブジェクトに対する補正方法を決定する補正方法決定手段を有することを特徴とする画像処理装置。

【請求項2】 画像を補正する画像処理装置において、前記画像から複数のオブジェクトを認識する認識手段と、前記複数のオブジェクトから主要オブジェクトと副オブジェクトを決定するオブジェクト決定手段と、前記主要オブジェクトと前記副オブジェクトとの関係から前記画像の補正方法を決定する補正方法決定手段を有することを特徴とする画像処理装置。

【請求項3】 前記補正方法決定手段は、前記主要オブジェクトと前記副オブジェクトとの関係として、前記主要オブジェクトの種類と前記副オブジェクトの種類の組み合わせを用いることを特徴とする請求項2に記載の画像処理装置。

【請求項4】 前記補正方法決定手段は、前記主要オブジェクトと前記副オブジェクトとの関係として、当該2つのオブジェクトの位置、大きさ、重みの少なくともひとつの関係を用いることを特徴とする請求項2に記載の画像処理装置。

【請求項5】 前記補正方法決定手段は、画像全体あるいはオブジェクトごとに行う補正方法を決定することを特徴とする請求項2ないし請求項4のいずれか1項に記載の画像処理装置。

【請求項6】 前記補正方法決定手段は、前記主要オブジェクト、副オブジェクト、認識対象外領域、画像全体の特徴量のうち少なくとも一つの特徴量をもとに補正方法を決定することを特徴とする請求項2ないし請求項4のいずれか1項に記載の画像処理装置。

【請求項7】 前記補正方法決定手段は、前記主要オブジェクトの属性情報と副オブジェクトの属性情報との関係から補正方法を決定することを特徴とする請求項2ないし請求項4のいずれか1項に記載の画像処理装置。

【請求項8】 前記補正方法決定手段は、色調および精細度を含んだ補正方法を決定することを特徴とする請求項2ないし請求項7のいずれか1項に記載の画像処理装置。

【請求項9】 画像を分類する画像処理装置において、前記画像から複数のオブジェクトを認識する認識手段と、前記複数のオブジェクトから主要オブジェクトと副オブジェクトを決定するオブジェクト決定手段と、前記主要オブジェクトの属性情報と前記副オブジェクトの属性情報との関係から前記画像の分類情報を決定する分類情報決定手段を有することを特徴とする画像処理装置。

【請求項10】 前記オブジェクトは、領域あるいは物あるいはそれらの集合体であることを特徴とする請求項

2ないし請求項9に記載の画像処理装置。

【請求項11】 前記オブジェクト決定手段は、前記オブジェクトの大きさ、位置、向き、個数のうち少なくともひとつの特徴を用いて前記主要オブジェクトを決定することを特徴とする請求項2ないし請求項10のいずれか1項に記載の画像処理装置。

【請求項12】 前記オブジェクト決定手段は、前記オブジェクトごとに定められた重み係数を用いて前記主要オブジェクトを決定することを特徴とする請求項2ないし請求項11のいずれか1項に記載の画像処理装置。

【請求項13】 前記オブジェクト決定手段は、ユーザの指示により前記主要オブジェクトを決定することを特徴とする請求項2ないし請求項10のいずれか1項に記載の画像処理装置。

【請求項14】 前記画像はPDLで記述されたデータであり、前記認識手段は、PDLから複数のオブジェクトを認識することを特徴とする請求項1ないし請求項13のいずれか1項に記載の画像処理装置。

【請求項15】 画像を補正する画像処理方法において、前記画像から複数のオブジェクトを認識し、また前記画像のシーンを認識し、シーンの認識結果に基づいてそれぞれの前記オブジェクトに対する補正方法を決定することを特徴とする画像処理方法。

【請求項16】 画像を補正する画像処理方法において、前記画像から複数のオブジェクトを認識し、前記複数のオブジェクトから主要オブジェクトと副オブジェクトを決定し、前記主要オブジェクトと前記副オブジェクトとの関係から前記画像の補正方法を決定することを特徴とする画像処理方法。

【請求項17】 前記主要オブジェクトと前記副オブジェクトとの関係として、前記主要オブジェクトの種類と前記副オブジェクトの種類の組み合わせを用いることを特徴とする請求項16に記載の画像処理方法。

【請求項18】 前記主要オブジェクトと前記副オブジェクトとの関係として、当該2つのオブジェクトの位置、大きさ、重みの少なくともひとつの関係を用いることを特徴とする請求項16に記載の画像処理方法。

【請求項19】 前記補正方法を決定する際には、画像全体あるいはオブジェクトごとに行うことを特徴とする請求項16ないし請求項18のいずれか1項に記載の画像処理方法。

【請求項20】 前記補正方法を決定する際には、前記主要オブジェクト、副オブジェクト、認識対象外領域、画像全体の特徴量のうち少なくとも一つの特徴量をもとに補正方法を決定することを特徴とする請求項16ないし請求項18のいずれか1項に記載の画像処理方法。

【請求項21】 前記補正方法を決定する際には、前記主要オブジェクトの属性情報と副オブジェクトの属性情報との関係から補正方法を決定することを特徴とする請求項16ないし請求項18のいずれか1項に記載の画像

処理方法。

【請求項22】 前記補正方法は、色調および精細度の補正を含むことを特徴とする請求項16ないし請求項21のいずれか1項に記載の画像処理方法。

【請求項23】 画像を分類する画像処理方法において、前記画像から複数のオブジェクトを認識し、前記複数のオブジェクトから主要オブジェクトと副オブジェクトを決定し、前記主要オブジェクトの属性情報と前記副オブジェクトの属性情報との関係から前記画像の分類情報を決定することを特徴とする画像処理方法。

【請求項24】 前記オブジェクトは、領域あるいは物あるいはそれらの集合体であることを特徴とする請求項16ないし請求項23に記載の画像処理方法。

【請求項25】 前記主要オブジェクトの決定は、前記オブジェクトの大きさ、位置、向き、個数のうち少なくともひとつの特徴を用いて決定することを特徴とする請求項16ないし請求項24のいずれか1項に記載の画像処理方法。

【請求項26】 前記主要オブジェクトの決定は、前記オブジェクトごとに定められた重み係数を用いて決定することを特徴とする請求項16ないし請求項25のいずれか1項に記載の画像処理方法。

【請求項27】 前記主要オブジェクトの決定は、ユーザの指示により決定することを特徴とする請求項16ないし請求項24のいずれか1項に記載の画像処理方法。

【請求項28】 前記画像はPDLで記述されたデータであり、PDLから複数のオブジェクトを認識することを特徴とする請求項15ないし請求項27のいずれか1項に記載の画像処理方法。

【請求項29】 請求項15ないし請求項28のいずれか1項に記載の画像処理方法をコンピュータに実行させることを特徴とする画像処理プログラム。

【請求項30】 請求項15ないし請求項28のいずれか1項に記載の画像処理方法をコンピュータに実行させるためのプログラムを記憶していることを特徴とする前記コンピュータが読み取り可能な記憶媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、デジタルカメラ等で撮影されたデジタル画像、ネガフィルムなどをフィルムスキャナ等で入力したデジタル画像、写真等を反射型スキャナで入力したデジタル画像、PDL（Page Description Language：ページ記述言語）で記述された画像などを好ましく再現するために行うべき補正方法を決定する技術に関するものである。また、同様の技術を用いて画像を分類するための分類情報を決定する技術に関するものである。

【0002】

【従来の技術】一般のデジタルカメラ等を利用して撮影を行う場合には、撮影の際にデジタルカメラに備えられ

ている測光システムによって露光条件などの撮影条件が自動的に設定され、その撮影条件に従って撮影する場合が多い。自動的に設定された撮影条件は、被写体ごく平均的な条件であることを前提として決められるため、撮影時の照明条件や、被写体への光の当たり具合、逆光条件など、平均的な条件とは異なる条件下では、所望の画像を得ることができない場合がある。例えば、逆光条件においては、シーン全体としては明るいため、主要被写体（例えば人物の顔など）が暗く写ってしまうことがある。また、被写体を照らす光源の違い（太陽光、蛍光灯など）や、屋外での太陽の条件（夕焼け、曇りなど）により、著しくカラーバランスがシフトして写りこんでしまう不具合が生じる場合があった。もちろん、フィルムカメラなどにおいても同様であり、自動的に設定された撮影条件に従って撮影された場合には、フィルム上の画像において同様の問題が発生しており、フィルムスキャナなどで読み取ったデジタル画像においても同様である。

【0003】このような不具合に対して、デジタル画像を補正処理することによって所望の画像を得ることが考えられる。しかし、一般の不慣れなユーザが各種の補正処理を選択しながら、パラメータを調整して補正処理を行ってゆくことは非常に困難である。そのため、自動的に最適な画像へ補正することが考えられている。

【0004】自動的に画像の補正処理を行うためには、当該画像がどのようなシーンを撮影したのかを認識し、その撮影シーンに応じた補正処理を行う必要がある。このような撮影シーンに応じた画像に対する補正処理を実現するために、従来よりいくつかの方法が提案されている。その一つとして、例えば特開平5-41830号公報に記載されている装置では、被写体が人物か否かに応じて露出設定を切り替えて、画像取得時に補正を行っている。また例えば特開平5-336535号公報に記載されている装置では、画像中の人物とそれ以外の部分において輪郭補正のパラメータを切り替えている。さらに、例えば特開2000-123164号公報に記載されている装置では、画像をブロックに分割し、ブロック毎に属性を判別して、その属性に応じた彩度変換を行っている。

【0005】図14は、従来の画像処理装置の一例を示すブロック図である。図中、11は入力画像、12は主要オブジェクト／領域認識部、13は補正量算出部、14は補正実行部、15は出力画像である。上述のような従来の各技術は、集約すると図14に示すような構成を取っている。すなわち、主要オブジェクト／領域認識部12において、入力画像11中の人物などの主要なオブジェクトの有無や主要なオブジェクトの領域を検出し、補正量算出部13において、主要なオブジェクトとそれ以外を区別した補正方法や補正パラメータなどを決定し、その補正方法、補正パラメータを用いて補正実行部

14において補正処理を実行し、出力画像15を得ている。

【0006】このような従来技術によって、主要なオブジェクトに注目した補正処理が可能になり、確かに主要なオブジェクトについては良好な画像が得られる。しかし、主要オブジェクトの有無や各オブジェクトごとに補正が一意に定められてしまうという問題がある。人間がもっとも注視する主要なオブジェクトを中心に補正することは効果的であるが、主要なオブジェクトだけに注目して補正してしまうと主要なオブジェクトだけが強調され、全体のバランスが崩れて違和感のある画像となってしまう場合がある。

【0007】例えば逆光条件で「人物」を撮影した場合、「人物」は暗く写ってしまう。これを補正するため「人物」が明るくなるように画像全体を補正すると、空などの背景の色が飛んでしまう。例えばオブジェクト単位で補正方法を決定する場合でも、例えば「人物」は明るく、「空」は彩度を強調する、というように一律的な補正方法では、「人物+空」というシーンに対して適した補正にはならない場合があった。

【0008】上述の例では画像を補正する場合について従来の技術を説明したが、例えば画像を保存する場合に、自動的に画像の内容を示す分類情報を付加して蓄積することが行われている。このような場合にも、従来より、画像中から主要なオブジェクトを抽出し、そのオブジェクトを示す分類情報を付加している。しかし、例えば中央に人物が写っている画像に対して「人物」という分類情報を付加しても、その画像の内容を的確に把握することは困難である。例えば、海で撮ったのか、山で撮ったのかということすら分からなかった。また、例えばオブジェクトを示す属性情報を単に羅列しただけでは、例えば風景写真などでは「空」は必ず存在するなど、分類情報が役に立たないといった問題があった。

【0009】

【発明が解決しようとする課題】本発明は、上述した事情に鑑みてなされたもので、シーンに応じてより好ましい補正を画像に対して施すことが可能な画像処理装置及び画像処理方法と、画像に対してより好ましい分類情報の付加が可能な画像処理装置及び画像処理方法を提供することを目的とするものである。さらに、そのような画像処理方法をコンピュータに実行させる画像処理プログラム、及び、そのような画像処理プログラムを格納した記憶媒体を提供することを目的とするものである。

【0010】

【課題を解決するための手段】本発明は、画像を補正する画像処理装置及び画像処理方法において、画像から複数のオブジェクトを認識し、それらのオブジェクトに対して画像のシーンの認識結果に基づいて補正方法を決定することを特徴とするものである。特に、画像から複数のオブジェクトを認識した後、認識した複数のオブジェク

トから主要オブジェクトと副オブジェクトを決定し、決定した主要オブジェクトと副オブジェクトとの関係から、画像の補正方法を決定するように構成したことを特徴とするものである。このように、画像のシーンの認識結果、特に、画像中の主要オブジェクトとともに副オブジェクトを用いてその関係から補正方法を決定するので、主要オブジェクトのみの認識結果に基づいて補正する場合に比べて、周囲の状況などに応じて補正処理を行うことができる。従って、画像に対してバランスの取れた補正処理を行うことが可能となり、より好ましい補正処理を実現することができる。

【0011】主要オブジェクトと副オブジェクトとの関係としては、主要オブジェクトの種類と副オブジェクトの種類のみ組み合わせや、2つのオブジェクトの位置、大きさ、重みの少なくともひとつの関係を用いることができる。また補正方法を決定する際には、画像全体あるいはオブジェクトごとに行うことができる。あるいは、主要オブジェクト、副オブジェクト、認識対象外領域、画像全体の特徴量のうち少なくとも一つの特徴量をもとにしたり、主要オブジェクトの属性情報と副オブジェクトの属性情報との関係から補正方法を決定することができる。また、補正方法には、色調および精細度の補正を含むことができる。

【0012】認識するオブジェクトとしては、領域あるいは物あるいはそれらの集合体とすることができ、その中から主要オブジェクトを決定する際には、オブジェクトの大きさ、位置、向き、個数などの特徴や、オブジェクトごとに定められた重み係数を用いたり、ユーザの指示により決定することができる。なお、処理対象の画像は、ビットマップの画像以外にも例えばPDLによって記述された画像であってもよい。

【0013】また本発明は、画像を分類する画像処理装置及び画像処理方法において、画像から複数のオブジェクトを認識し、認識した複数のオブジェクトから主要オブジェクトと副オブジェクトを決定し、決定した主要オブジェクトの属性情報と副オブジェクトの属性情報との関係から前記画像の分類情報を決定することを特徴とするものである。このように主要オブジェクトの属性情報だけでなく副オブジェクトの属性情報も考慮して、それらの関係から分類情報を決定するので、例えば「人物」が写っている画像であっても、「山」で撮ったのか、「海」で撮ったのかなどが分類情報として抽出することができ、的確に画像の内容を示す分類情報を画像に付加して格納することが可能になる。なおこの発明についても、上述のようなオブジェクトの認識及び主要オブジェクトの決定方法を利用することができる。また処理対象の画像についても、ビットマップのほか、PDLで記述された画像などであってもよい。

【0014】さらに本発明は、これらの画像処理方法をコンピュータに実行させる画像処理プログラム、およ

び、そのような画像処理プログラムを記憶している記憶媒体を提供するものであり、例えばパソコンやワークステーション、さらにはこのような画像処理を提供するサーバなどにおいて実現することができる。

【0015】

【発明の実施の形態】図1は、本発明の実施の一形態を示すブロック図である。図中、1は物体／領域認識部、2は主副オブジェクト決定部、3は補正方法決定部、4は補正量算出部、5は補正実行部、6は関係情報データベースである。物体／領域認識部1は、入力された画像から複数のオブジェクトを認識する。認識するオブジェクトは、領域、あるいは物、あるいは、それらの集合体とすることができる。オブジェクトの認識は、例えば「空領域」というオブジェクトの認識例では、周波数構造が低周波よりの特徴をもち、位置は画像上部にあり、色情報としては、青色相に含まれる閉じた領域を捕らえて認識することができる。また、人物や人物の顔などのオブジェクトの認識は、肌色領域や顔構造の検出など、既知の手法を用いて行うことができる。なお、オブジェクトの認識手法は任意であり、種々の公知の手法を用いることができる。

【0016】主副オブジェクト決定部2は、物体／領域認識部1で認識された複数のオブジェクトから、主要オブジェクトと副オブジェクトを決定する。主要オブジェクトの決定方法としては、例えば認識されたオブジェクトが画像中に占める大きさや位置、あらかじめ定められているオブジェクトの重みなどから決定することができる。あるいは、画像を表示してユーザが指示するように構成してもよい。主要オブジェクト以外の認識されたオブジェクトは、副オブジェクトとみなされる。但し、副オブジェクトの数が多い場合など、すべてを副オブジェクトにしなくてもよい。

【0017】補正方法決定部3は、基本的には画像のシーンを認識し、その認識結果に基づいてそれぞれのオブジェクトに対する補正方法を決定する。その一例として、ここでは主副オブジェクト家底部2において決定された主要オブジェクト及び副オブジェクトを利用する。まず主要オブジェクトとそれ以外の副オブジェクトの関係を解析する。解析の際には、例えば関係情報データベース6を参照して、主要オブジェクトと副オブジェクトの関係から補正箇所、特徴量算出方法、補正処理方法等の情報を取得することができる。主要オブジェクトと副オブジェクトとの関係としては、主要オブジェクトの種類と副オブジェクトの種類の組み合わせを用いたり、2つのオブジェクトの位置、大きさ、重み等の関係、それぞれの属性情報の関係などを用いることができる。また、決定する補正箇所としては、画像全体、あるいは主要オブジェクト、副オブジェクトことなどとしてことができ、各補正箇所毎に補正処理方法を決定することができる。なお、補正処理方法は、上述の主要オブジェクト

と副オブジェクトの関係から取得した特徴量算出方法に従って、主要オブジェクト、副オブジェクト認識対象外領域、画像全体などの特徴量を得て、それらの特徴量から決定することができる。

【0018】補正量算出部4は、補正方法決定部3において決定した補正方法に従い、どの程度の補正を行うかを算出する。例えば補正方法決定部3で取得した特徴量算出方法を基に特徴量を算出し（あるいは補正方法決定部3で算出した特徴量を用い）、各補正方法に対応する補正量の算出を行うことができる。特徴量算出方法には、従来のような一律な算出方法とは異なり、主要オブジェクトと副オブジェクトの組み合わせのパターンから、どのオブジェクトの特徴量を利用して補正量を算出するかといった定義がなされており、この定義を基に、それぞれの組み合わせのパターンにあった特徴量を得て、補正量の算出を行う。

【0019】補正実行部5は、入力された画像に対して、補正方法決定部3で決定された補正処理について、補正量算出部4で算出した補正量だけ、実際に補正処理を行う。補正処理としては、例えば色調補正や精細度補正などを行うことができる。

【0020】このような構成によって、従来のようにそれぞれのオブジェクト毎に画一的な補正処理を行う技術に比べ、主要オブジェクトを決定することによって、画像を鑑賞するユーザがもっとも関心を持つ、注視するオブジェクトを考慮した補正を行うことができる。さらに、主要オブジェクトだけでなく副オブジェクトを決定することによって、主要オブジェクトと副オブジェクトの関係において最適な補正処理をそれぞれのオブジェクトあるいは認識対象外領域または画像全体に施すことができる。従って、従来のように主要オブジェクトだけに補正を施すことによる周囲との不整合を回避し、全体としてシーンの特性を考慮した最良の補正処理を行うことが可能になる。一例として人物の肌色を補正することを考えると、従来は人物の肌色に対してある目標色への補正しか行えないが、主要オブジェクトと副オブジェクトの関係から補正方法を決定することによって、「海」の副オブジェクトを持つ人物画の場合は健康的な小麦色に補正目標色を変更するなど、認識された副オブジェクトによって補正を変化させることができる。

【0021】以下、各部の動作の詳細について、具体例を用いながら説明してゆく。なお、以下に示す画像の具体例においては、色彩などを表現するためにハッチングを用いており、実際の色彩の補正（例えば鮮やかさの補正）を行った場合には例えばハッチングの間隔などを異ならせて示している。

【0022】図2は、物体／領域認識部1で認識されるオブジェクトの一例の説明図である。上述のように物体／領域認識部1においては、オブジェクトとして、例えば人物の顔や、ある対象物品などを認識して定義した

り、ある閉領域などを認識して定義することができる。一例として、図2に示すような人物を含めた風景画像においては、「人物」、「空領域」、「山領域」などのオブジェクトを認識することができる。例えば「空領域」オブジェクトは、周波数構造としては、低周波であり、位置情報は上部にあるもので、色情報は、青色相に含まれる閉じた領域を捕らえることができる。また、人物や人物の顔などのオブジェクトとしての認識は、既知の手法を用いて識別を行えばよい。なお、認識したオブジェクト以外は、この例では認識対象外領域としている。

【0023】次に主副オブジェクト決定部2では、物体／領域認識部1で認識したオブジェクトの中から、主要オブジェクト及び副オブジェクトを決定する。図3は、主要オブジェクトの決定方法の一例の説明図である。図3には山と空の風景画の例を示しており、領域の大きさにより主要オブジェクトが決定される過程を示している。例えば主要オブジェクトの決定方法として、大きいほうのオブジェクトを主要オブジェクト、他を副オブジェクトとすることができる。この場合、図3(A)に示した例では、山のオブジェクトの占める割合が大きく、「山領域」のオブジェクトが主要オブジェクトとなり、「空領域」などの他のオブジェクトが副オブジェクトとなる。また、図3(B)に示した例では、逆に広い空が広がっているので、「空領域」オブジェクトを主要オブジェクトとし、「山領域」などの他のオブジェクトが副オブジェクトとなる。

【0024】図4は、主要オブジェクトの決定方法の別の例の説明図である。ここでは、各オブジェクトの大きさ、位置、向き、重み係数などをもとに主要オブジェクトを決定する例を示している。図4(A)に入力された画像を示しており、認識された各オブジェクトにa～eの符号を付してある。すなわち、aオブジェクトは「空領域」、bオブジェクトは「山領域」、c～eオブジェクトは「人物」であり、右側の人物ほど大きい人物が存在している。これらのオブジェクトについて、それぞれ、大きさ、位置、向きを調べ、重み付けをする。その結果を図4(B)に示している。位置スコアとしては、中央に近く、前景ほど重みを大きくしている。従って中央の人物であるdオブジェクトの重みが最も大きくなっている。また大きさスコアとしては、大きいほど重み付けを大きくしている。この例では「山領域」を示すbオブジェクトが最も大きな面積を占めているので、最も大きな重み付けがなされている。向きスコアは、特に人物などにおいて正面を向いているのか、それとも他の方向を向いているのかによって重み付けするものである。この例では、右側の「人物」を示すcオブジェクトが正面を向いているものとして大きな重み付けが行われている。なお、「空領域」や「山領域」については向きはないので0とされている。

【0025】さらにこの例では、オブジェクトごとに定

められた重み係数を設定している。例えば人物が存在する場合、一般的には山や空のオブジェクトよりも主である場合が多い。そのため、ここでも「空領域」のaオブジェクトや「山領域」のbオブジェクトよりも、「人物」のc～eオブジェクトに対して大きな重み係数を割り当てている。

【0026】そして、このようにしてそれぞれ設定した位置スコア、大きさスコア、向きスコア、重み係数を総合して総合スコアを算出している。この例では、

10 (位置スコア+大きさスコア+向きスコア)×重み係数によって総合スコアを算出している。この総合スコアが最も大きい値となったオブジェクトを主要オブジェクトとすればよい。この例では、右側の「人物」であるcオブジェクトが主要オブジェクトと決定される。また、その他のオブジェクトが副オブジェクトとなる。なお、副オブジェクトはいくつかに限定することができる。例えば総合スコアの大きい順に選択したり、あるいはオブジェクトの種別の異なるものを選択するなど、任意に選択することができる。

20 【0027】図4(B)に示した例では、オブジェクトの大きさ、位置、向きを数値化して使用したが、他の種々の特徴を使用することが可能である。もちろん、総合スコアの算出方法についても任意である。

【0028】ここでは主要オブジェクトの決定方法として2つの方法を示したが、これ以外にもいろいろな手法を適用することができる。例えば、ユーザが利用するパソコンなどのモニタ画面に画像を表示させながら、手動で主要オブジェクトを選択することも可能である。

30 【0029】次に補正方法決定部3では、上述のようにして主副オブジェクト決定部2で決定された主要オブジェクトと副オブジェクトとの関係から、入力された画像に対して行う補正方法を決定する。このとき用いる主要オブジェクトと副オブジェクトとの関係として、主要オブジェクトの種類と前記副オブジェクトの種類の組み合わせを用いることができる。図5は、主要オブジェクトと副オブジェクトのオブジェクトの種類の関係による補正方法の決定の一例の説明図である。図3においても説明したように、図5(A)では「山領域」が主要オブジェクト、「空領域」が副オブジェクトである「山」のシーンである。このような主要オブジェクトと副オブジェクトの種類の組み合わせを用い、この組み合わせの場合には例えば「空領域」に対して多少明るめにして「山領域」を鮮やかにする等といった補正方法を対応づけておくことができる。これによって、「空」と「山」のコントラストを大きくして、「山」をより強調した画像に補正することができる。また図5(B)では逆に、「空領域」が主要オブジェクト、「山領域」が副オブジェクトである「空」のシーンである。このような場合には、「空領域」を鮮やかにする等といった補正方法を対応づけておくことができる。これによって、主要オブジェク

トである「空領域」の色を、「山」の存在を考慮して、より鮮やかになるように補正することができる。

【0030】このように、主要オブジェクトと副オブジェクトの種類の組み合わせは画像のシーンを表しており、主要オブジェクトと副オブジェクトの種類の組み合わせによって補正方法を決定することによって、より好ましい補正方法を適用することが可能である。例えば上述の例のように同じ「空領域」と「山領域」のオブジェクトが存在する場合でも、その主副の組み合わせの関係からそれぞれの画像に対して、より好ましい補正方法を適用することができる。

【0031】このように補正方法を決定する際に、主要オブジェクトと副オブジェクトの種類の組み合わせから、どこを補正するのか、及び、どのような特徴を利用してどのように補正するのかを、各組み合わせ毎に決定する必要がある。どこを補正するのかとは、主要オブジェクト、副オブジェクトのいずれかあるいはどのオブジェクトを補正対象とするのか、それとも画像全体を補正するのかということである。また、どのような特徴とは、主要オブジェクト、副オブジェクト、認識対象外領域、画像全体のうちのどの部分について、例えば色相や濃淡、特定色などのどのような特徴量を利用するかということである。さらにそのような特徴を利用して、例えば色調補正や精細度補正、強調補正など、どのような補正処理を行えばよいかを決定する必要がある。

【0032】このような、どこをどのような特徴を利用してどのように補正するのかを決定するために、この例では関係情報データベース6を利用している。図6は、関係情報データベースの内容の一例の説明図である。図6に示す関係情報データベースの例では、図6(A)に示すオブジェクト組み合わせテーブルと、図6(B)に示す主要オブジェクトテーブルと、図6(C)に示す副オブジェクト順位テーブルと、図6(D)に示す特徴量算出データと、図6(E)に示す補正データにより構成されている。

【0033】図6(A)に示すオブジェクト組み合わせテーブルは、画像中に存在するオブジェクトの組み合わせから主要オブジェクトテーブルを参照するためのテーブルであり、この例では、「人物」、「空」、「海」、「山」のオブジェクトが定義されている例を示している。ここでは図2に示したように「人物」、「空」、「山」が存在する画像が入力されたものとして、主要オブジェクトテーブルへのポインタを示す矢線を図示している。

【0034】図6(B)に示す主要オブジェクトテーブルは、入力された画像中のオブジェクトのうち、いずれのオブジェクトが主要オブジェクトであるかにより副オブジェクト順位テーブルを参照するためのテーブルである。この例では「人物」オブジェクトが主要オブジェクトであった例を示し、副オブジェクト順位テーブルへの

ポインタを示す矢線を図示している。

【0035】図6(C)に示す副オブジェクト順位テーブルでは、副オブジェクト間の優先順位に応じて特徴量算出データ及び補正データを選択するためのテーブルである。ここまでの参照によって、画像中にどのようなオブジェクトが存在し、それらのオブジェクトのうち主要オブジェクトが何であり、副オブジェクトの優先順位がどのようになっているかによって、特徴量算出データ及び補正データが選択されることになる。図6(C)に示す例では、「空」を「山」よりも優先する場合を示している。

【0036】図6(D)に示す特徴量算出データは、上述の各テーブルによって決定された画像中に存在するオブジェクト、主要オブジェクト、副オブジェクトの優先順位において、どのオブジェクトからどのような特徴量を抽出するかを定義している。この例では、「人物」オブジェクトから濃淡情報を、「空」オブジェクトから平均色相情報と濃淡情報を、「山」オブジェクトから平均色相情報を、それぞれ取得する旨を示している。

【0037】また図6(E)に示す補正データは、上述の各テーブルによって決定された画像中に存在するオブジェクト、主要オブジェクト、副オブジェクトの優先順位において、どのオブジェクトに対してどのような特徴量を用いてどのような補正処理を行うかを定義している。用いる特徴量は図6(D)に示す特徴量算出データに定義されているが、特徴量を抽出するオブジェクトと、その特徴量を用いて補正処理を施すオブジェクトは、必ずしも一致しない。逆に、他のオブジェクトの特徴から補正処理を行うことが可能である。例えば図6(E)に示す例では、主オブジェクトが「人物」、副オブジェクトが優先順位の順に「空」、「山」であるとき、「人物」には「空」の濃淡情報を基にして人肌を明るくする補正を行うことが定義されている。また「空」には、「山」の平均色相情報を基に、「空」の平均色相を補正することが定義されている。さらに、「山」及び画像全体に対しては補正処理を行わないことが定義されている。このように他のオブジェクトの特徴を利用して補正処理を定義することによって、周囲の状況に応じた補正処理が可能となり、より好ましい補正を行うことができる。

【0038】図7は、決定した補正方法の画像への適用の一例の説明図である。例えば図2に示したような画像の一例が入力され、図6に示したような関係情報データベース6を検索することによって図6(D)に示す特徴量算出データ及び図6(E)に示す補正データが得られた場合、定義に従って図7(A)に矢印で示すように「空」の濃淡情報が「人物」、特に顔などの人肌部分に反映され、また「山」の平均色相情報が「空」の色相に反映される。これによって、例えば図7(B)に示すように補正されることになる。このようにして画像のシー

ンに応じてオブジェクト毎に補正を行うので、オブジェクトに単独で補正処理を行う場合に比べて、全体として調和の取れた補正処理を行うことができる。

【0039】どのオブジェクトのどのような特徴量を用いてどのオブジェクトをどのように補正するかは、補正データの定義によって変更することが可能である。図8は、補正対象を異ならせた補正例の説明図である。図8(A)、(B)とも入力された画像は同じであり、「空」が主要オブジェクト、「山」が副オブジェクトである。このような場合に、主要オブジェクトに補正を行ってもよいし、あるいは副オブジェクトに補正を行ってもよい。例えば図8(A)に示すように主要オブジェクトである「空」の色を調整することによって、空を好ましく見せることができる。また図8(B)に示すように、「空」を調整せず、副オブジェクトである「山」の色を調整して、逆に主要オブジェクトである「空」を好ましく見せるといった補正方法もある。もちろん、画像全体を補正するといった場合もある。いずれの補正方法を適用するかは補正データの定義に従うことになる。あるいは、後述するオブジェクトの種類や大きさ、属性などの他の様々な情報を利用したり、あるいは、特徴量算出データに従って抽出した各オブジェクトの特徴量によって補正データ自体を切り替えるような構成を用いることも可能である。

【0040】このように関係情報データベース4を利用して、物体／領域認識部1で認識したオブジェクト、主副オブジェクト決定部2で決定した主要オブジェクト及び副オブジェクト（このとき副オブジェクトの順位も決定しておく）から、算出すべき特徴量と、その特徴量を利用した補正方法を決定することができる。

【0041】上述の例では主要オブジェクトと副オブジェクトの組み合わせのみから補正方法を決定する例を示したが、このほかにも種々の情報を加味して補正方法を決定することができる。図9は、主要オブジェクトと副オブジェクトのオブジェクトの種類及び大きさの関係による補正方法の決定の一例の説明図である。図9では、主要オブジェクトと副オブジェクトとの組み合わせとともに、大きさの要素を加味する場合の例を示している。図9に示す2つの例において画像中に存在するオブジェクトはともに「空」と「山」と複数の「雲」である。ここでは「空」が大きな面積を有しているため、「空」オブジェクトが主要オブジェクトであり、「山」と「雲」オブジェクトが副オブジェクトである。しかし、図9(A)においては「雲」の存在が大きい。このような場合には、主要オブジェクトの「空」をやや鮮やかにするだけでなくとめおく。また図9(B)に示したように「雲」が小さく存在するのみであれば、それらの「雲」は無視できると判断して、「空」をより鮮やかに調整するといったことができる。

【0042】このように、存在するオブジェクトの大き

さなどを加味して補正方法を決定することによって、小さなオブジェクトの存在に左右されることなく、画像のシーンを的確に把握することができ、画像全体として好ましい補正を行うことができる。

【0043】図10は、主要オブジェクトと副オブジェクトのオブジェクトの属性の関係による補正方法の決定の一例の説明図である。この例では、オブジェクトの属性を利用することによって、さらに細かい調整を可能とした例を示している。例えば「空」、「山」というオブジェクトの組み合わせでも「空」が快晴の空であるか、夕焼けの空であるかの違いで、その再現方法を変更することが可能である。図10(A)に示した例では、主要オブジェクトである「空」オブジェクトに属性値として「快晴」が付加されている場合を示している。このような快晴のシーンの場合、例えば空を鮮やかに再現するため、「山」オブジェクトの特徴量を利用して「空」を鮮やかに再現することができる。

【0044】また図10(B)に示した例では、主要オブジェクトである「空」オブジェクトに属性値として「夕焼け」が付加されている場合を示している。このような夕焼けのシーンの場合には、夕焼けの色を強調するため、山のディテールを犠牲にしてシルエット効果が出るように「空」オブジェクトの特徴量を利用して「山」を暗く再現するように補正することができる。

【0045】このように、オブジェクトの属性を利用することによって、それぞれの属性に応じた補正処理が可能になり、より細かい補正処理が可能となる。なお、このような属性値による補正方法の切り換えは、例えば関係情報データベース6に属性値テーブルなどを設け、属性値による特徴量算出データ及び補正データを切り換え可能に構成しておけばよい。

【0046】上述のようにして補正方法決定部3において補正方法を決定したら、その補正方法に関する情報を補正量算出部4に渡し、補正量算出部4で補正量を決定する。例えば上述の各例においても「明るく」、「暗く」、「鮮やかに」、などといった抽象的な表現を用いているが、どの程度「明るく」、「暗く」、「鮮やかに」するかを補正量算出部4で算出する。このとき、補正方法決定部3で関係情報データベース6を検索して得られた特徴量算出データ及び補正データを基に、補正データにおける定義に従って、指定されたオブジェクトの特徴量から補正対象のオブジェクトの補正量を算出する。特徴量は、補正方法決定部3で抽出して補正量算出部4に渡してもよいし、特徴量算出データを補正方法決定部3から補正量算出部4に渡して補正量算出部4で特徴量の抽出を行ってもよい。

【0047】補正方法決定部3と補正量算出部4によって、どのオブジェクト（あるいは画像全体）に対してどのような補正処理をどの程度行うかが決定される。補正実行部5では、これらに基づいて、入力された画像に対

して補正処理を行い、出力することになる。補正実行部5で行う補正処理としては、明るさ、彩度、コントラスト、記憶色、シャープネスといった画像要素の補正処理を行うことができる。もちろん、他の種々の補正処理を行ってもよい。

【0048】上述の説明では入力される画像として特に限定はしていないが、例えばデジタルカメラで撮影したり、反射型スキャナで入力したり、あるいはフィルムカメラで撮影したフィルムをフィルムスキャナなどでスキャン入力した、いわゆるビットマップ画像を想定している。しかし本発明はこれに限らず、例えばPDL等で記述された画像データであってもよい。この場合は、物体／領域認識部1で認識されるオブジェクトとしては、1ページ内に存在している、より広い意味でのオブジェクトとして、例えば文字オブジェクト、写真（イメージ）オブジェクトなどが認識される。そして、1ページの画像のシーンを認識して各オブジェクトの補正方法を決定することができる。例えば、主副オブジェクト決定部2において主要オブジェクト及び副オブジェクトを決定し、これらの主要オブジェクト及び副オブジェクトの関係等から補正方法を決定することができる。

【0049】図11は、PDLにより記述された画像データへの適用例の説明図である。図11(A)に示す例では、見出し文字とともに大きな写真が配置されている。この画像では、主要オブジェクトは「写真」であり、副オブジェクトは「文字」となる。このような画像は、例えばパンフレットなどに見られる画像であり、多くの場合、写真を好ましく再現することが望まれる。そのため、「文字」の特徴量を利用して「写真」を鮮やかに好ましく補正すればよい。

【0050】また図11(B)に示す例では、「写真」とその写真を説明する「文字」が並べられている。このような文書は例えば商品説明資料などに多く見られ、写真中の主要物を特にはっきりさせることが望まれる場合が多い。そのため、「文字」の特徴量を利用して「写真」中の背景をばかして主要物を際立たせる補正処理を行うとよい。

【0051】このようにPDLで記述された画像データの場合でも、1ページ内の画像のシーン、例えば、主要オブジェクトである「写真」のレイアウトや、「文字」という副オブジェクトのレイアウトによって補正方法を切り替えることで、より好ましい補正方法を1ページの文書（文書中の各オブジェクト）に適用することが可能である。

【0052】図12は、本発明の別の実施の形態を示すブロック図である。図中、図1と同様の部分には同じ符号を付して説明を省略する。7は分類情報決定部、8は画像データベースである。上述の実施の形態では、オブジェクトの認識と、主要オブジェクト及び副オブジェクトの決定及びそれらの関係を、画像の補正に利用した例

を示した。しかし、主要オブジェクト及び副オブジェクトの関係は、他の用途にも利用することが可能である。図12に示した例では、入力された画像を分類して格納する画像データベースシステムに本発明を適用した例を示している。

【0053】分類情報決定部7は、主副オブジェクト決定部2で決定された主要オブジェクト及び副オブジェクトの関係に基づいて、入力された画像の分類情報を生成する。そして、分類情報を入力された画像とともに画像データベース8に登録、格納させる。これによって、画像の題材を考慮した分類が可能となり、例えば主要オブジェクトと副オブジェクトの関係に基づいて画像データベース8から画像を検索することが可能になる。

【0054】図13は、画像と分類情報の関係の一例の説明図である。例えば、入力された画像が図13(A)に示すように、山中で人物を写したものである場合、主要オブジェクトは「人物」であり、副オブジェクトは「山」や「空」である。図13(B)は、同じ人物を写した写真ではあるが、海で写したものである。この場合には、主要オブジェクトは「人物」、副オブジェクトは「海」や「空」となる。このような主要オブジェクト及び副オブジェクトの関係を分類情報として画像データベース8に格納しておくことができる。従って、図13(A)では山の中で人物を撮った写真、図13(B)では海で人物を撮った写真、といったように、画像のシーンを的確に示す分類を行うことが可能となる。

【0055】従来は、主要オブジェクトのみで画像の分類が行われていたため、図13に示すいずれの画像も分類情報として「人物」となっており、これらを区別して検索することができなかった。しかし本発明では、主要オブジェクト及び副オブジェクトの関係が分類情報として画像データベース8に格納されているので、「人物」の写真ではあるが、「海」で写したものの、といった検索を行うことができる。

【0056】

【発明の効果】以上の説明から明らかなように、本発明によれば、画像中のオブジェクトによって一律的に補正方法を決めずに、画像のシーンの認識結果、例えば主要オブジェクトと周辺の副オブジェクトの関係等から補正方法を決定することができるため、画像のシーンに応じて、より好ましい補正処理を実現することが出来るという効果がある。

【0057】また、このような主要オブジェクト及び副オブジェクトの関係を分類情報として利用することによって、画像に対してより好ましい分類情報を付加することができ、画像全体を的確に示す分類付けと画像内容による的確な検索を実現することができる。

【図面の簡単な説明】

【図1】 本発明の実施の一形態を示すブロック図である。

【図2】 物体／領域認識部1で認識されるオブジェクトの一例の説明図である。

【図3】 主要オブジェクトの決定方法の一例の説明図である。

【図4】 主要オブジェクトの決定方法の別の例の説明図である。

【図5】 主要オブジェクトと副オブジェクトのオブジェクトの種類の関係による補正方法の決定の一例の説明図である。

【図6】 関係情報データベースの内容の一例の説明図 10 である。

【図7】 決定した補正方法の画像への適用の一例の説明図である。

【図8】 補正対象を異ならせた補正例の説明図である。

【図9】 主要オブジェクトと副オブジェクトのオブジェクトの種類及び大きさの関係による補正方法の決定の一例の説明図である。

【図10】 主要オブジェクトと副オブジェクトのオブジェクトの属性の関係による補正方法の決定の一例の説明図である。

【図11】 PDLにより記述された画像データへの適用例の説明図である。

【図12】 本発明の別の実施の形態を示すブロック図である。

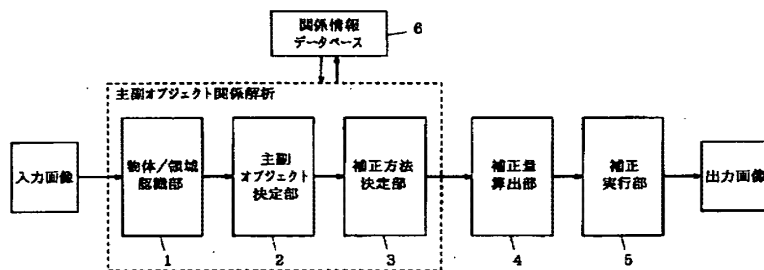
【図13】 画像と分類情報の関係の一例の説明図である。

【図14】 従来の画像処理装置の一例を示すブロック図である。

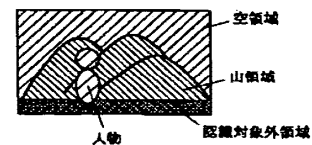
【符号の説明】

1…物体／領域認識部、2…主副オブジェクト決定部、3…補正方法決定部、4…補正量算出部、5…補正実行部、6…関係情報データベース、7…分類情報決定部、8…画像データベース、11…入力画像、12…主要オブジェクト／領域認識部、13…補正量算出部、14…補正実行部、15…出力画像。

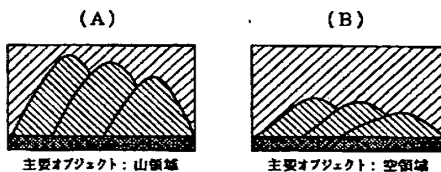
【図1】



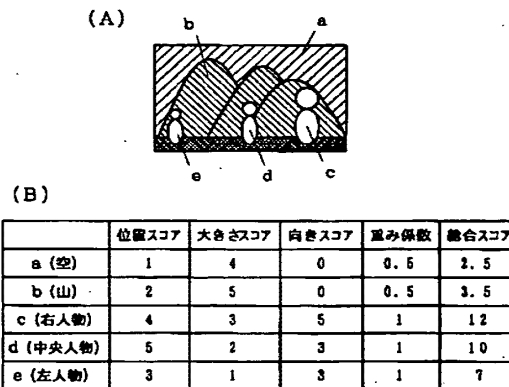
【図2】



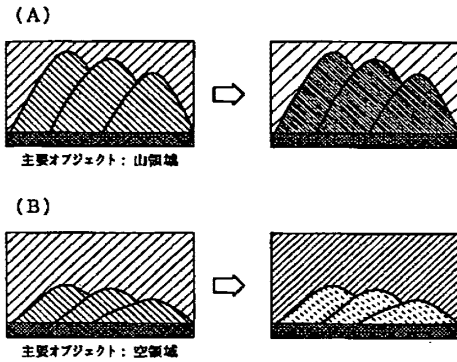
【図3】



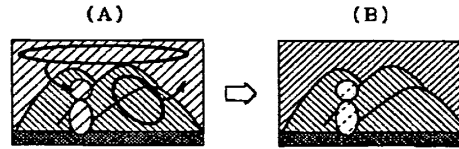
【図4】



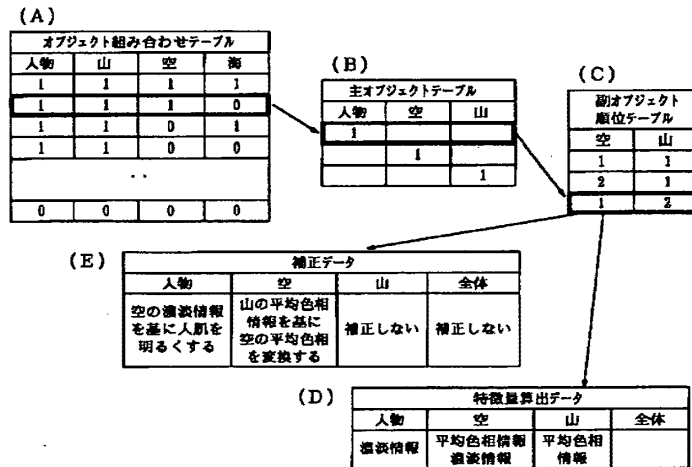
【図5】



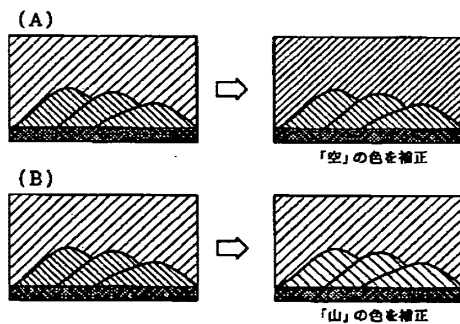
【図7】



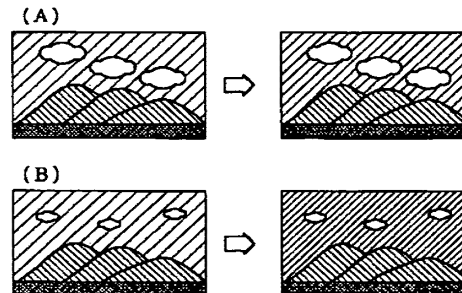
【図6】



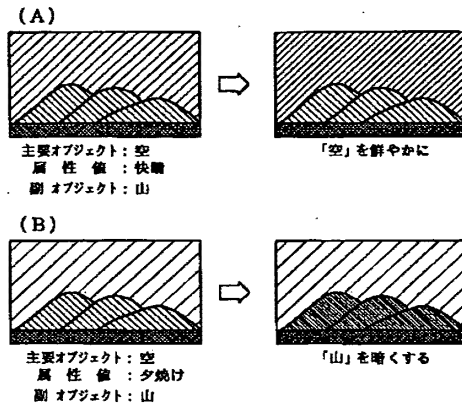
【図8】



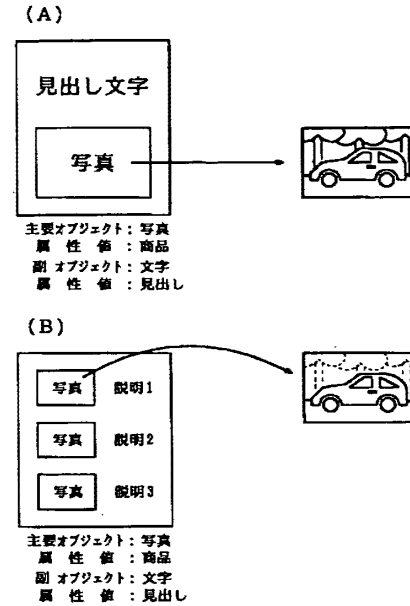
【図9】



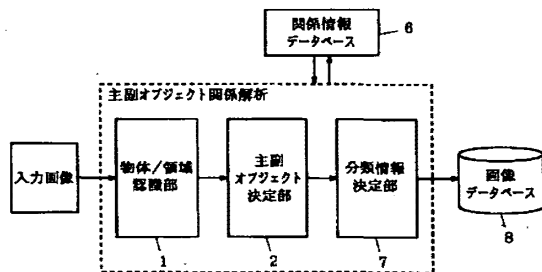
【図10】



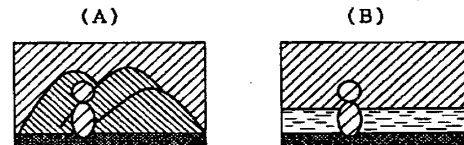
【図11】



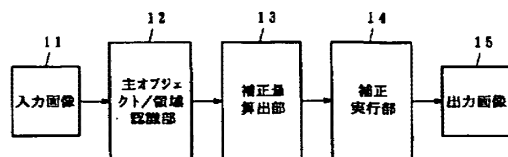
【図12】



【図13】



【図14】



*** NOTICES ***

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]An image processing system which amends a picture, comprising:

A recognition means to recognize two or more objects from said picture.

A Method-of-amendment determination means to recognize a scene of said picture and to determine a Method of amendment for said each object based on this recognition result.

[Claim 2]An image processing system which amends a picture, comprising:

A recognition means to recognize two or more objects from said picture.

An object determination means to determine main objects and a subobject from said two or more objects.

A Method-of-amendment determination means to determine a Method of amendment of said picture from relation between said main objects and said subobject.

[Claim 3]The image processing system according to claim 2, wherein combination of a kind of said main objects and a kind of said subobject is used for said Method-of-amendment determination means as relation between said main objects and said subobject.

[Claim 4]The image processing system according to claim 2 with which said Method-of-amendment determination means is characterized by a thing of a position of the two objects concerned, a size, and dignity for which one relation is used at least as relation between said main objects and said subobject.

[Claim 5]The image processing system according to any one of claims 2 to 4, wherein said Method-of-amendment determination means determines a Method of amendment performed for the whole picture or every object.

[Claim 6]The image processing system according to any one of claims 2 to 4, wherein said Method-of-amendment determination means determines a Method of amendment based on at least one characteristic quantity among characteristic quantity of said main object, a subobject, a field outside a recognition object, and the whole picture.

[Claim 7]The image processing system according to any one of claims 2 to 4, wherein said Method-of-amendment determination means determines a Method of amendment from relation between

attribution information of said main objects, and attribution information of a subobject.

[Claim 8]The image processing system according to any one of claims 2 to 7, wherein said Method-of-amendment determination means determines a Method of amendment having contained a color tone and a definition.

[Claim 9]A recognition means to recognize two or more objects from said picture in an image processing system which classifies a picture, An image processing system characterized by having a classification information determination means to determine classification information of said picture from relation between an object determination means to determine main objects and a subobject, and attribution information of said main objects and attribution information of said subobject from said two or more objects.

[Claim 10]Claim 2, wherein said objects are a field, things, or those aggregates thru/or the image processing system according to claim 9.

[Claim 11]The image processing system according to any one of claims 2 to 10, wherein said object determination means determines said main objects using one feature at least among a size of said object, a position, direction, and the number.

[Claim 12]The image processing system according to any one of claims 2 to 11, wherein said object determination means determines said main objects using a weighting factor defined for said every object.

[Claim 13]The image processing system according to any one of claims 2 to 10, wherein said object determination means determines said main objects with a user's directions.

[Claim 14]The image processing system according to any one of claims 1 to 13 which said picture is the data described by PDL, and is characterized by said recognition means recognizing two or more objects from PDL.

[Claim 15]An image processing method recognizing two or more objects from said picture, and recognizing a scene of said picture in an image processing method which amends a picture, and determining a Method of amendment for said each object based on a recognition result of a scene.

[Claim 16]In an image processing method which amends a picture, two or more objects are recognized from said picture, An image processing method determining main objects and a subobject from said two or more objects, and determining a Method of amendment of said picture from relation between said main objects and said subobject.

[Claim 17]The image processing method according to claim 16 characterized by using combination of a kind of said main objects, and a kind of said subobject as relation between said main objects and said subobject.

[Claim 18]The image processing method according to claim 16 characterized by a thing of a position of the two objects concerned, a size, and dignity for which one relation is used at least as relation between said main objects and said subobject.

[Claim 19]The image processing method according to any one of claims 16 to 18 characterized by carrying out for the whole picture or every object when determining said Method of amendment.

[Claim 20]The image processing method according to any one of claims 16 to 18 characterized by determining a Method of amendment based on at least one characteristic quantity among characteristic quantity of said main object, a subobject, a field outside a recognition object, and the whole picture when determining said Method of amendment.

[Claim 21]The image processing method according to any one of claims 16 to 18 characterized by determining a Method of amendment from relation between attribution information of said main objects, and attribution information of a subobject when determining said Method of amendment.

[Claim 22]The image processing method according to any one of claims 16 to 21, wherein said Method of amendment includes amendment of a color tone and a definition.

[Claim 23]In an image processing method which classifies a picture, two or more objects are recognized from said picture, An image processing method determining main objects and a subobject from said two or more objects, and determining classification information of said picture from relation between attribution information of said main objects, and attribution information of said subobject.

[Claim 24]Claim 16, wherein said objects are a field, things, or those aggregates thru/or the image processing method according to claim 23.

[Claim 25]The image processing method according to any one of claims 16 to 24 opting for determination of said main objects using one feature at least among a size of said object, a position, direction, and the number.

[Claim 26]The image processing method according to any one of claims 16 to 25 opting for determination of said main objects using a weighting factor defined for said every object.

[Claim 27]The image processing method according to any one of claims 16 to 24 opting for determination of said main objects with a user's directions.

[Claim 28]The image processing method according to any one of claims 15 to 27 which said picture is the data described by PDL, and is characterized by recognizing two or more objects from PDL.

[Claim 29]An image processing program making a computer perform the image processing method according to any one of claims 15 to 28.

[Claim 30]A storage which said computer having memorized a program for making a computer perform the image processing method according to any one of claims 15 to 28 can read.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]The digital image by which this invention was photoed with the digital camera etc., the digital image which inputted the negative film etc. by the film scanner etc., It is related with the technology of determining the Method of amendment which should be performed in order to reproduce preferably the digital image which inputted the photograph etc. with the reflection type scanner, the picture described by PDL (Page Description Language: Page Description Language), etc. It is related with the technology of determining the classification information for classifying a picture using the same technology.

[0002]

[Description of the Prior Art]With the photometry system prepared for the case where a photograph is taken using a common digital camera etc. at the digital camera, in the case of photography, photographing conditions, such as an exposing condition, are set up automatically and take a photograph according to the photographing condition in many cases. Since a photographic subject is

decided on the assumption that it is very average conditions, the photographing condition set up automatically may be unable to acquire a desired picture under different conditions from average conditions, such as Lighting Sub-Division conditions at the time of photography, hit condition of the light to a photographic subject, backlight conditions. For example, on backlight conditions, since it is bright as the whole scene, major objects (for example, a person's face etc.) may be reflected darkly. There was a case where the fault which a color-balance shifts remarkably, and is reflected and crowded by the conditions (evening glow, cloudy weather, etc.) of the differences in the light source which illuminates a photographic subject (sunlight, a fluorescent lamp, etc.), and the sun in the outdoors arose. Of course, also in a film camera etc., it is the same, and when a photograph is taken according to the photographing condition set up automatically, the same problem has occurred in the picture on a film.

Also in the digital image read by the film scanner etc., it is the same.

[0003]It is possible to such fault to acquire a desired picture by carrying out the compensation process of the digital image. However, while a general unfamiliar user chooses various kinds of compensation processes, it is dramatically difficult to adjust a parameter and to perform a compensation process. Therefore, it considers amending to the optimal picture automatically.

[0004]In order to perform the compensation process of a picture automatically, the picture concerned needs to recognize whether it is what photoed what kind of scene, and needs to perform the compensation process according to the photographing scene. In order to realize the compensation process to the picture according to such a photographing scene, some methods are proposed from before. As one of them, with the equipment indicated, for example to JP,H5-41830,A, it responds for a photographic subject to be a person, exposure setting is changed, and it is amending at the time of image acquisition. For example, in the equipment indicated to JP,H5-336535,A, the parameter of outline correction is changed to the person in a picture in the other portion. In the equipment indicated, for example to JP,2000-123164,A, a picture is divided into a block, an attribute is distinguished for every block, and chroma conversion according to the attribute is performed.

[0005]Drawing 14 is a block diagram showing an example of the conventional image processing system. As for a main object / field recognition part, and 13, 11 are [an amendment execution part and 15] outputted images a correction amount calculation section and 14 an inputted image and 12 among a figure. If each above conventional technology is collected, it has taken composition as shown in drawing 14. Namely, in [in a main object / field recognition part 12, detect the existence of main objects, such as a person in the inputted image 11, and the field of main objects, and] the correction amount calculation section 13, A Method of amendment, a corrected parameter, etc. which distinguished except [its] from main objects were determined, the compensation process was performed in the amendment execution part 14 using the Method of amendment and a corrected parameter, and the outputted image 15 has been obtained.

[0006]By such conventional technology, the compensation process which observed main objects becomes possible, and a good picture is acquired about objects main to be sure. However, there is a problem that amendment will be provided in a meaning for every existence of main objects or object. Although it is effective to amend focusing on the main objects at which human being gazes most, if it amends only paying attention to main objects, only main objects are emphasized, and it may become

a picture where the whole balance collapses and which is uncomfortable.

[0007]For example, when a "person" is photoed on backlight conditions, a "person" will be reflected darkly. If the whole picture is amended so that it may become bright in order to amend this a "person", the color of the empty background will fly. For example, even when a Method of amendment was determined by an object unit, for example by a uniform Method of amendment, there was a case where it did not become amendment for which it was suitable to the scene [say / that a "person" is bright and "empty" emphasizes chroma saturation] "person + sky."

[0008]Although the above-mentioned example explained the Prior art about the case where a picture is amended, when saving a picture, for example, adding and accumulating the classification information which shows the contents of the picture automatically is performed. Also in this case, from before, main objects were extracted out of the picture and the classification information which shows the object is added. However, even if it adds the classification information of a "person" to the picture by which the person is reflected, for example in the center, it is difficult to grasp the contents of the picture exactly. For example, it was not even understood whether it was photographed in the mountain whether it photographed in the sea. There was a problem that classification information -- "empty" certainly exists with a scenery photograph -- was not helpful only by enumerating the attribution information which shows an object, for example, for example.

[0009]

[Problem to be solved by the invention]An image processing system and an image processing method which this invention was made in view of the situation mentioned above, and can perform more desirable amendment to a picture according to a scene. It aims at providing the image processing system and image processing method of more desirable classification information which can be added to a picture. It aims at providing the image processing program which makes a computer perform such an image processing method, and the storage which stored such an image processing program.

[0010]

[Means for solving problem]In the image processing system and image processing method which amend a picture, this invention recognizes two or more objects from a picture, and carries out the feature of determining a Method of amendment based on the recognition result of the scene of a picture to those objects. After having recognized two or more objects from a picture especially, two or more an object to main objects and subobjects which have been recognized were determined, and it constituted from relation between the determined main objects and a subobject so that the Method of amendment of a picture might be determined. Thus, compared with the recognition result of the scene of a picture, and the case where it amends based on the recognition result of only main objects since a Method of amendment is especially determined from the relation using a subobject with the main objects in a picture, a compensation process can be performed according to the surrounding situation etc. Therefore, it becomes possible to perform the compensation process which balance was able to take to the picture, and a more desirable compensation process can be realized.

[0011]As relation between main objects and a subobject, a relation of combination of a kind of main objects and a kind of subobject, a position of two objects, size, and dignity which is one at least can be used. When determining a Method of amendment, it can carry out for the whole picture or every object. Or it can carry out based on at least one characteristic quantity among characteristic quantity of a main object and secondary object, a field outside a recognition object, and the whole

picture, or a Method of amendment can be determined from relation between attribution information of main objects, and attribution information of a subobject. Amendment of a color tone and a definition can be included in a Method of amendment.

[0012]When it can be considered as a field, things, or those aggregates and main objects are determined from the inside as an object to recognize, The features, such as a size of an object, a position, direction, and the number, and a weighting factor defined for every object can be used, or a user's directions can determine. A picture of a processing object may be a picture described by PDL besides a picture of a bit map.

[0013]In an image processing system and an image processing method with which this invention classifies a picture, From a picture, two or more objects are recognized and classification information of said picture is determined from relation between attribution information of main objects which determined and determined main objects and a subobject from two or more recognized objects, and attribution information of a subobject. Thus, since not only attribution information of main objects but attribution information of a subobject is taken into consideration and classification information is determined from those relations, For example, even if it is the picture to which a "person" is reflected, it enables them for having photographed in the "sea" whether it photographed in a "mountain" etc. to add to a picture classification information which can extract as classification information and shows the contents of the picture exactly, and to store it. Also about this invention, recognition of the above objects and a deciding method of main objects can be used. It may be the picture etc. which were described by PDL besides a bit map also about a picture of a processing object.

[0014]An image processing program which this invention makes perform these image processing methods to a computer furthermore, And in a server etc. which provide a storage which has memorized such an image processing program, and provide a personal computer, a workstation, and still such Image Processing Division, it is realizable.

[0015]

[Mode for carrying out the invention]Drawing 1 is a block diagram showing one form of enforcement of this invention. As for a correction method deciding part and 4, an object / field recognition part, and 2 are [an amendment execution part and 6] relevant information databases a correction amount calculation section and 5 a main-sub object deciding part and 3 one among a figure. An object / field recognition part 1 recognizes two or more objects from an inputted picture. An object to recognize can be used as a field, things, or those aggregates. In an example of recognition of the object [recognition / of an object] for example "vacant regions", frequency structure has the feature from a low frequency wave, and it is in the picture upper part, and the position can catch a closed field included in a blue phase as a color information, and can be recognized. The recognition of objects, such as a face of a person or a person, can perform a complexion range, detection of face structure, etc. using a known technique. The recognition technique of an object is arbitrary and various publicly known techniques can be used.

[0016]The main-sub object deciding part 2 determines two or more an object to main objects and subobjects which have been recognized by the object / field recognition part 1. It can determine from the dignity etc. of the size which the object recognized, for example occupies in a picture as a deciding method of main objects, or a position and the object defined beforehand. Or it may

constitute so that a picture may be displayed and a user may direct. It is considered that the object as which it has been recognized other than a main object is a subobject. However, when there are many subobjects, it is not necessary to make all into a subobject.

[0017]Fundamentally, the correction method deciding part 3 recognizes the scene of a picture, and determines the Method of amendment for each object based on the recognition result. As the example, the main object determined in the main-sub object house pars basilaris ossis occipitalis.2 and a subobject are used here. The relation between main objects and the other subobject is analyzed first. In the case of analysis, information, including an amendment part, a characteristic quantity calculating method, the compensation process method, etc., is acquirable from the relation between main objects and a subobject with reference to the relevant information database 6, for example. As relation between main objects and a subobject, the combination of the kind of main objects and the kind of subobject can be used, or relations, such as a position of two objects, a size, and dignity, the relation of each attribution information, etc. can be used. moreover -- as the amendment part to determine -- a whole picture or main object, and secondary object -- it can be considered as things etc. and the compensation process method can be determined for every amendment part. In accordance with the characteristic quantity calculating method acquired from the relation between above-mentioned main objects and a subobject, the compensation process method can obtain characteristic quantity, such as a field outside a main object and secondary object recognition object, and the whole picture, and can determine it from those characteristic quantity.

[0018]The correction amount calculation section 4 computes what amendment is performed in accordance with a Method of amendment determined in the correction method deciding part 3. for example, characteristic quantity can be computed based on a characteristic quantity calculating method acquired by the correction method deciding part 3 (or -- using characteristic quantity computed by the correction method deciding part 3), and a correction amount corresponding to each Method of amendment can be computed. Unlike a uniform calculating method like before, in a characteristic quantity calculating method from a pattern of combination of main objects and a subobject. A correction amount is computed by definition using characteristic quantity of which object to compute a correction amount being made, and obtaining characteristic quantity which suited a pattern of each combination based on this definition.

[0019]The amendment execution part 5 actually performs a compensation process to an inputted picture only a correction amount computed by the correction amount calculation section 4 about a compensation process for which it opted by the correction method deciding part 3. As a compensation process, color correction, definition amendment, etc. can be performed, for example.

[0020]Amendment in consideration of an object at which it gazes in which a user who appreciates a picture gets interested most can be performed by determining main objects by such composition compared with technology of performing a uniform compensation process for every object like before. In relation between main objects and a subobject, optimal compensation process can be performed to each object, a field outside a recognition object, or the whole picture by determining not only a main object but a subobject. Therefore, mismatching with the circumference by amending only to main objects like before is avoided, and it becomes possible to perform the best compensation process which took the characteristic of a scene into consideration as a whole. Although considering amending a person's flesh color as an example only amendment to a certain target color can be

conventionally performed to a person's flesh color, by determining a Method of amendment from relation between main objects and a subobject. In the case of a portrait with a "marine" subobject, amendment can be changed by a recognized subobject, such as changing an amendment target color into healthy light brown color.

[0021] Hereafter, the details of operation of each part are explained, using an example. The interval of hatching, etc. are changed and the example of the picture shown below is shown, when hatching is used and actual color is amended (for example, amendment of vividness), in order to express color etc.

[0022] Drawing 2 is an explanatory view of an example of the object recognized by the object / field recognition part 1. As mentioned above, in an object / field recognition part 1, a person's face, a certain object article, etc. can be recognized and defined as an object, for example, or a certain closed region can be recognized and defined. In the scene camera which includes a person as shows drawing 2 as an example, objects, such as a "person", "vacant regions", and a "mountain field", can be recognized. For example, a "vacant-regions" object is a low frequency wave as a frequency structure, position information is in the upper part and the color information can catch the closed field included in a blue phase. The recognition as objects, such as a face of a person or a person, should just identify using a known technique. In this example, it is considered as the field outside a recognition object except the recognized object.

[0023] Next, in the main-sub object deciding part 2, a main object and a subobject are determined out of the object recognized by the object / field recognition part 1. Drawing 3 is an explanatory view of an example of the deciding method of main objects. The example of the landscape of a mountain and empty is shown in drawing 3, and the process in which main objects are determined by the size of a field is shown. For example, the object of the larger one can be made into main objects as a deciding method of main objects, and others can be made into a subobject. In this case, in the example shown in drawing 3 (A), the rate that the object of a mountain occupies is large, the object of a "mountain field" turns into main objects, and other objects, such as "vacant regions", turn into a subobject. In the example shown in drawing 3 (B), since a conversely large sky spreads out, a "vacant-regions" object is made into main objects, and other objects, such as a "mountain field", turn into a subobject.

[0024] Drawing 4 is an explanatory view of another example of the deciding method of main objects. Here, the example which determines main objects based on the size of each object, a position, direction, a weighting factor, etc. is shown. The picture inputted into drawing 4 (A) is shown, and the mark of a-e is given to each recognized object. Namely, a "mountain field" and a c-e object are "persons", and, as for a object, as large a person as a right-hand side person exists, as for "vacant regions" and b object. About these objects, a size, a position, and direction are investigated and a weighting is carried out, respectively. The result is shown in drawing 4 (B). As a position score, it is close to a center and dignity is enlarged as the foreground. Therefore, the dignity of d object which is a central person is the largest. As a size score, the weighting is enlarged, so that it is large. Since b object which shows a "mountain field" in this example occupies the biggest area, the biggest weighting is made. the direction score has turned to the transverse plane especially in a person etc. - or the weighting of other directions is carried out by whether it is suitable. In this example, the weighting as what has turned to the transverse plane with big c object which shows right-hand side

"person" is performed. Since there is no direction about "vacant regions" and a "mountain field", it is referred to as 0.

[0025]Furthermore in this example, the weighting factor defined for every object is set up. For example, when a person exists, it is generally more nearly main than the object of a mountain or empty in many cases. Therefore, the big weighting factor is assigned to the c-e object of a "person" rather than a object of "vacant regions", or b object of the "mountain field" also here.

[0026]And the synthetic score is computed by synthesizing the position score, the size score, direction score, and weighting factor which were carried out in this way and set up, respectively. In this example, the synthetic score is computed with x (score for position score + size score +) weighting factor. This synthetic score should just make the object used as the largest value main objects. In this example, c object which is right-hand side "person" is determined as main objects. Other objects turn into a subobject. A subobject can be limited to some. For example, it can choose arbitrarily, such as choosing it as descending of a synthetic score, or choosing that from which the classification of an object differs.

[0027]Although the size of an object, a position, and direction were evaluated and used in the example shown in drawing 4 (B), it is possible to use other various features. Of course, it is arbitrary also about the calculating method of a synthetic score.

[0028]Although two methods were shown as a deciding method of main objects here, techniques various besides this are applicable. For example, it is also possible to choose main objects manually, displaying a picture on monitor display, such as a personal computer which a user uses.

[0029]Next, in the correction method deciding part 3, the Method of amendment performed to the inputted picture from the relation between the main objects determined by the main-sub object deciding part 2 as mentioned above and a subobject is determined. As relation between the main objects used at this time, and a subobject, the combination of the kind of main objects and the kind of said subobject can be used. Drawing 5 is an explanatory view of an example of the determination of the Method of amendment by the relation of the kind of object of main objects and a subobject. As it explained also in drawing 3, in drawing 5 (A), it is a scene of the "mountain" "whose mountain field" is a main object and whose "vacant regions" is subobjects. The Method of amendment of making it somewhat brighter to "vacant regions" in the case of this combination, and making a "mountain field" vivid using the combination of the kind of such main objects and subobject etc. can be matched. By this, contrast of "empty" and a "mountain" can be enlarged and it can amend in the picture which emphasized the "mountain" more. In drawing 5 (B), it is a scene of the "empty" "whose vacant regions" is main objects and whose "mountain field" is a subobject conversely. In such a case, the Method of amendment of making "vacant regions" vivid etc. can be matched. In consideration of existence of a "mountain", this can amend the color of the "vacant regions" which is main objects so that it may become more vivid.

[0030]Thus, the combination of the kind of main objects and subobject expresses the scene of the picture, and it is possible by determining a Method of amendment with the combination of the kind of main objects and subobject to apply a more desirable Method of amendment. For example, even when the object of the same "vacant regions" and a "mountain field" exists like an above-mentioned example, a more desirable Method of amendment can be applied from the relation of the combination of the main ** to each picture.

[0031] Thus, when determining a Method of amendment, it is necessary to determine for every combination using amending where and what kind of feature it amends how from the combination of the kind of main objects and subobject. carrying out either of the main object and secondary objects, or which object to where is amended with an object of amendment -- or it is whether to amend the whole picture. What kind of feature is about which portion of a main object and secondary object, the field outside a recognition object, and the whole picture to use characteristic quantity like a throat, such as hue, a shade, a specific color, for example. It is necessary to determine what kind of compensation processes, such as color correction, definition amendment, enhancement correction, should be performed, using still such a feature.

[0032] In order to determine where is such amended how using what kind of feature, the relevant information database 6 is used in this example. Drawing 6 is an explanatory view of an example of the contents of the relevant information database. An object combination table shown in drawing 6 (A) in an example of a relevant information database shown in drawing 6. It is constituted by main object tables shown in drawing 6 (B), a subobject ranking table shown in drawing 6 (C), characteristic quantity calculation data shown in drawing 6 (D), and correction data shown in drawing 6 (E).

[0033] An object combination table shown in drawing 6 (A) is a table for referring to main object tables from combination of an object which exists in a picture, and shows an example by which an object of a "person", "empty", the "sea", and a "mountain" is defined in this example. Here, an arrow which shows a pointer to main object tables is illustrated as that into which a picture in which a "person", "empty", and a "mountain" exist as shown in drawing 2 was inputted.

[0034] Main object tables shown in drawing 6 (B) are tables for referring to a subobject ranking table by whether which object is a main object among objects in an inputted picture. In this example, a "person" object is illustrating an arrow which shows an example which was a main object and shows a pointer to a subobject ranking table.

[0035] In the subobject ranking table shown in drawing 6 (C), it is a table for choosing characteristic quantity calculation data and correction data according to the priority between subobjects. By the reference so far, what kind of object will exist in a picture, main objects will be what among those objects, and characteristic quantity calculation data and correction data will be chosen by what the priority of the subobject has become. The example shown in drawing 6 (C) shows the case where priority is given to "empty" over a "mountain."

[0036] In the priority of an object [which exists in the picture determined by each above-mentioned table], main object, and secondary object, the characteristic quantity calculation data shown in drawing 6 (D) defines what kind of characteristic quantity is extracted from which object. This example shows acquiring [shade information] a "mountain" object to average hue information for an "empty" object to average hue information, and shade information, respectively from the "person" object.

[0037] In a priority of an object [which exists in a picture determined by each above-mentioned table], main object, and secondary object, correction data shown in drawing 6 (E) defines what kind of compensation process is performed using what kind of characteristic quantity to which object. Although characteristic quantity to be used is defined as characteristic quantity calculation data shown in drawing 6 (D), an object which extracts characteristic quantity, and an object which performs a compensation process using the characteristic quantity are not necessarily in agreement.

On the contrary, it is possible to perform a compensation process from the feature of other objects. For example, in an example shown in drawing 6 (E), when a main object is a "person" and subobjects are "empty" and a "mountain" in order of a priority, performing amendment which makes body warmth bright based on "empty" shade information is defined as a "person." Amending an "empty" average hue is defined as "empty" based on average hue information on a "mountain." Not performing a compensation process to a "mountain" and the whole picture is defined. Thus, by defining a compensation process using the feature of other objects, a compensation process according to the surrounding situation becomes possible, and more desirable amendment can be performed.

[0038]Drawing 7 is an explanatory view of an example of application in a picture of a determined Method of amendment. For example, when correction data shown in characteristic quantity calculation data and drawing 6 (E) which are shown in drawing 6 (D) by searching the relevant information database 6 as an example of a picture as shown in drawing 2 inputted and shown in drawing 6 is obtained, As an arrow shows to drawing 7 (A) according to a definition, "empty" shade information is reflected in body warmth portions, such as a "person", especially a face, and average hue information on a "mountain" is reflected in "empty" hue. It will be amended by this as shown, for example in drawing 7 (B). Thus, since it amends for every object according to a scene of a picture, compared with a case where a compensation process is independently performed to an object, a compensation process which was able to take harmony as a whole can be performed.

[0039]It can be changed by the definition of correction data which object is amended how using characteristic quantity like which object throat. Drawing 8 is an explanatory view of the example of amendment which changed the object of amendment. The picture as which drawing 8 (A) and (B) was inputted is the same, "empty" is a main object and a "mountain" is a subobject. In such a case, it may amend to main objects or may amend to a subobject. For example, by adjusting the color of the "empty" which is a main object as shown in drawing 8 (A), empty can be shown preferably. As shown in drawing 8 (B), "empty" is not adjusted, but the color of the "mountain" which is a subobject is adjusted, and there is also a Method of amendment of showing preferably the "empty" which is a main object conversely. Of course, it may have been said that the whole picture was amended. Whether which Method of amendment is applied will follow the definition of correction data. Or it is also possible to use other various information, including the kind of object mentioned later, a size, an attribute, etc., or to use composition which changes the correction data itself with the characteristic quantity of each object extracted according to characteristic quantity calculation data.

[0040]Thus, the object recognized by the object / field recognition part 1 using the relevant information database 4, The Method of amendment which used the characteristic quantity which should be computed, and its characteristic quantity from the main object determined by the main-sub object deciding part 2 and the subobject (the ranking of the subobject is also determined at this time) can be determined.

[0041]Although the above-mentioned example showed the example which determines a Method of amendment only from the combination of main objects and a subobject, various information can be considered and a Method of amendment can be determined. Drawing 9 is an explanatory view of the kind of object of main objects and a subobject, and an example of the determination of the Method of amendment by the relation of a size. Drawing 9 shows the example in the case of considering the

element of a size with the combination of main objects and a subobject. The objects which exist in a picture in two examples shown in drawing 9 are both "empty", a "mountain", and two or more "clouds." Since "empty" has a big area here, an "empty" object is a main object and a "mountain" and a "cloud" object are subobjects. However, in drawing 9 (A), existence of "clouds" is large. In such a case, because the "empty" of main objects is made a little vivid, it limits and sets. As shown in drawing 9 (B), when it was only that "clouds" exists small, it could judge that those "clouds" could be disregarded and it was able to be said that "empty" was adjusted more skillfully.

[0042] Thus, without being influenced by existence of a small object by considering the size etc. of the existing object and determining a Method of amendment, the scene of a picture can be grasped exactly and amendment desirable as the whole picture can be performed.

[0043] Drawing 10 is an explanatory view of an example of the determination of the Method of amendment by the relation of the attribute of the object of main objects and a subobject. In this example, by using the attribute of an object shows the example which enabled still finer adjustment. For example, it is that difference which "empty" is fine empty also in the combination of the object "empty" and a "mountain", or is the empty of evening glow, and it is possible to change the reproduction method. The example shown in drawing 10 (A) shows the case where "fine weather" is added to the "empty" object which is a main object as an attribute value. Since empty is reproduced skillfully, for example in the case of such a fine scene, "empty" is skillfully reproducible using the characteristic quantity of a "mountain" object.

[0044] The example shown in drawing 10 (B) shows the case where "evening glow" is added to the "empty" object which is a main object as an attribute value. In the case of such a scene of evening glow, since the color of evening glow is emphasized, it can amend so that a silhouette effect may show up at the sacrifice of the detail of a mountain and a "mountain" may be darkly reproduced using the characteristic quantity of an "empty" object.

[0045] Thus, by using the attribute of an object, the compensation process according to each attribute becomes possible, and the finer compensation process of it becomes possible. The change of the Method of amendment by such an attribute value establishes an attribute value table etc., for example in the relevant information database 6, and should just constitute the characteristic quantity calculation data and the correction data based on an attribute value so that a change is possible.

[0046] If a Method of amendment is determined [in / as mentioned above / the correction method deciding part 3], the information about the Method of amendment will be passed to the correction amount calculation section 4, and a correction amount will be determined by the correction amount calculation section 4. for example, -- in each above-mentioned example -- "bright" -- "dark" -- "vivid" -- etc. -- although a said abstract expression is used, it is "brightly" computed how much "darkly" by the correction amount calculation section 4 whether it is made "vivid." At this time, the correction amount of the object of an object of amendment is computed from the characteristic quantity of the object specified according to the definition in correction data based on the characteristic quantity calculation data and the correction data which were produced by searching the relevant information database 6 with the correction method deciding part 3. Characteristic quantity is extracted by the correction method deciding part 3, it may be passed to the correction amount calculation section 4, may pass characteristic quantity calculation data to the correction amount calculation section 4 from the correction method deciding part 3, and may extract

characteristic quantity by the correction amount calculation section 4.

[0047]It is determined what kind of how many compensation processes the correction method deciding part 3 and the correction amount calculation section 4 perform to which object (or picture whole). In the amendment execution part 5, it will output by performing a compensation process to the inputted picture based on these. As a compensation process performed by the amendment execution part 5, the compensation process of image elements, such as a luminosity, chroma saturation, contrast, a memory color, and sharpness, can be performed. Of course, other various compensation processes may be performed.

[0048]Although limitation in particular has not been carried out as a picture inputted in above-mentioned explanation, take a photograph, for example with a digital camera, it inputs with a reflection type scanner, or what is called a bitmapped image that carried out the scanning input of the film photoed with the film camera by the film scanner etc. is assumed. However, this invention may be the image data described, for example by PDL etc. not only in this. In this case, as an object recognized by the object / field recognition part 1, a character object, a photograph (image) object, etc. are recognized as an object in the larger meaning which exists in 1 page, for example. And the scene of a 1-page picture can be recognized and the Method of amendment of each object can be determined. For example, a main object and a subobject can be determined in the main-sub object deciding part 2, and a Method of amendment can be determined from the relation between these main objects and a subobject, etc.

[0049]Drawing 11 is an explanatory view of an example of application to image data described by PDL. In an example shown in drawing 11 (A), a big photograph is arranged with a reference letter. In this picture, main objects are "photographs" and a subobject serves as a "character." Such a picture is a picture looked at by pamphlet etc., for example, and, in many cases, to reproduce a photograph preferably is desired. Therefore, what is necessary is just to amend a "photograph" preferably skillfully using characteristic quantity of a "character."

[0050]In an example shown in drawing 11 (B), a "character" explaining a "photograph" and its photograph is put in order. Many such documents for example, in description-of-item data etc. are seen, and to clarify especially main things in a photograph is desired in many cases. Therefore, it is good to perform a compensation process which obscures a background in a "photograph" using characteristic quantity of a "character", and makes main things conspicuous.

[0051]Also in the case of image data described by PDL, thus, a scene of a picture in 1 page, For example, a more desirable thing for which it is and a Method of amendment is applied to a 1-page document (each object in a document) is possible by changing a Method of amendment according to a layout of a "photograph" which is a main object, and the layout of the subobject a "character."

[0052]Drawing 12 is a block diagram showing another embodiment of this invention. Among a figure, the same mark is given to the same portion as drawing 1, and explanation is omitted. 7 is a classification information deciding part and 8 is an image database. By an above-mentioned embodiment, an example which used determination and those relations between a main object and a subobject for amendment of a picture was indicated to be recognition of an object. However, relation between a main object and a subobject can be used for other uses. An example shown in drawing 12 shows an example which applied this invention to an image database system which classifies and stores an inputted picture.

[0053]The classification information deciding part 7 generates the classification information of the inputted picture based on the relation between the main object determined by the main-sub object deciding part 2, and a subobject. And it is made to register and store in the image database 8 with the picture into which classification information was inputted. It becomes possible to attain the classification in consideration of the subject matter of the picture, for example, to search a picture from the image database 8 by this, based on the relation between main objects and a subobject.

[0054]Drawing 13 is an explanatory view of an example of the relation between a picture and classification information. For example, as the inputted picture is shown in drawing 13 (A), when copying a person in Yamanaka, main objects are "persons" and subobjects are a "mountain" and "empty." Although drawing 13 (B) is the photograph which copied the same person, it is copied in the sea. In this case, main objects serve as a "person" and a subobject serves as the "sea" and "empty." It is storable in the image database 8 by making relation between such a main object and a subobject into classification information. Therefore, as it was called the photograph which took a picture of a person in the mountain in drawing 13 (A), and the photograph which took a picture of a person in drawing 13 (B) in the sea, it becomes possible to perform the classification which shows the scene of a picture exactly.

[0055]Conventionally, since a classification of a picture was performed only by main objects, any picture shown in drawing 13 serves as a "person" as classification information, and they were not able to be searched [were able to distinguish these and]. However, in this invention, since relation between a main object and a subobject is stored in the image database 8 as classification information, it is a photograph of a "person", but search called what copied in the "sea" can be performed.

[0056]

[Effect of the Invention]According to this invention, without deciding a Method of amendment uniformly by the object in a picture so that clearly from the above explanation, Since a Method of amendment can be determined from the relation of the recognition result of the scene of a picture, for example, main objects and a surrounding subobject, etc., according to the scene of a picture, it is effective in a more desirable compensation process being realizable.

[0057]By using the relation between such a main object and a subobject as classification information, more desirable classification information can be added to a picture and exact search by classification attachment and the image content which show the whole picture exactly can be realized.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing one form of enforcement of this invention.

[Drawing 2]It is an explanatory view of an example of the object recognized by the object / field recognition part 1.

[Drawing 3]It is an explanatory view of an example of the deciding method of main objects.

[Drawing 4]It is an explanatory view of another example of the deciding method of main objects.

[Drawing 5]It is an explanatory view of an example of the determination of the Method of amendment

by the relation of the kind of object of main objects and a subobject.

[Drawing 6] It is an explanatory view of an example of the contents of the relevant information database.

[Drawing 7] It is an explanatory view of an example of application in the picture of the determined Method of amendment.

[Drawing 8] It is an explanatory view of the example of amendment which changed the object of amendment.

[Drawing 9] It is an explanatory view of the kind of object of main objects and a subobject, and an example of the determination of the Method of amendment by the relation of a size.

[Drawing 10] It is an explanatory view of an example of the determination of the Method of amendment by the relation of the attribute of the object of main objects and a subobject.

[Drawing 11] It is an explanatory view of the example of application to the image data described by PDL.

[Drawing 12] It is a block diagram showing another embodiment of this invention.

[Drawing 13] It is an explanatory view of an example of the relation between a picture and classification information.

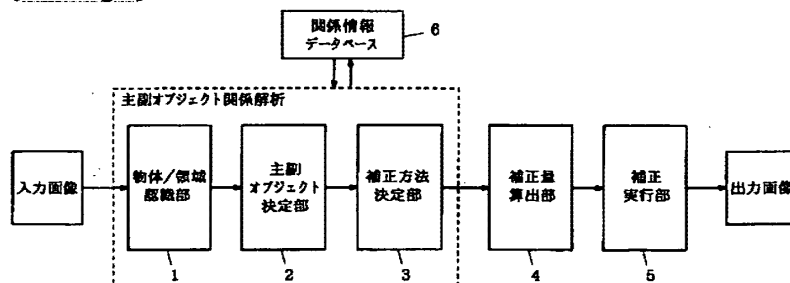
[Drawing 14] It is a block diagram showing an example of the conventional image processing system.

[Explanations of letters or numerals]

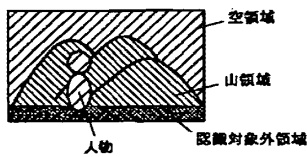
1 -- An object / field recognition part, 2 -- A main-sub object deciding part, 3 -- Correction method deciding part, 4 -- A classification information deciding part, 8 / -- An image database, 11 / -- An inputted image, 12 / -- A main object / field recognition part 13 / -- A correction amount calculation section, 14 / -- An amendment execution part, 15 / -- Outputted image.] -- A correction amount calculation section, 5 -- An amendment execution part, 6 -- A relevant information database, 7

DRAWINGS

[Drawing 1]

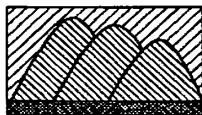


[Drawing 2]



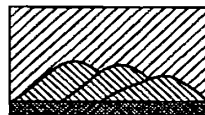
[Drawing 3]

(A)



主要オブジェクト: 山領域

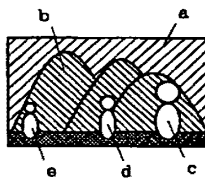
(B)



主要オブジェクト: 空領域

[Drawing 4]

(A)

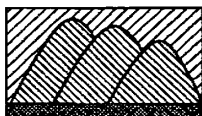


(B)

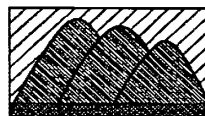
	位置スコア	大きさスコア	向きスコア	重み係数	総合スコア
a (空)	1	4	0	0.5	2.5
b (山)	2	5	0	0.5	3.5
c (右人物)	4	3	5	1	12
d (中央人物)	5	2	3	1	10
e (左人物)	3	1	3	1	7

[Drawing 5]

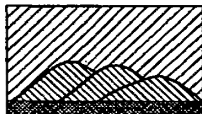
(A)



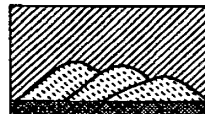
主要オブジェクト: 山領域



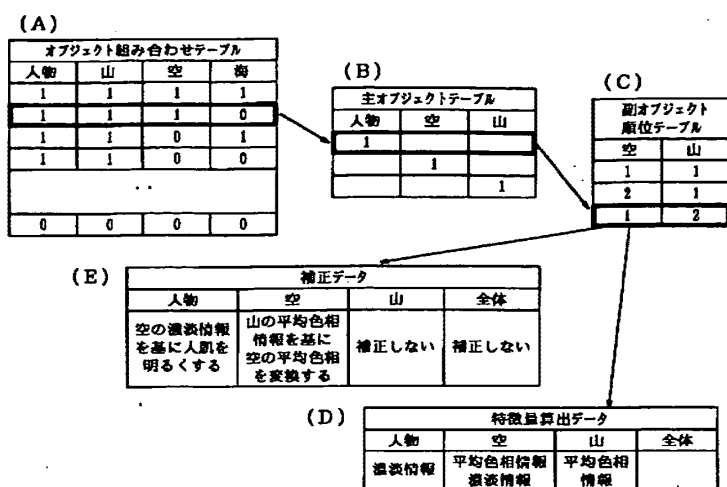
(B)



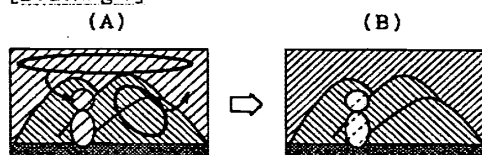
主要オブジェクト: 空領域



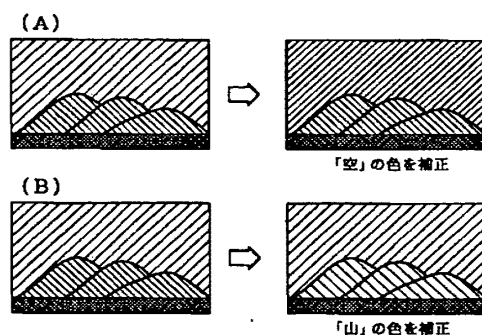
[Drawing 6]



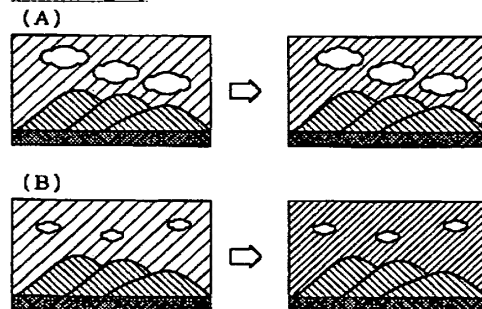
[Drawing 7]



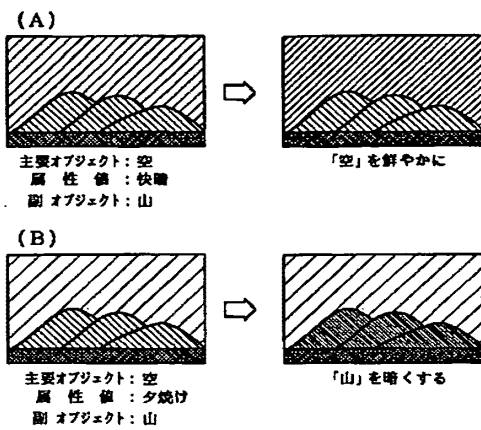
[Drawing 8]



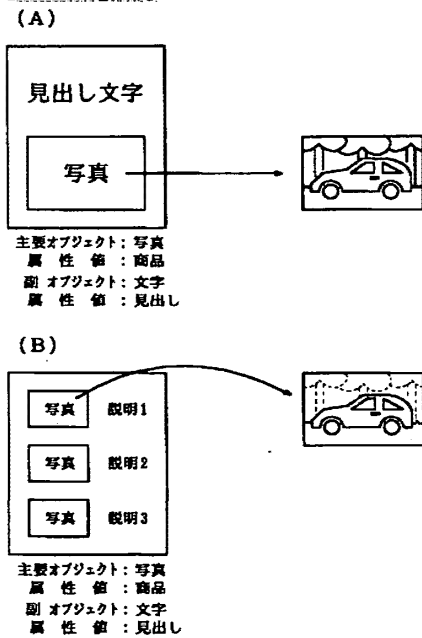
[Drawing 9]



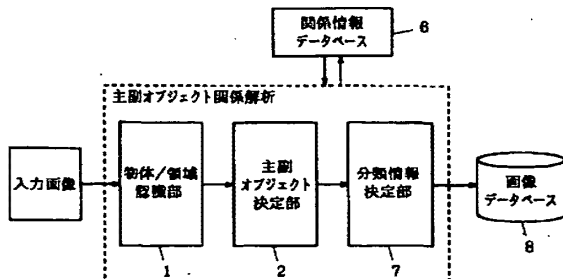
[Drawing 10]



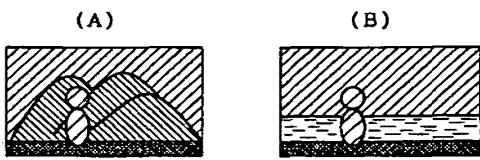
[Drawing 11]



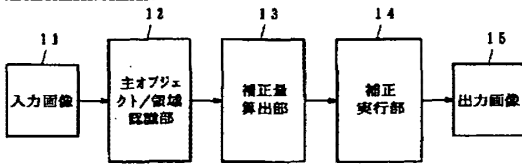
[Drawing 12]



[Drawing 13]



[Drawing 14]



Jbu
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Toshie IMAI

Application No. 12/590,586

Filed: November 10, 2009

For: DETERMINATION OF MAIN OBJECT ON
IMAGE AND IMPROVEMENT OF IMAGE
QUALITY ACCORDING TO MAIN OBJECT



) Attorney Docket No. MIPFP147C

) Examiner: P. Tran

) Group Art Unit: 2624

) Date: November 30, 2010

) Confirmation No. 2020

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on November 30, 2010.

Signed:

Diane Schwanbeck
Diane Schwanbeck

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

The references listed in the attached PTO Form 1449, copies of the non-U.S. references of which are attached, may be material to examination of the above-identified patent application. Applicant submits these references in compliance with his duty of disclosure pursuant to 37 CFR §§ 1.56 and 1.97. The Examiner is requested to consider these references and to acknowledge such consideration by signing the appropriate location on the attached PTO Form 1449.

References L and M are in the Japanese language. The relevance of References L and M can be ascertained by reviewing the attached machine-generated English translations these references (Applicant notes that Reference L was previously submitted without an English translation). In addition, Reference R is an English-language abstract of Reference M.

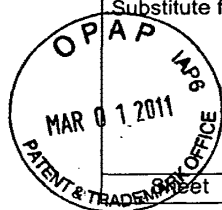
Applicant states that the references listed in the attached PTO Form 1449 were cited in a communication in a counterpart Japanese application not more than three months prior to the filing of this Information Disclosure Statement (IDS). Accordingly, no fees are due in connection with the filing of this IDS. In the event fees are due to effect consideration of the cited references, the Commissioner may charge such fees to Deposit Account 50-0805 (Order No. MIFP147C).

Respectfully submitted,
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Substitute for Form 1449/PTO

Information Disclosure Statement By Applicant

(Use as many sheets as necessary)

Application Number	12/590,586
Filing Date:	November 10, 2009
First Named Inventor:	Toshie IMAI
Art Unit:	2624
Examiner Name:	P. Tran
Attorney Docket Number:	MIPFP147C

1 of 1

U.S. Patent Documents

Examiner Initial	Cite No.	Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear
	A				
	B				
	C				
	D				
	E				
	F				
	G				
	H				
	I				
	J				
	K				

Foreign Patent Documents

Examiner Initial	Cite No.	Foreign Patent Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	Translation
	L	JP 11-167634	6/1999	Okochi et al		YES NO
	M	JP 2001-160057	6/2001	Sato et al.		x
	N	JP 2003-087815	3/2003	Nochida		x
	O					
	P					
	Q					

Non Patent Literature Documents

Examiner Initial	Cite No.	Include name of author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	R	
	S	
	T	
	U	
	V	
	W	

Examiner Signature	Date Considered
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Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

IMAGE AREA DIVIDING METHOD, IMAGE AREA DIVIDING DEVICE, RECORDING MEDIUM STORING IMAGE AREA DIVIDING PROGRAM, IMAGE RETRIEVING METHOD, IMAGE RETRIEVING DEVICE AND RECORDING MEDIUM STORING IMAGE RETRIEVAL PROGRAM.

Publication number: JP11167634 (A)

Publication date: 1999-06-22

Inventor(s): OKOCHI YORIYUKI; KOBAYASHI HIDEYUKI +

Applicant(s): OMRON TATEISI ELECTRONICS CO +

Classification:

- international: **G06T7/00**; (IPC1-7): G06T7/00

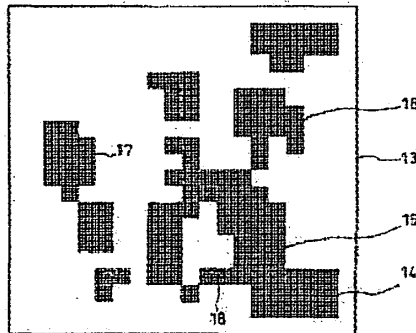
- European:

Application number: JP19970350002 19971203

Priority number(s): JP19970350002 19971203

Abstract of JP 11167634 (A)

PROBLEM TO BE SOLVED: To divide an image in an area in which the characteristics of the image is well represented in accordance with the image and further to perform image retrieval with high accuracy.
SOLUTION: An image 13 is divided into a grid form to obtain plural small rectangular areas, feature variables such as the average color and the representative color in each small area are extracted, small areas which have common feature variables are integrated and polygonal division areas 14 to 18 are formed. By this, it is divided into a division area that represents the features, the similarity of the division area of a key image and the division area of an object image of an image database is calculated and the object image that is the most similar is taken out as a target image.



Data supplied from the *espacenet* database — Worldwide

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平11-167634

(43) 公開日 平成11年(1999) 6月22日

(51) Int.Cl.⁶

G 0 6 T 7/00

識別記号

F I

C 0 6 F 15/70

3 3 0 Z

審査請求 未請求 請求項の数18 F D (全 18 頁)

(21) 出願番号 特願平9-350002

(22) 出願日 平成9年(1997)12月3日

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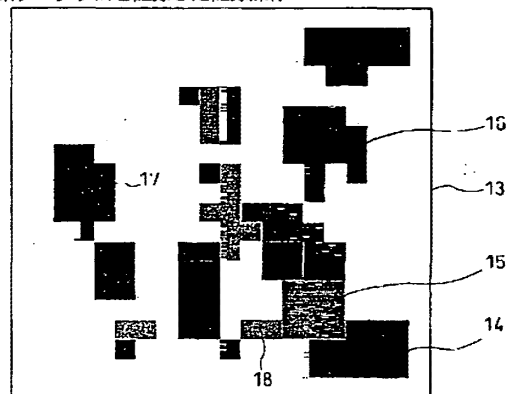
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(54) 【発明の名称】 画像の領域分割方法、画像の領域分割装置、画像の領域分割プログラムを記録した記録媒体、画像検索方法、画像検索装置および画像検索プログラムを記録した記録媒体

(57) 【要約】

【課題】 画像に応じて、その画像の特徴をよく表している領域で分割できるようにし、さらに、精度の高い画像検索を行えるようにする。

【解決手段】 画像13を、格子状に分割して複数の矩形の小領域に分割し、各小領域の平均色や代表色などの特徴量を抽出して共通する特徴量を有する小領域を統合して多角形の分割領域14~18を形成することにより、画像に応じて、その特徴を表した分割領域に分割できるようにし、キー画像の分割領域と画像データベースの対象画像の分割領域との類似度を算出して最も類似した対象画像を目的の画像として取り出すようにしている。



【特許請求の範囲】

【請求項1】 画像を複数の小領域に分割し、各小領域の特徴量を抽出し、抽出した特徴量の共通性に基づいて、前記小領域を統合して分割領域を形成することを特徴とする画像の領域分割方法。

【請求項2】 前記各小領域を、前記画像を格子状に分割した矩形の小領域とするとともに、前記分割領域を、前記矩形の各辺に隣接する小領域を前記特徴量の共通性に基づいて統合してなる多角形の分割領域とする請求項1記載の画像の領域分割方法。

【請求項3】 前記特徴量を、平均色、代表色または濃度とする請求項1または2記載の画像の領域分割方法。

【請求項4】 前記特徴量を、平均色または代表色とし、前記小領域を構成する色の数および各色に対応する画素数に基づいて、画像を分割する分割幅が適当であるか否かを判定し、適当でないとき判定されたときには、分割幅を設定し直して再度複数の小領域へ分割する請求項1または2記載の画像の領域分割方法。

【請求項5】 画像を複数の小領域に分割する分割手段と、各小領域の特徴量を抽出する抽出手段と、抽出した特徴量の共通性に基づいて、各小領域を統合して分割領域を形成する形成手段と、を備えることを特徴とする画像の領域分割装置。

【請求項6】 前記分割手段は、前記画像を格子状に分割して矩形の前記小領域とし、前記形成手段は、前記矩形の各辺に隣接する小領域を前記特徴量の共通性に基づいて統合して多角形の分割領域を形成する請求項5記載の画像の領域分割装置。

【請求項7】 前記抽出手段は、各小領域の平均色、代表色または濃度を抽出し、前記形成手段は、抽出した小領域の平均色、代表色または濃度の共通性に基づいて、各小領域を統合する請求項5または6記載の画像の領域分割装置。

【請求項8】 前記小領域を構成する色の数および各色に対応する画素数に基づいて、前記画像を分割する分割幅が適当であるか否かを判定する判定手段を備え、前記抽出手段は、各小領域の平均色または代表色を抽出し、前記形成手段は、抽出した小領域の平均色または代表色の共通性に基づいて、各小領域を統合し、前記分割手段は、前記分割幅が適当でないとき判定されたときには、分割幅を設定し直して再度複数の小領域へ分割する請求項5または6記載の画像の領域分割装置。

【請求項9】 画像を複数の小領域に分割する分割手段と、各小領域の特徴量を抽出する抽出手段と、抽出した特徴量の共通性に基づいて、各小領域を統合して分割領域を形成する形成手段と、

を含む画像の領域分割プログラムを記録した記録媒体。

【請求項10】 前記分割手段は、前記画像を格子状に分割して矩形の前記小領域とし、前記形成手段は、前記矩形の各辺に隣接する小領域を前記特徴量の共通性に基づいて統合して多角形の分割領域を形成するものである請求項9記載の画像の領域分割プログラムを記録した記録媒体。

【請求項11】 前記抽出手段は、各小領域の平均色、代表色または濃度を抽出し、前記形成手段は、抽出した小領域の平均色、代表色または濃度の共通性に基づいて、各小領域を統合するものである請求項9または10記載の画像の領域分割プログラムを記録した記録媒体。

【請求項12】 前記小領域を構成する色の数および各色に対応する画素数に基づいて、前記画像を分割する分割幅が適当であるか否かを判定する判定手段が記録され、前記抽出手段は、各小領域の平均色または代表色を抽出し、前記形成手段は、抽出した小領域の平均色または代表色の共通性に基づいて、各小領域を統合し、前記分割手段は、前記分割幅が適当でないとき判定されたときには、分割幅を設定し直して再度複数の小領域へ分割する請求項9または10記載の画像の領域分割プログラムを記録した記録媒体。

【請求項13】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索方法であって、前記キー画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、画像データベースの対象画像を、前記キー画像と同一の分割領域で分割し、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求めて目的の画像を検索することを特徴とする画像検索方法。

【請求項14】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索方法であって、前記キー画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、画像データベースの対象画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求めて目的の画像を検索することを特徴とする画像検索方法。

【請求項15】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索装置であって、前記請求項5ないし8のいずれかに記載の画像の領域分割装置と、前記画像の領域分割装置で分割された前記キー画像と同一の分割領域で前記対象画像を分割する分割手段と、キー画像の分割領域の特徴量と対象画像の対応する分割

領域の特徴量との類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段と、を備えることを特徴とする画像検索装置。

【請求項16】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索装置であって、前記請求項5ないし8のいずれかに記載の画像の領域分割装置と、

前記画像の領域分割装置で分割された前記キー画像の分割領域の特徴量と前記画像の領域分割装置で分割された前記対象画像の対応する分割領域の特徴量との類似度を求める類似度算出手段と、

算出された類似度に基づいて、目的の画像を検索する検索手段と、を備えることを特徴とする画像検索装置。

【請求項17】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索プログラムを記録した記録媒体であって、前記請求項9ないし12のいずれかに記載の記録媒体に記録された画像の領域分割プログラムと、前記画像の領域分割プログラムで分割された前記キー画像と同一の分割領域で前記対象画像を分割する分割手順と、

キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段と、を含む画像検索プログラムを記録した記録媒体。

【請求項18】 キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索プログラムを記録した記録媒体であって、前記請求項9ないし12のいずれかに記載の記録媒体に記録された画像の領域分割プログラムと、前記画像の領域分割プログラムで分割された前記キー画像の分割領域の特徴量と前記画像の領域分割プログラムで分割された前記対象画像の対応する分割領域の特徴量の類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段と、を含む画像検索プログラムを記録した記録媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、画像データベースの対象画像の中から索引となるキー画像と同一もしくは類似の目的の画像を検索する画像検索システムなどに好適な画像の領域分割および画像検索の技術に関する。

【0002】

【従来の技術】従来、索引となるキー画像に基づいて、多数の対象画像が格納された画像データベースの中から前記キー画像と同一あるいは類似した目的の画像を検索する場合には、キー画像および画像データベースの中の

対象画像を、予め定めた複数の領域に分割し、各分割領域毎に画像の特徴量、例えば、分割領域の平均色や分割領域で最も多く使われている代表色などを抽出し、その特徴量を使って得られる画像の類似度から目的の画像を取り出すようにしており、一般には、画像の分割領域の形状は、予め固定されていた。

【0003】

【発明が解決しようとする課題】ところが、このような従来例では、分割領域の形状が固定されているために、画像の中でその画像の特徴をよく表している部分が、うまく分割領域に入らず、複数の分割領域に亘ってしまい、各分割領域毎の特徴量、例えば平均色を抽出した場合に、前記特徴のある部分の色が十分に反映されない場合があり、このように、画像の特徴のある部分の特徴量が正確に抽出できない場合があるために、精度の高い画像の検索ができないといった難点がある。

【0004】本発明は、上述の点に鑑みて為されたものであって、画像に応じて、その画像の特徴をよく表している領域で分割できるようにし、さらに、精度の高い画像検索を行えるようにすることを目的とする。

【0005】

【課題を解決するための手段】本発明では、上述の目的を達成するために、次のように構成している。

【0006】すなわち、請求項1の本発明の画像の領域分割方法は、画像を複数の小領域に分割し、各小領域の特徴量を抽出し、抽出した特徴量の共通性に基づいて、前記小領域を統合して分割領域を形成するものである。

【0007】請求項2の本発明は、請求項1の発明において、前記各小領域を、前記画像を格子状に分割した矩形の小領域とするとともに、前記分割領域を、前記矩形の各辺に隣接する小領域を前記特徴量の共通性に基づいて統合してなる多角形の分割領域とするものである。

【0008】請求項3の本発明は、請求項1または2の発明において、前記特徴量を、平均色、代表色または濃度とするものである。

【0009】請求項4の本発明は、請求項1または2の発明において、前記特徴量を、平均色または代表色とし、前記小領域を構成する色の数および各色に対応する画素数に基づいて、前記画像を分割する分割幅が適当であるか否かを判定し、適当でない判定されたときには、分割幅を設定し直して再度複数の小領域へ分割するものである。

【0010】請求項5の本発明の画像の領域分割装置は、画像を複数の小領域に分割する分割手段と、各小領域の特徴量を抽出する抽出手段と、抽出した特徴量の共通性に基づいて、各小領域を統合して分割領域を形成する形成手段とを備えている。

【0011】請求項6の本発明は、請求項5の発明において、前記分割手段は、前記画像を格子状に分割して矩形の前記小領域とし、前記形成手段は、前記矩形の各辺

に隣接する小領域を前記特徴量の共通性に基づいて統合して多角形の分割領域を形成するものである。

【0012】請求項7の本発明は、請求項5または6の発明において、前記抽出手段は、各小領域の平均色、代表色または濃度を抽出し、前記形成手段は、抽出した小領域の平均色、代表色または濃度の共通性に基づいて、各小領域を統合するものである。

【0013】請求項8の本発明は、請求項5または6の発明において、前記小領域を構成する色の数および各色に対応する画素数に基づいて、前記画像を分割する分割幅が適当であるか否かを判定する判定手段を備え、前記抽出手段は、各小領域の平均色または代表色を抽出し、前記形成手段は、抽出した小領域の平均色または代表色の共通性に基づいて、各小領域を統合し、前記分割手段は、前記分割幅が適当でないとき判定されたときには、分割幅を設定し直して再度複数の小領域へ分割するものである。

【0014】請求項9の本発明の画像の領域分割プログラムを記録した記録媒体は、画像を複数の小領域に分割する分割手順と、各小領域の特徴量を抽出する抽出手順と、抽出した特徴量の共通性に基づいて、各小領域を統合して分割領域を形成する形成手順と、を含む画像の領域分割プログラムを記録したものである。

【0015】請求項10の本発明は、請求項9の発明において、前記分割手順は、前記画像を格子状に分割して矩形の前記小領域とし、前記形成手順は、前記矩形の各辺に隣接する小領域を前記特徴量の共通性に基づいて統合して多角形の分割領域を形成するものである。

【0016】請求項11の本発明は、請求項9または10の発明において、前記抽出手順は、各小領域の平均色、代表色または濃度を抽出し、前記形成手順は、抽出した小領域の平均色、代表色または濃度の共通性に基づいて、各小領域を統合するものである。

【0017】請求項12の本発明は、請求項9または10において、前記小領域それぞれを構成する色の数および各色に対応する画素数に基づいて、前記画像を分割する分割幅が適当であるか否かを判定する判定手順が記録され、前記抽出手順は、各小領域の平均色または代表色を抽出し、前記形成手順は、抽出した小領域の平均色または代表色の共通性に基づいて、各小領域を統合し、前記分割手順は、前記分割幅が適当でないとき判定されたときには、分割幅を設定し直して再度複数の小領域へ分割するものである。

【0018】請求項13の本発明の画像検索方法は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索方法であって、前記キー画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、画像データベースの対象画像を、前記キー画像と同一の分割領域で分割し、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特

徴量との類似度を求めて目的の画像を検索するものである。

【0019】請求項14の本発明の画像検索方法は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索方法であって、前記キー画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、画像データベースの対象画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割し、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求めて目的の画像を検索するものである。

【0020】請求項15の本発明の画像検索装置は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索装置であって、前記請求項5ないし8のいずれかに記載の画像の領域分割装置と、前記画像の領域分割装置で分割された前記キー画像と同一の分割領域で前記対象画像を分割する分割手段と、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段とを備えている。

【0021】請求項16の本発明の画像検索装置は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索装置であって、前記請求項5ないし8のいずれかに記載の画像の領域分割装置と、前記画像の領域分割装置で分割された前記キー画像の分割領域の特徴量と前記画像の領域分割装置で分割された前記対象画像の対応する分割領域の特徴量との類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段とを備えるものである。

【0022】請求項17の本発明の画像検索プログラムを記録した記録媒体は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索プログラムを記録した記録媒体であって、前記請求項9ないし12のいずれかに記載の記録媒体に記録された画像の領域分割プログラムと、前記画像の領域分割プログラムで分割された前記キー画像と同一の分割領域で前記対象画像を分割する分割手順と、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量との類似度を求める類似度算出手段と、算出された類似度に基づいて、目的の画像を検索する検索手段とを含む画像検索プログラムを記録したものである。

【0023】請求項18の本発明の画像検索プログラムを記録した記録媒体は、キー画像を索引として画像データベースの対象画像から目的の画像を検索する画像検索プログラムを記録した記録媒体であって、前記請求項9ないし12のいずれかに記載の記録媒体に記録された画像の領域分割プログラムと、前記画像の領域分割プログラムで分割された前記キー画像の分割領域の特徴量と前

記画像の領域分割プログラムで分割された前記対象画像の対応する分割領域の特徴量の類似度を求める類似度算出手順と、算出された類似度に基づいて、目的の画像を検索する検索手順を含む画像検索プログラムを記録したものである。

【0024】請求項1、5または9の本発明によれば、画像を複数の小領域に分割し、各小領域の特徴量を抽出し、抽出した特徴量の共通性に基づいて、前記小領域を統合して分割領域を形成するので、画像は、特徴量が共通する分割領域毎に分割されることになり、画像の特徴量に応じて分割領域が動的に変更されることになる。

【0025】請求項2、6または10の本発明によれば、前記各小領域を矩形とし、この矩形の各辺に隣接する小領域の特徴量の共通性に基づいて統合して多角形の分割領域を形成するので、画像は、共通の特徴量が連続する分割領域毎に分割されることになる。

【0026】請求項3、7または11の本発明によれば、前記特徴量を、平均色、代表色または濃度とするので、カラー画像を、平均色または代表色が共通する分割領域に分割し、あるいは、濃淡画像を、濃度が共通する分割領域に分割することができる。

【0027】請求項4、8または12の本発明によれば、小領域を構成する色の数および各色に対応する画素数に基づいて、画像の分割幅が適当であるかを判定し、適当でないとき判定されたときには、再度複数の小領域へ分割するので、例えば、小領域を構成する色の数が多く、しかも、各色の画素数が略等しくて小領域に画像の特徴がよく表れていないような場合には、画像を再分割して画像の特徴がよく表れる小領域を形成することができる。

【0028】請求項13、15または17の本発明によれば、キー画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法で分割するので、キー画像の分割領域は、そのキー画像の特徴を表した分割領域となっており、このキー画像の分割領域の特徴量と、同一の分割領域で分割した対象画像の分割領域の特徴量との類似度を求めて目的の画像を検索するので、キー画像の特徴に最も類似した対象画像を取り出すことができる。

【0029】請求項14、16または18の本発明によれば、キー画像および対象画像を、前記請求項1ないし4のいずれかに記載の画像の領域分割方法でそれぞれ分割するので、キー画像および対象画像の分割領域は、それぞれの画像の特徴を表した分割領域となっており、対応する分割領域の特徴量の類似度を求めて目的の画像を検索するので、キー画像の特徴に最も類似した対象画像を取り出すことができる。

【0030】

【発明の実施の形態】以下、図面によって、本発明の実施の形態について、詳細に説明する。

【0031】図1は、本発明に係る画通検索システムの

概略構成図である。

【0032】この画像検索システム1は、キー画像に基づいて、同一または類似の目的の画像を検索する画像検索装置としてのコンピュータ2と、多数の対象画像が蓄積された画像データベース3とを備えており、このような画像検索システムは、例えば、インターネット上の画像の検索、インテリアや工業デザインの支援あるいはデジタルスチルカメラのアルバムシステムなどの様々な用途に使用できるものであり、この実施の形態では、入力されるキー画像と同一または最も類似した目的の画像を、画像データベース3から検索するものである。

【0033】この画像検索システムでは、画像の領域分割プログラムを含む画像の検索プログラムを記録したFD（フロッピーディスク）、CD-ROMあるいはHD（ハードディスク）などの記録媒体を、ドライブ装置にセットしてコンピュータ2に後述する画像の領域分割および検索処理を実行させるものである。

【0034】図2は、この実施の形態の機能ブロック図であり、この実施の形態の画像検索システムは、入力されるカラーの静止画像であるキー画像4を、後述のように特徴量の抽出に好適な分割領域に分割するとともに、画像データベース3の対象画像を分割する本発明に係る画像の領域分割装置としての領域分割手段5と、分割された分割領域毎に特徴量を抽出してキー画像4と対象画像との分割領域の類似度を算出する類似度算出手段6と、算出した類似度に基づいて同一もしくは最も類似した目的の画像7を画像データベース3から取り出す検索手段8とを備えている。

【0035】この実施の形態では、従来のように固定した形状に画像を分割するのではなく、画像の特徴をよく表している部分に対応して分割領域を動的に変更させるものであり、本発明に係る領域分割手段5では、次のようにして画像を分割している。すなわち、この実施の形態の画像の領域分割方法では、キー画像4を、格子状に分割して複数の矩形の小領域とし、各小領域の特徴量、例えば、平均色や代表色をそれぞれ抽出し、抽出した特徴量の共通性に基づいて小領域を順次統合して多角形の分割領域を形成するのである。

【0036】今、キー画像4として、例えば、図3に示される200×200画素の画像が与えられたとすると、この画像を格子状に分割して、例えば、10×10画素の複数の小領域9に分割する。

【0037】次に、小領域9毎に特徴量を抽出するのであるが、この実施の形態では、特徴量として平均色または代表色を用いている。ここで、平均色は、小領域9の全画素についてのR、G、B値をそれぞれ合計し、各合計値を小領域9の全画素数でそれぞれ割って得られるR、G、B値で規定される色であり、代表色は、小領域9内で最も多い色である。なお、後述の減色処理は、予め定められている複数の色に統合して色の数を減らすも

のである。

【0038】この実施の形態では、特徴量の抽出について、次の4種類の抽出処理パターンのいずれかを採用するものであり、この4種類の抽出処理パターンは、①減色処理を行って平均色を抽出する、②減色処理を行って代表色を抽出する、③減色処理を行うことなく平均色を抽出する、④減色処理を行うことなく代表色を抽出するの4種類であって、このいずれかを次のようにして決定する。

【0039】ここで、画像全体の小領域の数をX、その小領域に属する画素数をYとして以下に説明する。

【0040】先ず、各小領域それぞれについて、各小領域を構成する各画素のRGB値をヒストグラム化して同じ色の画素数を集計する。この場合、R、G、Bのそれぞれで集計するのではなく（R、G、Bの3つのヒストグラムを作成するのではなく）、RGBの3つをセットとして、すなわち、RGB値で規定される各色毎にヒストグラムを作成する。

【0041】このようにして各小領域について、それぞれ

$$\begin{aligned} B_{max} &\leq Y \times L / 100 && \text{であるときには、減色する} \\ B_{max} &> Y \times L / 100 && \text{であるときには、減色しない} \end{aligned}$$

と判定するのである。

【0045】また、特徴量として、平均色または代表色のいずれを抽出するかは、各小領域で使用されている色の数nが、ある閾値M以下であるか否かによって判定するものであり、使用されている色の数nが、ある閾値M以下であるときには、代表色とし、ある閾値Mを越えているときには、平均色とするものであり、この判定を、各小領域毎に行う。

【0046】すなわち、

$n \leq M$ であるときには、代表色とする
 $n > M$ であるときには、平均色とする
 と判定するのである。

【0047】以上の判定処理を、各小領域毎に行うことで、各小領域は、上述の4種類の抽出処理パターンのいずれかに分類される。この時点では、あくまでも各小領域が4種類の抽出処理パターンのいずれに分類されるかを判定するのみで、実際の減色処理などは実行しない。

【0048】このようにしてすべての小領域についての分類が終了したところで、4種類の抽出処理パターンのうちどれが最も多かったかを集計し、最も多かった抽出処理パターンを、その画像についての抽出処理パターンとして採用し、減色処理や平均色の計算などの必要な処理を行うものである。

【0049】図4は、以上の処理のフローチャートであり、先ず、小領域内の同じRGB値、すなわち、同じ色の画素を集計し（ステップn1）、最も多くの画素数となった色の画素数が閾値以下であるか否かを判断し（ステップn2）、閾値以下でないときには、その小領域は減色しない候補としてステップn4に移り（ステップn

7）、閾値以下であるときには、その小領域は減色する候補としてステップn4に移る（ステップn3）。

【0042】例えば、（R、G、B）が、（10、120、5）で規定される色A1の画素数がB1、（150、200、20）で規定される色A2の画素数がB2、同様に（Rn、Gn、Bn）で規定される色Anの画素数がBnといったように小領域を構成する各色Aについての画素数Bを、各小領域についてそれぞれ集計するのである。

【0043】その結果、最も多い画素数となったRGB値（色）についての画素数 B_{max} の割合が、ある閾値L%以下であるときには、その小領域については、多くの色が使われていて色の特徴がうまく抽出されていないので、減色処理を行うべきであると判定し、前記ある閾値L%を越えているときには、色の特徴がうまく抽出されているので、減色処理を行う必要はないと判定するものであり、この判定は、各小領域毎に行われる。

【0044】すなわち、

7）、閾値以下であるときには、その小領域は減色する候補としてステップn4に移る（ステップn3）。

【0050】ステップn4では、その小領域で使用されている色の数が、閾値以下であるか否かを判断し、閾値以下でないときには、その小領域を平均色の候補としてステップn6に移り（ステップn8）、閾値以下であるときには、その小領域を代表色の候補としてステップn6に移る（ステップn5）。

【0051】ステップn6では、その小領域が、4種類の抽出処理パターンのいずれに属するかを分類し、対象となるすべての小領域について分類処理が終わったか否かを判断し（ステップn9）、終わっていないときには、ステップn1に戻り、終わったときには、最も多くの小領域が含まれる抽出処理パターンを、その画像についての抽出処理方法として決定し（ステップn10）、減色処理や平均色計算処理などの必要な処理を行い（ステップn11）、各小領域についての色彩の特徴量を抽出して終了する（ステップn12）。

【0052】図3のキー画像4を、以上のようにして小領域9に分割して各小領域9の特徴量として代表色を抽出した画像10を図5に示す。

【0053】なお、画像を複数の小領域に分割する分割幅は、予めシステム上で設定してあってもよいし、システムの使用者によって入力されたものを使用してもよいが、さらに、次のようにして分割した小領域が適当な大きさであるか否かを判定して適当でないとは判定されたときには、さらに、小さな小領域に再度分割するようにしてもよい。

【0054】すなわち、最初に分割した各小領域を上

のように4種類の抽出処理パターンに分類した際に、減色して平均色の抽出処理パターンに分類された小領域の数Cがある閾値N%以下であるときには、再分割を行わず、ある閾値N%よりも大きい場合には、多くの色が使われていて色の特徴がうまく抽出されていない小領域が多いということであり、この場合には、画像を分割する分割幅を小さくしてより小さな小領域に画像を再分割して再度上述の処理を行うものである。また、再分割しても小領域の数Cがある閾値N%以下にならない場合は、さらに、分割幅を小さくして再分割するものである。

【0055】すなわち、
 $C \leq X \times N / 100$ であるときには、再分割しない
 $C > X \times N / 100$ であるときには、再分割すると判定するものである。

【0056】図6は、以上の再分割処理のフローチャートであり、この図6においては、ステップn9までは、上述の図4の処理と同様である。

【0057】ステップn13において、減色して平均色の抽出処理パターンに分類された小領域があるか否かを判断し、ないときには、ステップn15に移り、あるときには、減色して平均色のパターンに分類された小領域の数が閾値以下であるか否かを判断し（ステップn14）、閾値以下であるときには、ステップn15に移り、閾値以下でないときには、分割幅を小さくして画像全体を再分割して上述の図4のステップn1に戻る。また、ステップn15では、最も多くの小領域が含まれるパターンの抽出処理方法を、その画像についての抽出処理方法として決定し、減色処理や平均色計算処理などの必要な処理を行い（ステップn16）、各小領域についての色彩の特徴量を抽出して終了する（ステップn17）。

【0058】しかしながら、再分割を繰り返すというのは、それだけ処理時間が増大することになるので、小領域を構成する画素数がある閾値以下になった場合には、再分割は行うことなく、その時点で最も小領域の数が多かったパターンの抽出処理方法を採用するようにしてもよい。

【0059】図7は、その場合のフローチャートであり、図6に対応する部分には、同一のステップ番号を付す。

【0060】ステップn14において、減色して平均色の抽出処理パターンに分類された小領域の数が閾値以下でないときには、分割幅を小さくして画像全体を再分割し（ステップn18）、再分割によって形成された小領域を構成する画素数が、閾値以下であるか否かを判断し（ステップn19）、閾値以下であるときには、ステップn15に移って再分割を行う前までの処理結果に基づいて、画像の抽出処理方法を決定し、閾値以下でないときには、上述の図4のステップn1に戻って再分割した小領域について、図4の処理を行うものである。

【0061】なお、上述の各実施の形態では、画像全体として一つの抽出処理方法を採用したけれども、本発明の他の実施の形態として、各小領域毎に、各小領域が分類された抽出処理方法を採用してもよい。

【0062】図8は、この場合のフローチャートを示しており、まず、小領域内の同じRGB値、すなわち、同じ色の画素を集計し（ステップn101）、最も多くの画素数となった色の画素数が閾値以下であるか否かを判断し（ステップn102）、閾値以下でないときには、その小領域は減色しない候補としてステップn104に移り（ステップn107）、閾値以下であるときには、その小領域は減色する候補としてステップn104に移る（ステップn103）。

【0063】ステップn104では、その小領域で使用されている色の数が、閾値以下であるか否かを判断し、閾値以下でないときには、その小領域を平均色の候補としてステップn106に移り（ステップn108）、閾値以下であるときには、その小領域を代表色の候補としてステップn106に移る（ステップn105）。

【0064】ステップn106では、その小領域が、4種類の抽出処理パターンのいずれに属するかを分類し、対象となるすべての小領域について分類処理が終わったか否かを判断し（ステップn109）、終わっていないときには、ステップn101に戻り、終わったときには、個々の小領域毎に、その小領域が分類された抽出処理方法をその小領域についての抽出処理方法として決定し（ステップn110）、減色処理や平均色計算処理などの必要な処理を行い（ステップn111）、各小領域についての特徴量を抽出して終了する（ステップn112）。

【0065】また、この場合には、減色して平均色と判定された小領域については、その小領域のみをさらに細かく再分割してもよい。また、この場合には、小領域を構成する画素数がある閾値以下になった時には、再分割は行わないで、その時点でできている小領域で減色して平均色という処理を行うものである。

【0066】図9は、この場合の処理のフローチャートであり、この図9においては、ステップn110までは、上述の図8の処理と同様である。

【0067】ステップn110において、4種類の抽出処理方法のいずれかが採用された各小領域の中に、減色して平均色を抽出するという抽出処理方法が採用された小領域があるか否かを判断し（ステップn113）、ないときには、ステップn115に移り、あるときには、その小領域を構成する画素数が閾値以下であるか否かを判断し（ステップn114）、閾値以下でないときには、分割幅を小さくしてその小領域を再分割して上述の図8のステップn101に戻って新たに分割形成された小領域についてのみ図8と同様の処理を行う。また、ステップn115では、ステップn110で採用された抽

出処理方法に従って減色処理や平均色計算処理などの必要な処理を行い、各小領域についての特徴量を抽出して終了する(ステップn116)。

【0068】次に、本発明の画像の領域分割方法では、以上のようにして小領域に分割されて各小領域の特徴量を抽出した後に、その特徴量の共通性に基づいて、小領域を順次統合して多角形の分割領域を形成するものであり、この小領域の統合の処理について説明する。

【0069】図10(A)に示されるように、例えば3×3で構成される領域11を、1小領域分ずらしながら、注目しているある小領域12の4辺12₁~12₄に接している小領域において、共通の特徴量、例えば共通の代表色を持つ小領域13~15があった場合には、それら小領域13~15を、同図(B)に示されるように統合するものである。

【0070】図11は、この小領域の統合による分割領域の形成処理のフローチャートであり、この例では、画像全体について、特徴量として代表色を用いた場合について説明する。

【0071】先ず、着目している小領域の一辺に接している小領域の代表色を調べ(ステップn201)、着目している小領域と同じ色であるか否かを判断し(ステップn202)、同じ色でないときには、ステップn204に移り、同じ色であるときには、その同じ色の小領域を、着目している小領域に統合してステップn204に移る(ステップn203)。

【0072】ステップn204では、着目している小領域の4辺について処理が終了したか否かを判断し、終了していないときには、次の辺について処理を行うためにステップn201に戻り(ステップn206)、終了したときには、すべての小領域について処理が終了したか否かを判断し(ステップn205)、終了していないときには、次の小領域について同様の処理を行うためにステップn201に戻り(ステップn207)、終了したときには、統合による分割領域の形成が終了する。

【0073】以上のようにして、本発明の画像の領域分割方法では、キー画像を、特徴量の共通した多角形の分割領域に分割することができる。この多角形の分割領域が、具体的に何を示しているかということはわからなくても、特徴量が共通した関連のある小領域の集合体であることは明らかであって、画像の特徴量を抽出する単位として意味があるものである。

【0074】図12は、小領域に分割されて代表色が抽出された図5の画像10に対して、共通の代表色で統合処理を行って分割領域を形成した画像13である。なお、この図12では、分割領域のいくつかに参照符号14~18を付している。

【0075】次に、以上のようにしてキー画像を、特徴量が共通する多角形の分割領域に分割した後、画像データベース3の対象画像についても、領域分割手段5でキ

ー画像の多角形の分割領域と同一の分割領域で分割する。すなわち、キー画像と対象画像とを重ねた状態で、キー画像の多角形の分割領域と同一の位置にある領域を対象画像の分割領域として分割するものである。

【0076】そして、類似度算出手段6では、対象画像についても各分割領域の特徴量、例えば代表色を抽出し、キー画像の分割領域の特徴量と対象画像の対応する分割領域の特徴量の類似度を算出し、各分割領域についての類似度を合計した値を、画像全体の類似度として算出するものである。

【0077】具体的には、キー画像と対象画像との対応する分割領域毎に、RGB空間での距離を、下記の式により求めて各分割領域毎の類似度とし、各分割領域毎の類似度を合計したものを画像全体の類似度として算出するものである。

【0078】すなわち、キー画像aと対象画像bの対応する分割領域の特徴量、例えば代表色のRGB値を、それぞれ(Ra, Ga, Ba), (Rb, Gb, Bb)とすると、その分割領域の類似度Cabは、
$$Cab = \{ (Ra - Rb)^2 + (Ga - Gb)^2 + (Ba - Bb)^2 \}^{1/2}$$
となる。

【0079】検索手段8は、以上のようにして算出した各分割領域の類似度を合計した画像全体の類似度の値が最も小さい対象画像を、最も類似した目的の画像であるとして画像データベース3から取り出すものである。

【0080】図13は、以上の検索処理のフローチャートであり、上述のようにしてキー画像が特徴量の共通する分割領域に分割された後の処理を示している。

【0081】先ず、キー画像の分割領域と同一の分割領域で対象画像を分割し(ステップn301)、対象画像の分割領域毎の特徴量として、例えば代表色を決定し(ステップn302)、画像データベースの対象画像のすべてについて処理が終了したか否かを判断し(ステップn303)、終了していないときには、ステップn301に戻り、終了したときには、キー画像と対象画像との類似度を求め(ステップn304)、画像データベースのすべての対象画像について処理が終わったか否かを判断し(ステップn305)、終わっていないときには、ステップn304に戻り、終わったときには、最も類似した対象画像を、目的の画像に決定する(ステップn306)。

【0082】上述の実施の形態では、対象画像を、キー画像と同一の分割領域に分割して類似度を求めたけれども、本発明の他の実施の形態として、対象画像に対してもキー画像と同様に、小領域に分割した後に統合して分割領域を求めるようにしてもよい。

【0083】この場合、分割領域は、対象画像の画像内容に依存するので、様々な領域となるが、この分割領域の境界線は、その画像の形状的な特徴を示すものと考え

て類似度を求めてもよい。具体的には、例えば、図14(A)に示されるキー画像4の分割領域4₁に対応する分割領域19₁、19₂が、同図(B)に示されるように、対象画像19に複数ある場合には、同図(C)に示されるように、キー画像4の分割領域4₁と重なる面積が最も大きい領域19₁を、対象画像19の対応する分割領域として類似度を求めるものである。

【0084】図15は、以上の処理のフローチャートである。

【0085】まず、キー画像を領域分割して分割領域を形成し(ステップn401)、対象画像についても、その画像に応じて領域分割して分割領域を形成し(ステップn402)、画像データベースのすべての対象画像について領域分割が終了したか否かを判断し(ステップn403)、終了したときには、ある対象画像に対してキー画像のある分割領域に重なっている分割領域を抽出し(ステップn404)、重なっている分割領域が複数あるときには、重なっている面積の差に基づいて対応する分割領域を決定し(ステップn405)、キー画像の全分割領域について処理が終わったか否かを判断し(ステップn407)、終わっていないときには、キー画像の次の分割領域について処理するためにステップn404に戻り(ステップn408)、終わったときには、全対象画像について終了したか否かを判断し(ステップn407)、終了していないときには、次の対象画像について処理するためにステップn404に戻り(ステップn409)、終了したときには、上述の図13フローチャートと同様に、キー画像の分割領域と対象画像の対応する分割領域との類似度を求めて目的の画像を検索するのである。

【0086】また、本発明の他の実施の形態では、分割領域の境界にある幅(例えば±1画素分)を持たせ、分割領域を拡大した領域または縮小した領域についても類似度を求めて検索してもよい。これによれば、キー画像と対象画像のズレを考慮して検索が行えることになる。なお、ある幅は、システム上で設定してあってもよいし、使用者が入力設定できるようにしてもよい。

【0087】さらに、本発明の他の実施の形態として、例えば、図16に示されるように、統合されず残った孤立した小領域20については、検索対象からはずしてもよい。

【0088】また、検索対象から外す領域を、使用者が入力設定できるようにしてもよい。

【0089】上述の各実施の形態では、カラー画像の領域分割および画像検索に適用して説明したけれども、本発明はカラー画像に限るものではなく、白黒の濃淡画像に適用してもよく、この場合には、小領域の特徴量としては、例えば、小領域の黒の画素数を、小領域の全画素数で割って得られる濃度を用いてもよい。

【0090】また、本発明においては、小領域を統合す

るに際しては、特徴量が同一の小領域で統合してもよいし、特徴量がある範囲内に収まる小領域で統合してもよい。

【0091】

【発明の効果】以上のように本発明によれば、次の効果が奏される。

【0092】すなわち、請求項1、5または9の本発明によれば、画像に応じて分割領域を動的に変更し、特徴量が共通する分割領域毎に分割できることになり、分割領域が固定されていた従来例に比べて、画像に応じて、その特徴をよく表した領域で分割できることになる。

【0093】請求項2、6または10の本発明によれば、画像は、特徴量が共通する連続した分割領域毎に分割されることとなり、画像の特徴をよく表した領域で分割できることになる。

【0094】請求項3、7または11の本発明によれば、カラー画像を、平均色または代表色が共通する分割領域毎に分割でき、あるいは、濃淡画像を、濃度が共通する分割領域毎に分割することができ、カラー画像あるいは濃淡画像を、その特徴をよく表した領域で分割できることになる。

【0095】請求項4、8または12の本発明によれば、画像の分割幅が適当でないと判定されたときには、再度複数の小領域へ分割するので、例えば、小領域を構成する色の数が多く、しかも、各色の画素数が略等しくて小領域に画像の特徴がよく表れていないような場合には、画像を再分割して画像の特徴がよく表れる小領域を形成し、最終的に画像の特徴がよく表れた分割領域に分割できることになる。

【0096】請求項13、15または17の本発明によれば、キー画像を、その特徴をよく表した分割領域で分割でき、この分割領域と対象画像の対応する分割領域との類似度を求めて目的の画像を検索するので、キー画像を固定した分割領域で分割して検索していた従来例に比べて、精度の高い検索が行える。

【0097】請求項14、16または18の本発明によれば、キー画像および対象画像を、その特徴をよく表した分割領域でそれぞれ分割でき、この分割領域の類似度を求めて目的の画像を検索するので、キー画像および対象画像を固定した分割領域で分割して検索していた従来例に比べて、精度の高い検索が行える。

【図面の簡単な説明】

【図1】本発明に係る画像検索システムの構成図である。

【図2】図1の実施の形態の機能ブロック図である。

【図3】キー画像の一例を示す図である。

【図4】特徴量抽出の動作説明に供するフローチャートである。

【図5】小領域に分割した特徴量を抽出した画像を示す図である。

【図6】他の実施の形態に係る特徴量抽出の動作説明に供するフローチャートである。

【図7】他の実施の形態に係る特徴量抽出の動作説明に供するフローチャートである。

【図8】本発明の他の実施の形態に係る図4に対応するフローチャートである。

【図9】他の実施の形態に係る特徴量抽出の動作説明に供するフローチャートである。

【図10】小領域の統合を説明するための図である。

【図11】小領域の統合の動作説明に供するフローチャートである。

【図12】小領域を統合した分割領域を形成した画像を示す図である。

【図13】画像検索の動作説明に供するフローチャートである。

【図14】分割画像の対応関係を説明するための図である。

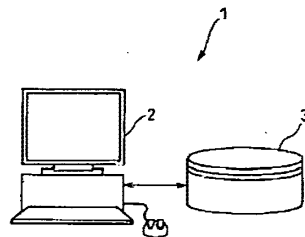
【図15】他の実施の形態に係る画像検索の動作説明に供するフローチャートである。

【図16】孤立した小領域の処理を説明するための図である。

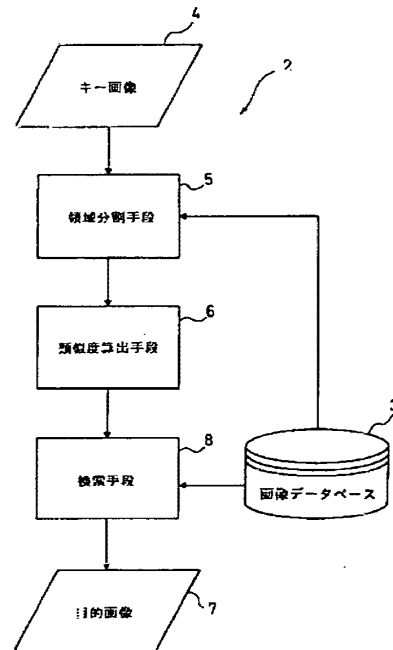
【符号の説明】

3	画像データベース
4	キー画像
5	領域分割手段
6	類似度算出手段
8	検索手段
9	小領域
14～18	分割領域

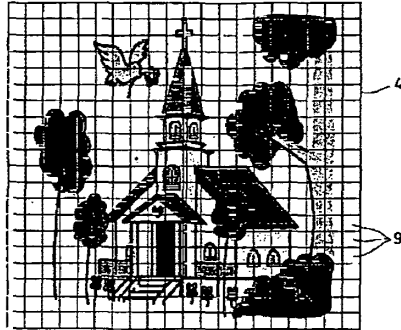
【図1】



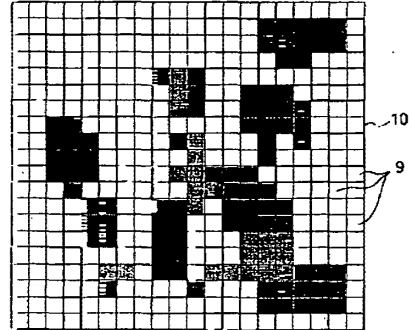
【図2】



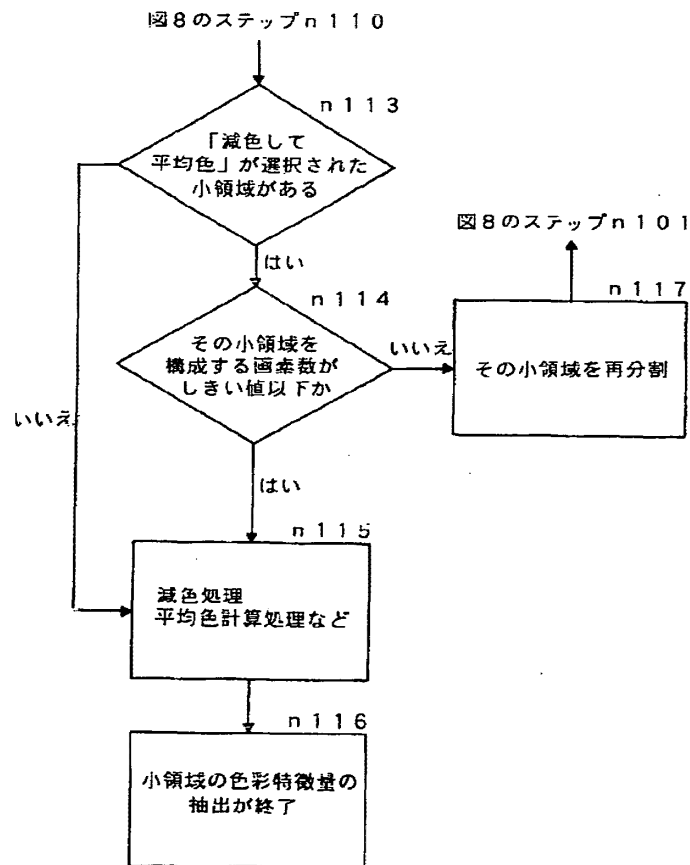
【図3】



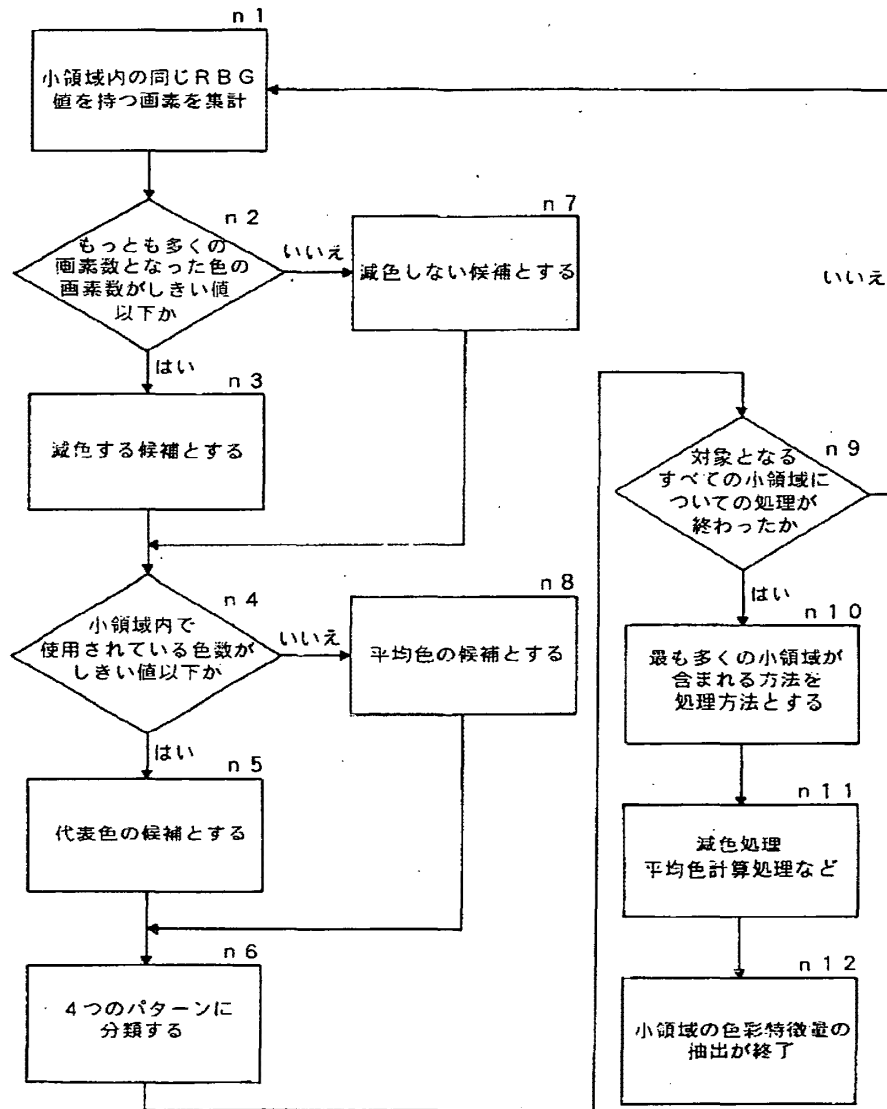
【図5】



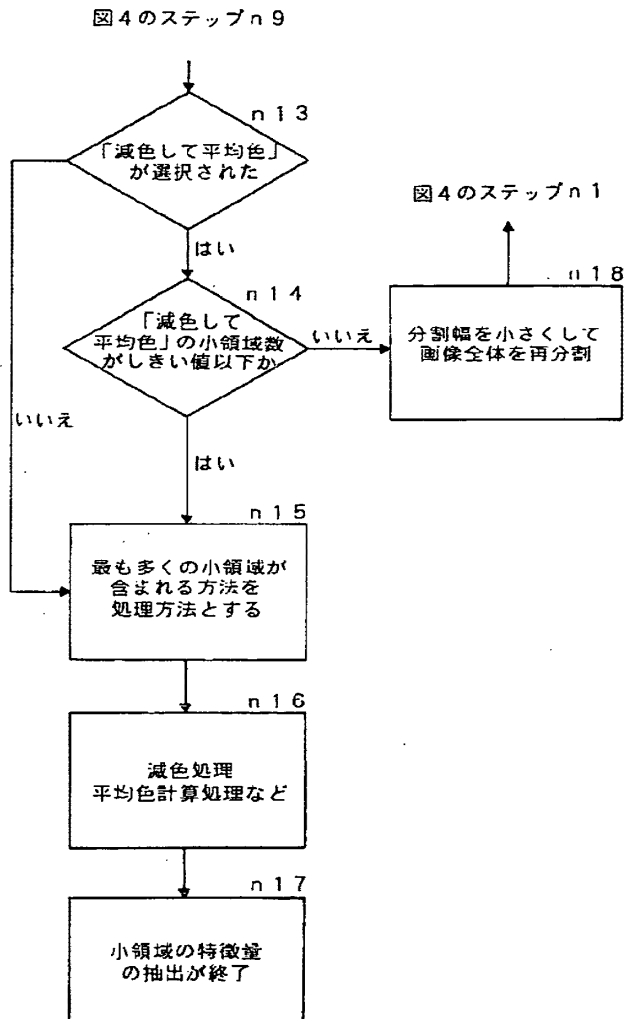
【図9】



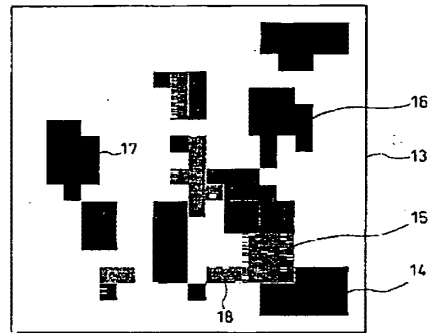
【図4】



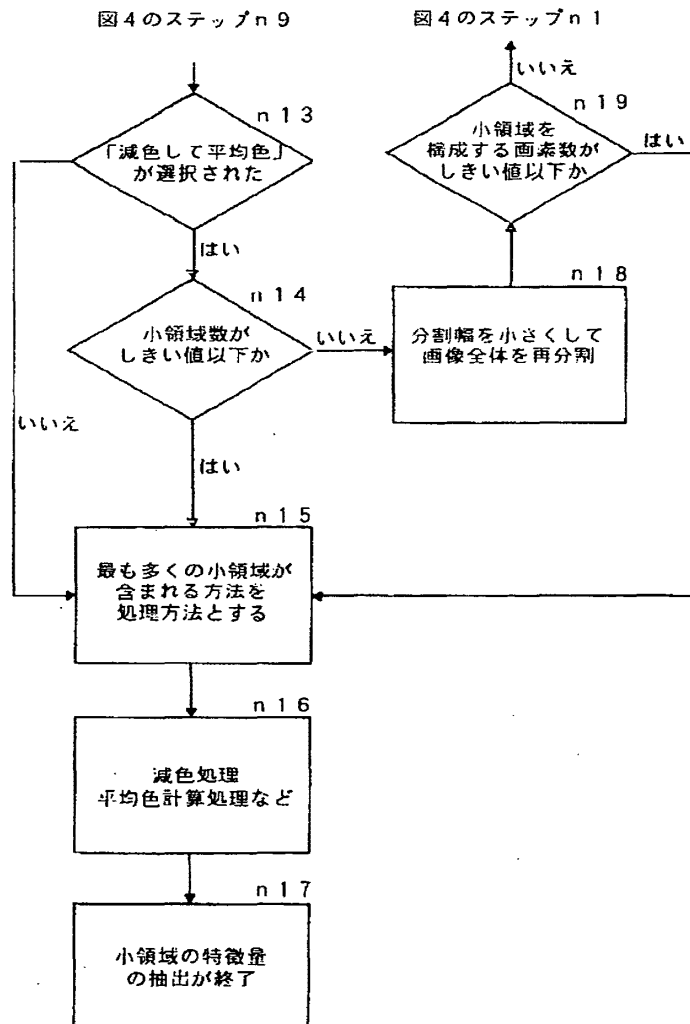
【図6】



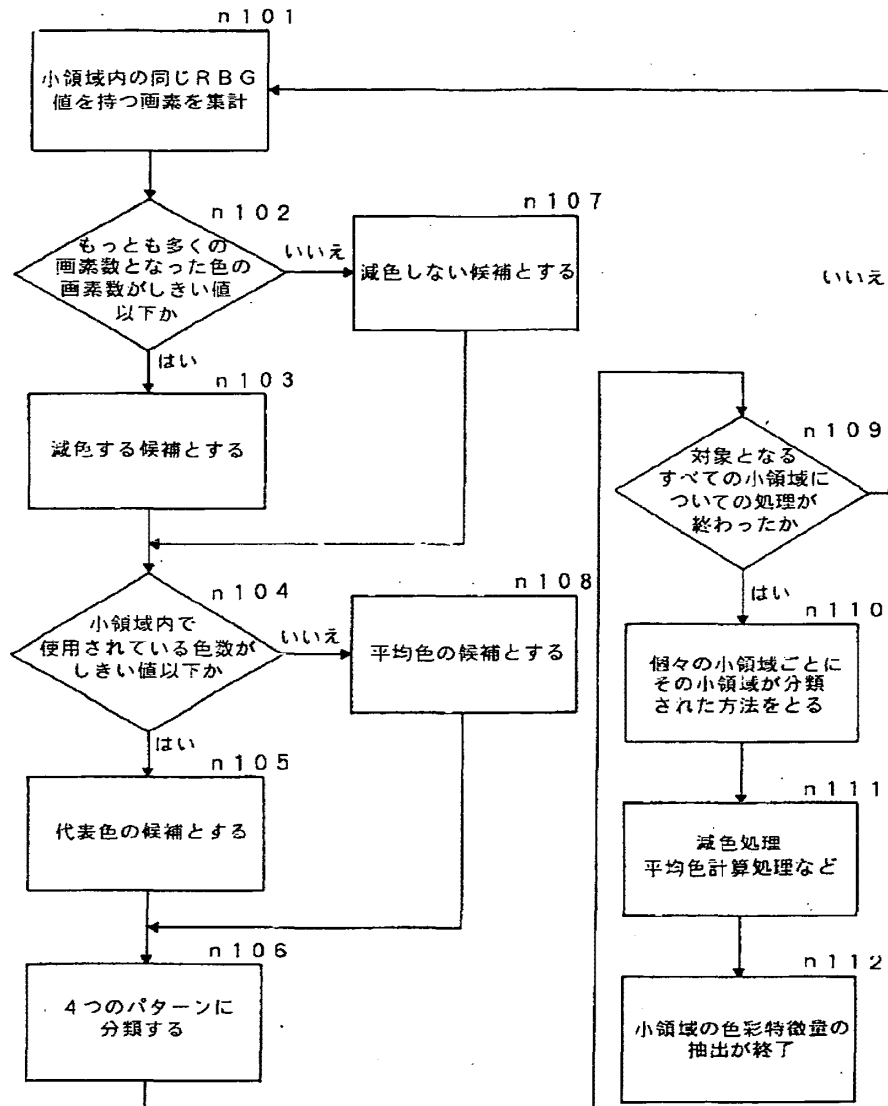
【図12】



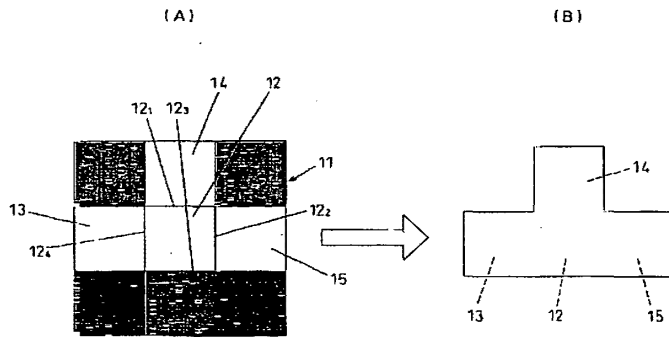
【図7】



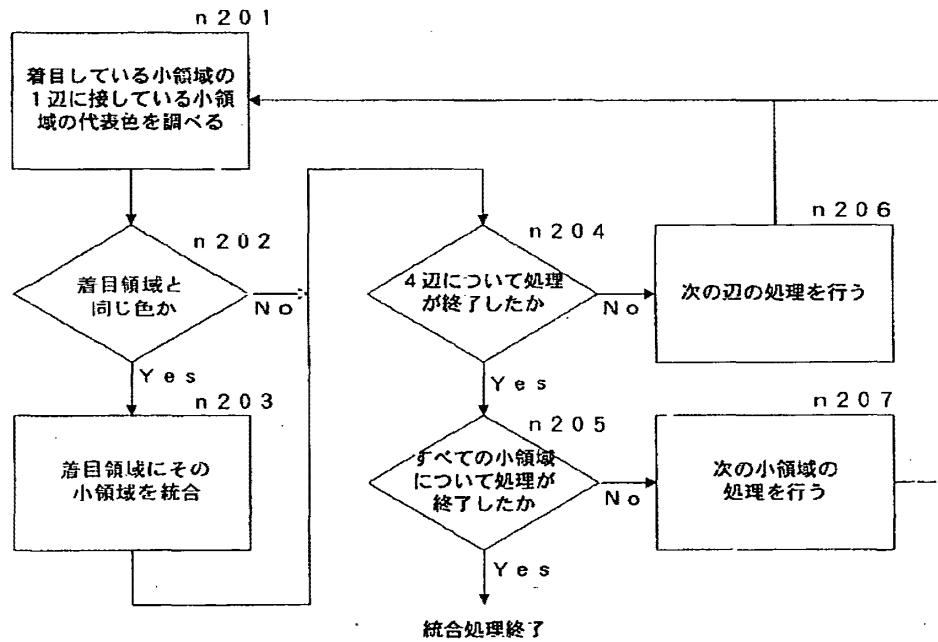
【図8】



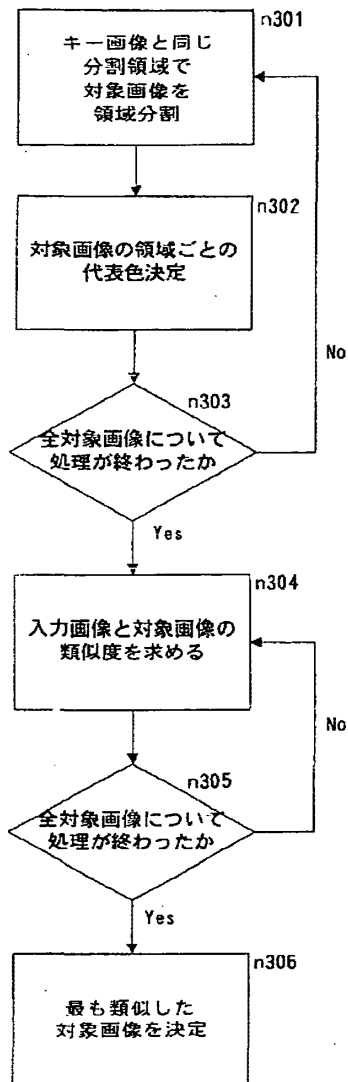
【図10】



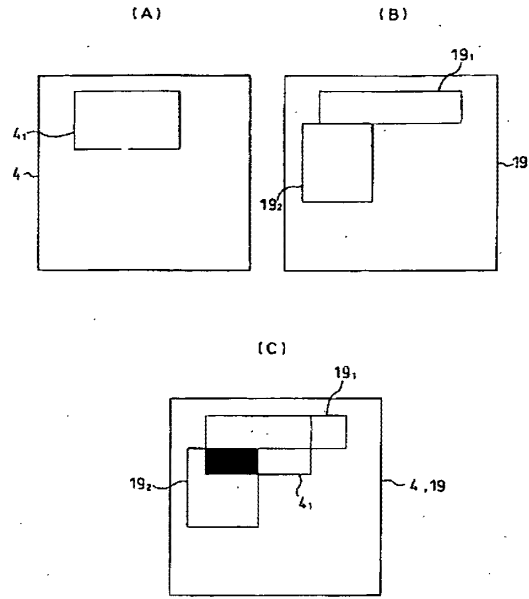
【図11】



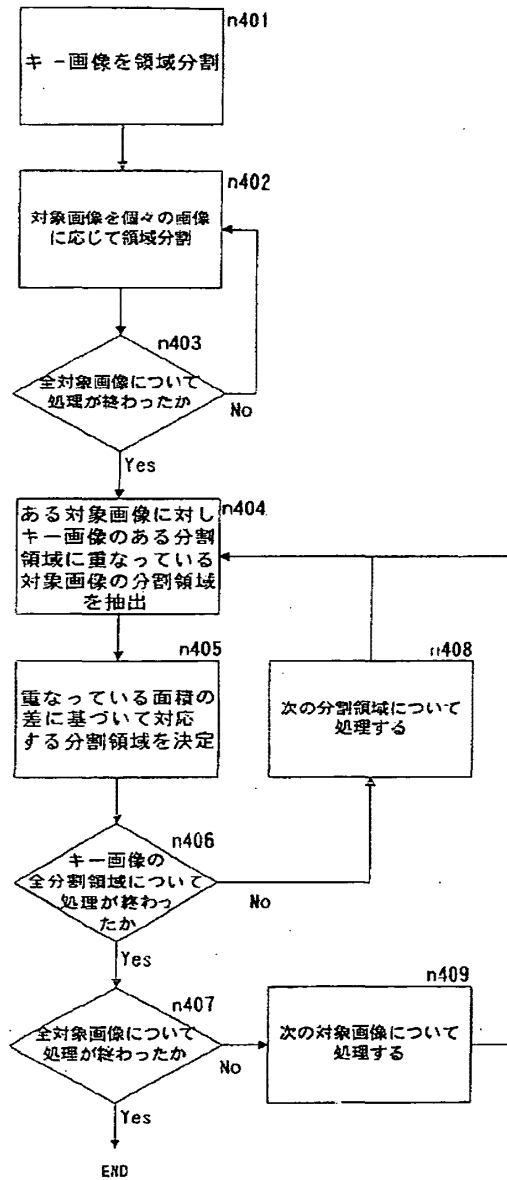
【図13】



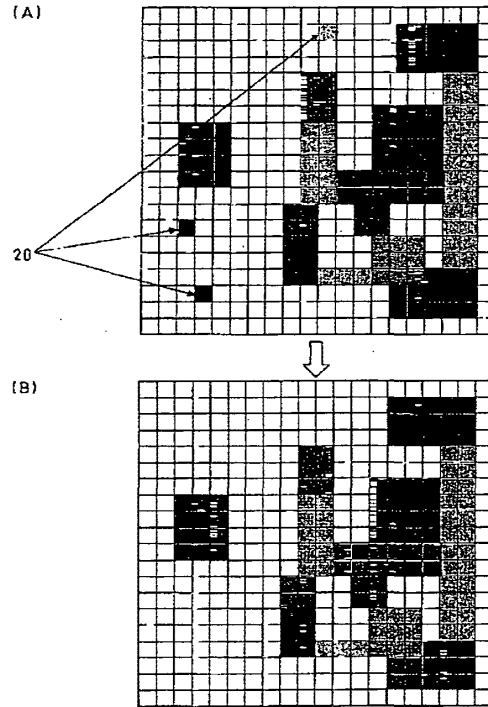
【図14】



【図15】



【図16】



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2.*** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]An area division method of a picture dividing a picture into two or more small regions, unifying said small region based on the similarity of characteristic quantity which extracted and extracted characteristic quantity of each small region, and forming a region division.

[Claim 2]An area division method of the picture according to claim 1 made into a region division of a polygon which unifies a small region which adjoins said region division each neighborhood of said rectangle based on the similarity of said characteristic quantity while making said each small region into a small region of a rectangle which divided said picture in the shape of a lattice.

[Claim 3]An area division method of the picture according to claim 1 or 2 which makes said characteristic quantity a mean color, a representative color, or concentration.

[Claim 4]Based on the number of colors which make said characteristic quantity a mean color or a representative color, and constitute said small region, and a pixel number corresponding to each color, An area division method of the picture according to claim 1 or 2 which resets up division width and is again divided to two or more small regions when it judges whether division width which divides a picture is suitable and is judged with it not being suitable.

[Claim 5]Area division equipment of a picture provided with a division means to divide a picture into two or more small regions, an extraction means to extract characteristic quantity of each small region, and means forming that unifies each small region and forms a region division based on the similarity of extracted characteristic quantity.

[Claim 6]Area division equipment of the picture according to claim 5 which said division means divides said picture in the shape of a lattice, and makes it said rectangular small region, and said means forming unifies a small region which adjoins each neighborhood of said rectangle based on the similarity of said characteristic quantity, and forms a polygonal region division.

[Claim 7]Area division equipment of the picture according to claim 5 or 6 which unifies each small region based on the similarity of a mean color of a small region which said extraction means extracted a mean color, a representative color, or concentration of each small region, and extracted said means forming, a representative color, or concentration.

[Claim 8]Based on the number of colors which constitute said small region, and a pixel number

corresponding to each color, have a judging means which judges whether division width which divides said picture is suitable, and said extraction means, Extract a mean color or a representative color of each small region, and said means forming, Area division equipment of the picture according to claim 5 or 6 which unifies each small region based on the extracted similarity of a mean color of a small region, or a representative color, resets up division width when judged with said division width not being suitable for said division means, and is again divided to two or more small regions.

[Claim 9]A recording medium which recorded an area division program of a picture including a division procedure of dividing a picture into two or more small regions, an extracting procedure which extracts characteristic quantity of each small region, and a formation procedure which unifies each small region and forms a region division based on the similarity of extracted characteristic quantity.

[Claim 10]A recording medium which recorded an area division program of the picture according to claim 9 which is what said division procedure divides said picture in the shape of a lattice, and makes it said rectangular small region, and said formation procedure unifies a small region which adjoins each neighborhood of said rectangle based on the similarity of said characteristic quantity, and forms a polygonal region division.

[Claim 11]A recording medium which recorded an area division program of the picture according to claim 9 or 10 which is what unifies each small region based on the similarity of a mean color of a small region which said extracting procedure extracted a mean color, a representative color, or concentration of each small region, and extracted said formation procedure, a representative color, or concentration.

[Claim 12]Based on the number of colors which constitute said small region, and a pixel number corresponding to each color, it is recorded by determining procedure to judge whether division width which divides said picture is suitable, and it said extracting procedure, Extract a mean color or a representative color of each small region, and said formation procedure, A recording medium which recorded an area division program of the picture according to claim 9 or 10 which unifies each small region based on the extracted similarity of a mean color of a small region, or a representative color, resets up division width when judged with said division width not being suitable for said division procedure, and is again divided to two or more small regions.

[Claim 13]It is an image retrieval method which searches the target picture from an object image of an image database by making a key image into an index, Said key image is divided with an area division method of said picture according to any one of claims 1 to 4, An image retrieval method dividing an object image of an image database in the same region division as said key image, and searching the target picture in quest of similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

[Claim 14]It is an image retrieval method which searches the target picture from an object image of an image database by making a key image into an index, Said key image is divided with an area division method of said picture according to any one of claims 1 to 4, An image retrieval method dividing an object image of an image database with an area division method of said picture

according to any one of claims 1 to 4, and searching the target picture in quest of similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

[Claim 15]Are an image retrieval apparatus with which the target picture is searched from an object image of an image database by making a key image into an index, and Area division equipment of said picture according to any one of claims 5 to 8, A division means to divide said object image in the same region division as said key image divided with the area division equipment of said picture, An image retrieval apparatus provided with a similarity calculation means which asks for similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds, and a search means to search the target picture based on computed similarity.

[Claim 16]Are an image retrieval apparatus with which the target picture is searched from an object image of an image database by making a key image into an index, and Area division equipment of said picture according to any one of claims 5 to 8, A similarity calculation means which asks for similarity of characteristic quantity of a region division of said key image divided with the area division equipment of said picture, and characteristic quantity of a region division where said object image divided with the area division equipment of said picture corresponds, An image retrieval apparatus having a search means to search the target picture, based on computed similarity.

[Claim 17]A recording medium which recorded an image retrieval program which searches the target picture from an object image of an image database by making a key image into an index, comprising:

An area division program of a picture recorded on said recording medium according to any one of claims 9 to 12.

A division procedure of dividing said object image in the same region division as said key image divided by an area division program of said picture.

A similarity calculation procedure of asking for similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

A retrieving procedure which searches the target picture based on computed similarity.

[Claim 18]A recording medium which recorded an image retrieval program which searches the target picture from an object image of an image database by making a key image into an index, comprising:

An area division program of a picture recorded on said recording medium according to any one of claims 9 to 12.

A similarity calculation procedure of asking for similarity of characteristic quantity of a region division of said key image divided by an area division program of said picture, and characteristic quantity of a region division where said object image divided by an area division program of said picture corresponds, and a retrieving procedure which searches the target picture based on

computed similarity.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the area division of the suitable picture for the image retrieval system etc. with which the picture of the purpose the same as that of the key image which serves as an index out of the object image of an image database, or similar is searched, and the technology of image retrieval.

[0002]

[Description of the Prior Art] In searching conventionally the picture of the purpose which was the same as that of said key image, or was similar out of the image database with which many object images were stored based on the key image used as an index, A key image and the object image in an image database are divided into two or more fields appointed beforehand, He extracts the characteristic quantity of a picture, for example, the representative color etc. which are used most in the mean color of a region division, or a region division, for every region division, and is trying to take out the target picture from the similarity of the picture acquired using the characteristic quantity.

Generally, the form of the region division of a picture was being fixed beforehand.

[0003]

[Problem to be solved by the invention] However, since the form of the region division is being fixed in such a conventional example, The portion with which the feature of the picture is well expressed in the picture does not go into a region division well, When two or more region divisions are covered and the characteristic quantity for every region division, for example, a mean color, is extracted, the color of a portion with said feature may not fully be reflected, and in this way, Since characteristic quantity of the characteristic portion of a picture may be unable to extract correctly, there is a difficulty that search of a high-precision picture cannot be performed.

[0004] In view of an above-mentioned point, it succeeded in this invention, and it is ****. The purpose is responding, enabling it to divide in a field which expresses the feature of the picture well, and enabling it to perform still higher-precision image retrieval.

[0005]

[Means for solving problem] In order to attain the above-mentioned purpose, it constitutes from this invention as follows.

[0006] That is, an area division method of a picture of this invention of Claim 1 divides a picture into two or more small regions, unifies said small region based on the similarity of characteristic

quantity which extracted and extracted characteristic quantity of each small region, and forms a region division.

[0007]In invention of Claim 1, let this invention of Claim 2 be a region division of a polygon which unifies a small region which adjoins said region division each neighborhood of said rectangle based on the similarity of said characteristic quantity while it makes said each small region a small region of a rectangle which divided said picture in the shape of a lattice.

[0008]This invention of Claim 3 makes said characteristic quantity a mean color, a representative color, or concentration in Claim 1 or invention of 2.

[0009]In Claim 1 or invention of 2, this invention of Claim 4 said characteristic quantity, When it is considered as a mean color or a representative color, it judges whether division width which divides said picture is suitable based on the number of colors which constitute said small region, and a pixel number corresponding to each color and it is judged with it not being suitable, division width is reset up and it divides to two or more small regions again.

[0010]The area division equipment of the picture of this invention of Claim 5 is provided with the following.

A division means to divide a picture into two or more small regions.

An extraction means to extract the characteristic quantity of each small region.

Means forming which unifies each small region and forms a region division based on the similarity of the extracted characteristic quantity.

[0011]In invention of Claim 5, this invention of Claim 6 divides said picture in the shape of a lattice, and makes said division means said rectangular small region, and said means forming unifies the small region which adjoins each neighborhood of said rectangle based on the similarity of said characteristic quantity, and forms a polygonal region division.

[0012]In Claim 5 or invention of 6, as for this invention of Claim 7, said extraction means extracts the mean color, the representative color, or concentration of each small region, and said means forming unifies each small region based on the similarity of the mean color of the extracted small region, a representative color, or concentration.

[0013]In Claim 5 or invention of 6, this invention of Claim 8 based on the number of the colors which constitute said small region, and the pixel number corresponding to each color, Have a judging means which judges whether the division width which divides said picture is suitable, and said extraction means, The mean color or representative color of each small region is extracted, said means forming unifies each small region based on the extracted similarity of the mean color of a small region, or a representative color, and when judged with said division width not being suitable, said division means resets up division width, and divides it to two or more small regions again.

[0014]A recording medium which recorded an area division program of a picture of this invention of Claim 9, An area division program of a picture including a division procedure of dividing a picture into two or more small regions, an extracting procedure which extracts characteristic quantity of each small region, and a formation procedure which unifies each small region and

forms a region division based on the similarity of extracted characteristic quantity is recorded.

[0015]In invention of Claim 9, this invention of Claim 10 divides said picture in the shape of a lattice, and makes said division procedure said rectangular small region, and said formation procedure unifies a small region which adjoins each neighborhood of said rectangle based on the similarity of said characteristic quantity, and forms a polygonal region division.

[0016]In Claim 9 or invention of 10, as for this invention of Claim 11, said extracting procedure extracts a mean color, a representative color, or concentration of each small region, and said formation procedure unifies each small region based on the similarity of a mean color of an extracted small region, a representative color, or concentration.

[0017]In Claim 9 or 10, this invention of Claim 12 based on the number of colors which constitute said each of small region, and a pixel number corresponding to each color, It is recorded by determining procedure to judge whether division width which divides said picture is suitable, and it said extracting procedure, A mean color or a representative color of each small region is extracted, said formation procedure unifies each small region based on the extracted similarity of a mean color of a small region, or a representative color, and when judged with said division width not being suitable, said division procedure resets up division width, and divides it to two or more small regions again.

[0018]They are an image retrieval method of this invention of Claim 13, and an image retrieval method which searches the target picture from an object image of an image database by making a key image into an index, Said key image is divided with an area division method of said picture according to any one of claims 1 to 4, An object image of an image database is divided in the same region division as said key image, and the target picture is searched in quest of similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

[0019]An image retrieval method of this invention of Claim 14 is an image retrieval method which searches the target picture from an object image of an image database by making a key image into an index, Said key image is divided with an area division method of said picture according to any one of claims 1 to 4, An object image of an image database is divided with an area division method of said picture according to any one of claims 1 to 4, and the target picture is searched in quest of similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

[0020]An image retrieval apparatus of this invention of Claim 15 is provided with the following. It is an image retrieval apparatus with which the target picture is searched from an object image of an image database by making a key image into an index, and is area division equipment of said picture according to any one of claims 5 to 8.

A division means to divide said object image in the same region division as said key image divided with the area division equipment of said picture.

A similarity calculation means which asks for similarity of characteristic quantity of a region division of a key image, and characteristic quantity of a region division where an object image corresponds.

A search means to search the target picture based on computed similarity.

[0021]The image retrieval apparatus of this invention of Claim 16 is characterized by comprising: It is an image retrieval apparatus with which the target picture is searched from the object image of an image database by making a key image into an index, and is area division equipment of said picture according to any one of claims 5 to 8.

The similarity calculation means which asks for the similarity of the characteristic quantity of the region division of said key image divided with the area division equipment of said picture, and the characteristic quantity of the region division where said object image divided with the area division equipment of said picture corresponds.

A search means to search the target picture based on the computed similarity.

[0022]The recording medium which recorded the image retrieval program of this invention of Claim 17, It is the recording medium which recorded the image retrieval program which searches the target picture from the object image of an image database by making a key image into an index, An area division program of the picture recorded on said recording medium according to any one of claims 9 to 12, The division procedure of dividing said object image in the same region division as said key image divided by the area division program of said picture, An image retrieval program including the similarity calculation procedure of asking for the similarity of the characteristic quantity of the region division of a key image and the characteristic quantity of the region division where an object image corresponds, and the retrieving procedure which searches the target picture based on the computed similarity is recorded.

[0023]A recording medium which recorded an image retrieval program of this invention of Claim 18, It is the recording medium which recorded an image retrieval program which searches the target picture from an object image of an image database by making a key image into an index, An area division program of a picture recorded on said recording medium according to any one of claims 9 to 12, A similarity calculation procedure of asking for similarity of characteristic quantity of a region division of said key image divided by an area division program of said picture, and characteristic quantity of a region division where said object image divided by an area division program of said picture corresponds, Based on computed similarity, an image retrieval program including a retrieving procedure which searches the target picture is recorded.

[0024]Since according to Claim 1 and this invention of 5 or 9 a picture is divided into two or more small regions, said small region is unified based on the similarity of characteristic quantity which extracted and extracted characteristic quantity of each small region and a region division is formed, A picture will be divided for every region division where characteristic quantity is common, and a region division will be dynamically changed according to characteristic quantity of a picture.

[0025]According to Claim 2 and this invention of 6 or 10, since said each small region is made into a rectangle, a small region which adjoins each neighborhood of this rectangle is unified based on the similarity of characteristic quantity and a polygonal region division is formed, a picture will

be divided for every region division where common characteristic quantity continues.

[0026] Since said characteristic quantity is made into a mean color, a representative color, or concentration according to Claim 3 and this invention of 7 or 11, a color picture can be divided into the region division where a mean color or a representative color is common, or a shade image can be divided into the region division where concentration is common.

[0027] According to Claim 4 and this invention of 8 or 12, based on the number of the colors which constitute a small region, and the pixel number corresponding to each color, When it judges and is judged with it not being suitable, whether the division width of a picture is suitable, since it divides to two or more small regions again, there are many colors which constitute a small region, for example — moreover — the pixel number of each color — abbreviation — when it is equal and the feature of the picture does not appear in the small region well, the small region which re-divides a picture and where the feature of a picture appears well can be formed.

[0028] Since a key image is divided with the area division method of said picture according to any one of claims 1 to 4 according to Claim 13 and this invention of 15 or 17, the region division of a key image, It is a region division showing the feature of that key image, and since the target picture is searched in quest of the similarity of the characteristic quantity of the region division of this key image, and the characteristic quantity of the region division of the object image divided in the same region division, an object image most similar to the feature of a key image can be taken out.

[0029] Since a key image and an object image are divided, respectively with the area division method of said picture according to any one of claims 1 to 4 according to Claim 14 and this invention of 16 or 18, The region division of the key image and the object image is a region division showing the feature of each picture, and since it searches the target picture in quest of the corresponding similarity of the characteristic quantity of a region division, it can take out an object image most similar to the feature of a key image.

[0030]

[Mode for carrying out the invention] Hereafter, Drawings explain an embodiment of the invention in detail.

[0031] Drawing 1 is an outline block diagram of the **** search system concerning this invention.

[0032] The computer 2 as an image retrieval apparatus with which this image retrieval system 1 searches the picture of the same or similar purpose based on a key image, Have the image database 3 with which many object images were accumulated, and such an image retrieval system, For example, it is what can be used for various uses, such as search of the picture on the Internet, interior design, support of industrial design or an album system of a digital still camera, The key image inputted and the picture of the purpose similar identically or most are searched with this embodiment from the image database 3.

[0033] FD which recorded a retrieval program of a picture including an area division program of a picture in this image retrieval system (floppy disk), Area division and retrieval processing of a picture which set recording media, such as CD-ROM or HD (hard disk), in a drive device, and

mention them later to the computer 2 are performed.

[0034]Drawing 2 is provided with the following.

Are a functional block diagram of this embodiment and an image retrieval system of this embodiment, The area dividing means 5 as area division equipment of a picture which starts this invention which divides an object image of the image database 3 while dividing the key image 4 which is a still picture in color inputted into a suitable region division for extraction of characteristic quantity like the after-mentioned.

The divided similarity calculation means 6 which computes similarity of a region division of the key image 4 and an object image by extracting characteristic quantity for every region division. The search means 8 which takes out the picture 7 of the purpose similar identically or most based on computed similarity from the image database 3.

[0035]A region division is made to change dynamically corresponding to a portion with which the feature of a picture is expressed well rather than dividing a picture into form fixed like before in this embodiment, and a picture is divided as follows in the area dividing means 5 concerning this invention. Namely, in an area division method of a picture of this embodiment. The key image 4 is divided in the shape of a lattice, it is considered as a small region of two or more rectangles, a small region is unified one by one based on the similarity of characteristic quantity which extracted characteristic quantity of each small region, for example, a mean color and a representative color, respectively, and extracted them, and a polygonal region division is formed.

[0036]Supposing the 200x200-pixel picture shown in drawing 3 is given as the key image 4 now, for example, this picture will be divided in the shape of a lattice, for example, it will divide into two or more 10x10-pixel small regions 9.

[0037]Next, although characteristic quantity is extracted every small region 9, in this embodiment, a mean color or a representative color is used as characteristic quantity. It is a color specified with R and G which are produced by a mean color's totaling R about all the pixels of the small region 9, G, and B value, respectively, and dividing each total value by a total pixel number of the small region 9 here, respectively, and B value, and representative colors are most colors in the small region 9. The below-mentioned subtractive color processing is unified in two or more colors defined beforehand, and reduces the number of colors.

[0038]In this embodiment, about extraction of characteristic quantity, adopt either of the following four kinds of extracting processing patterns, and four kinds of this extracting processing pattern, ** It is four kinds of extracting a representative color, without performing ** subtractive color processing in which a mean color is extracted without performing ** subtractive color processing in which perform subtractive color processing and a mean color is extracted and in which perform ** subtractive color processing and a representative color is extracted, and determine this either as follows.

[0039]Here, a pixel number which belongs the number of small regions of the whole picture to X and its small region is set to Y, and it explains below.

[0040]First, about each of each small region, an RGB value of each pixel which constitutes each

small region is histogram-ized, and a pixel number of the same color is totaled. In this case, a histogram is created for each [does not total by each of R, G, and B (not creating three histograms, R, G, and B), but are specified with an RGB value by considering three of RGB as a set] color of every.

[0041] Thus, about each small region, the pixel number B is computed in each color A of every [which constitutes each small region].

[0042] For example, (R, G, B), The pixel number B about each color A which constitutes a small region as a pixel number of the color A_n as which a pixel number of the color A₂ as which a pixel number of the color A₁ specified by (10, 120, 5) is specified by B₁, and (150, 200, 20) is specified to B-2 and the appearance by (R_n, G_n, B_n) called it B_n. It totals about each small region, respectively.

[0043] As a result, when a rate of pixel number $B_{\max}$ about an RGB value (color) used as most pixel numbers is L% or less of a certain threshold value. Since many colors are used and the feature of a color is not well extracted about the small region, when it judges with subtractive color processing being performed and is over said L% of a certain threshold value, Since the feature of a color is extracted well, it judges with it not being necessary to perform subtractive color processing, and this judgment is performed for every small region.

[0044] That is, when it is $B_{\max} > Y \times L / 100$ the color of is decreased when it is $B_{\max} \leq Y \times L / 100$, it judges with not decreasing color.

[0045] Any shall be extracted between a mean color or a representative color as characteristic quantity. It judges whether several n of a color currently used in each small region is below a certain threshold value M, when several n of a color currently used is below a certain threshold value M, it is considered as a representative color, and when it is over a certain threshold value M, it is considered as a mean color and this judgment is performed for every small region.

[0046] That is, when it is $n > M$ made into a representative color when it is $n \leq M$, it judges with considering it as a mean color.

[0047] Each small region is classified into either of four kinds of above-mentioned extracting processing patterns according to performing the above decision processing for every small region. At this time, subtractive color processing actual only by judging into any of four kinds of extracting processing patterns each small region is classified to the last is not performed.

[0048] In thus, a place which a classification about all the small regions ended. It totals which was the largest among four kinds of extracting processing patterns, an extracting processing pattern which were is adopted as an extracting processing pattern about the picture, and required processing of subtractive color processing, calculation of a mean color, etc. is performed.

[0049] Drawing 4 is a flow chart of the above processing, and The RGB value first same [in a small region], Namely, total a pixel of the same color (Step n1), judge whether a pixel number of a color used as most many pixel numbers is below a threshold value (Step n2), and when it is not a threshold value less or equal. It moves from the small region to Step n4 as a candidate who does not decrease color (Step n7), and when it is below a threshold value, it moves from the small region to Step n4 as a candidate who decreases color (Step n3).

[0050]In Step n4, judge whether the number of colors currently used in the small region is below a threshold value, and when it is not a threshold value less or equal, It moves from the small region to Step n6 as a candidate of a mean color (Step n8), and when it is below a threshold value, it moves from the small region to Step n6 as a candidate of a representative color (Step n5).

[0051]It is classified to any of four kinds of extracting processing patterns the small region belongs according to Step n6, When judging whether sorting processing finished (Step n9) and having finished about no target small regions, When it returned and finishes with Step n1, an extracting processing pattern in which most many small regions are included, It determines as the extracting processing method about the picture (Step n10), and required processing of subtractive color processing, mean color computation, etc. is performed (Step n11), and characteristic quantity of color about each small region is extracted, and it ends (Step n12).

[0052]The picture 10 which divided the key image 4 of drawing 3 into the small region 9 as mentioned above, and extracted the representative color as characteristic quantity of each small region 9 is shown in drawing 5.

[0053]The division width which divides a picture into two or more small regions, Although it may set up on the system beforehand and what was inputted by the user of the system may be used, When the small region divided as follows judges whether it is a suitable size and it judges that it is not suitable, it may be made to divide into a still smaller small region again.

[0054]Namely, when each small region divided first is classified into four kinds of extracting processing patterns as mentioned above, When it is N% or less of a threshold value with several C of the small region which decreased color and was classified into the extracting processing pattern of the mean color, Re-division is not performed, but in being larger than N% of a certain threshold value, many colors are used, and I hear that there are many small regions where the feature of the color is not extracted well, it is, division width which divides a picture is made small in this case, a picture is re-divided into a smaller small region, and it performs above-mentioned processing again. Even if it re-divides, when not becoming N% or less of a threshold value with several C of a small region, further, division width is made small and is re-divided.

[0055]That is, when it is $C > X \times N / 100$ which is not re-divided when it is $C \leq X \times N / 100$, it judges with re-dividing.

[0056]Drawing 6 is a flow chart of the above re-split application, and Step n9 of it is the same as that of processing of above-mentioned drawing 4 in this drawing 6.

[0057]Judge whether there is any small region which decreased color and was classified into the extracting processing pattern of the mean color in Step n13, and when there is nothing, Move to Step n15, judge whether the number of the small regions which decreased color and were classified into the pattern of the mean color is below a threshold value at a certain time (Step n14), and when it is below a threshold value, It moves to Step n15, and when it is not below a threshold value, division width is made small, the whole picture is re-divided, and it returns to Step n1 of above-mentioned drawing 4. The extracting processing method of a pattern that most many small regions are included in Step n15, It determines as the extracting processing method

about the picture, and required processing of subtractive color processing, mean color computation, etc. is performed (Step n16), and the characteristic quantity of the color about each small region is extracted, and it ends (Step n17).

[0058]However, it may be made to adopt the extracting processing method of the pattern which had most small regions at the time, without performing re-division, when the pixel number from which repeating re-division constitutes a small region since processing time will increase so much becomes below a certain threshold value.

[0059]Drawing 7 is a flow chart in that case, and gives the same step number to the portion corresponding to drawing 6.

[0060]When the number of the small regions which decreased color and were classified into the extracting processing pattern of the mean color in Step n14 is not a threshold value less or equal, The pixel number which constitutes the small region which made division width small, re-divided the whole picture (Step n18), and was formed by re-division, Judge whether it is below a threshold value (Step n19), and when it is below a threshold value, The extracting processing method of a picture is determined based on the processing result to forward [which moves to Step n15 and performs re-division], and when it is not below a threshold value, drawing 4 is processed about the small region returned and re-divided into Step n1 of above-mentioned drawing 4.

[0061]In each above-mentioned embodiment, although the one extracting processing method was adopted as the whole picture, the extracting processing method according to which each small region was classified may be adopted for every small region as other embodiments of this invention.

[0062]Drawing 8 is shown and the flow chart in this case The RGB value first same [in a small region], Namely, total the pixel of the same color (Step n101), judge whether the pixel number of the color used as most many pixel numbers is below a threshold value (Step n102), and when it is not a threshold value less or equal. It moves from the small region to Step n104 as a candidate who does not decrease color (Step n107), and when it is below a threshold value, it moves from the small region to Step n104 as a candidate who decreases color (Step n103).

[0063]In Step n104, judge whether the number of the colors currently used in the small region is below a threshold value, and when it is not a threshold value less or equal, It moves from the small region to Step n106 as a candidate of a mean color (Step n108), and when it is below a threshold value, it moves from the small region to Step n106 as a candidate of a representative color (Step n105).

[0064]It is classified to any of four kinds of extracting processing patterns the small region belongs according to Step n106, When judging whether sorting processing finished (Step n109) and having finished about no target small regions, When it returned and finishes with Step n101, The extracting processing method according to which the small region was classified is determined as the extracting processing method about the small region for each small region of every (Step n110), Required processing of subtractive color processing, mean color computation, etc. is performed (Step n111), and the characteristic quantity about each small region is

extracted, and it ends (Step n112).

[0065]About the small region which decreased color and was judged in this case to be a mean color, only that small region may be re-divided still more finely. Color is decreased in the small region made at that time without performing re-division, when it reaches below the threshold value that has a pixel number which constitutes a small region in this case, and processing called a mean color is performed.

[0066]Drawing 9 is a flow chart of processing in this case, and Step n110 of it is the same as that of processing of above-mentioned drawing 8 in this drawing 9.

[0067]In Step n110, in each small region where either of four kinds of extracting processing methods was adopted, Decrease color, judge whether there is any small region where the extracting processing method of extracting a mean color was adopted (Step n113), and when there is nothing, Move to Step n115, judge whether the pixel number which constitutes the small region is below a threshold value at a certain time (Step n114), and when it is not a threshold value less or equal, The processing same only about the small region by which made division width small, re-divided the small region, returned to Step n101 of above-mentioned drawing 8, and the split shape was newly carried out as drawing 8 is performed. In Step n115, in accordance with the extracting processing method adopted at Step n110, required processing of subtractive color processing, mean color computation, etc. is performed, and the characteristic quantity about each small region is extracted, and it ends (Step n116).

[0068]Next, with the area division method of the picture of this invention, after being divided into a small region as mentioned above and extracting the characteristic quantity of each small region, based on the similarity of that characteristic quantity, a small region is unified one by one, a polygonal region division is formed, and processing of integration of this small region is explained.

[0069]In the small region which is in contact with four-side 12_1 of a certain small region 12 currently observed - 12_4 while shifting the field 11 which comprises 3×3 by one small region as shown in drawing 10 (A) for example, When there are the small regions 13-15 with common characteristic quantity, for example, a common representative color, these small regions 13-15 are unified as shown in the figure (B).

[0070]Drawing 11 is a flow chart of formation processing of the region division by integration of this small region, and explains the case where a representative color is used as characteristic quantity about the whole picture, in this example.

[0071]First, the representative color of the small region which is in contact with one side of the small region to which its attention is paid is investigated (Step n201). It judges whether it is the same color as the small region to which its attention is paid (Step n202), when it is not the same color, it moves to Step n204, and when it is the same color, the small region of the same color is unified to the small region to which its attention is paid, and it moves from it to Step n204 (Step n203).

[0072]Judge whether in Step n204, processing was completed about four sides of the small region to which its attention is paid, and when not having ended, In order to process the following

neighborhood, when it returned and (Step n206) ends to Step n201, In order to judge whether processing was completed about all the small regions (Step n205) and to perform processing that it is the same about the next small region when not having ended, when it returned and (Step n207) ends to Step n201, formation of the region division by integration is completed.

[0073]It can divide into the polygonal region division where characteristic quantity was common in the key image by the area division method of the picture of this invention as mentioned above. Even if the region division of this polygon does not understand what is shown concretely, it is meaningful as a unit which be [it / an aggregate of the small region with relation where characteristic quantity was common] is clear, and extracts the characteristic quantity of a picture.

[0074]Drawing 12 is the picture 13 which performed an integrating process with a common representative color, and formed a region division to the picture 10 of drawing 5 from which it was divided into a small region and a representative color was extracted. In this drawing 12, the reference marks 14-18 are given to some of region divisions.

[0075]Next, after dividing into a polygonal region division where characteristic quantity is common in a key image as mentioned above, it divides by the area dividing means 5 also about an object image of the image database 3 in the same region division as a region division of a polygon of a key image. That is, it is in a state which piled up a key image and an object image, and a field in the same position as a region division of a polygon of a key image is divided as a region division of an object image.

[0076]In the similarity calculation means 6, also about an object image, and the characteristic quantity of each region division, For example, a representative color is extracted, the similarity of the characteristic quantity of the region division of a key image and the characteristic quantity of the region division where an object image corresponds is computed, and the value which totaled the similarity about each region division is computed as similarity of the whole picture.

[0077]For every corresponding region division of a key image and an object image, in quest of the distance in RGB space, it is considered as the similarity for every region division by the following formula, and, specifically, what totaled the similarity for every region division is computed as similarity of the whole picture.

[0078]Namely, if the characteristic quantity of the region division where key image a and the object image b correspond, for example, the RGB value of a representative color, is set to (Rb, Gb, Bb), respectively (Ra, Ga, Ba), The similarity Cab of the region division becomes $Cab = \{(Ra - Rb)^2 + (Ga - Gb)^2 + (Ba - Bb)^2\}^{1/2}$.

[0079]The search means 8 picks out an object image with the smallest value of the similarity of the whole picture which totaled the similarity of each region division computed as mentioned above from the image database 3 noting that it is a picture of the most similar purpose.

[0080]Drawing 13 is a flow chart of the above retrieval processing, and shows the processing after the key image was divided into the region division where characteristic quantity is common as mentioned above.

[0081]First, divide an object image (Step n301) and in the same region division as a region

division of a key image as characteristic quantity for every region division of an object image. For example, determine a representative color (Step n302), judge whether processing was completed about all the object images of an image database (Step n303), and when not having ended, When it returned and ends to Step n301, Ask for similarity of a key image and an object image (Step n304), and it is judged whether processing finished about all the object images of an image database (Step n305), When not having finished, it returns to Step n304, and when it finishes, a most similar object image is determined as the target picture (Step n306).

[0082]Although an object image was divided into the same region division as a key image and it asked for similarity, it unifies, after dividing into a small region like a key image also to an object image as other embodiments of this invention, and may be made to ask for a region division in an above-mentioned embodiment.

[0083]In this case, since it is dependent on an image content of an object image, a region division turns into various fields, but may think that a boundary line of this region division shows the geometrical feature of that picture, and may ask for similarity. As shown in the figure (B), region division 19_1 corresponding to region division 4_1 of the key image 4 shown in drawing 14 (A) and 19_2 specifically, for example, When more than one are in the object image 19, as shown in the figure (C), it asks for similarity as a region division where the object image 19 corresponds field 19_1 with the largest area that laps with region division 4_1 of the key image 4.

[0084]Drawing 15 is a flow chart of the above processing.

[0085]First, carry out area division of the key image, form a region division (Step n401), and also about an object image. According to the picture, carry out area division, and a region division is formed (Step n402). When it judges whether area division was completed (Step n403) and ends about all the object images of an image database, When a region division which has lapped with a region division which has a key image to a certain object image is extracted (Step n404) and there are two or more overlapping region divisions, A region division corresponding based on a difference of an overlapping area is determined (Step n405). When judging whether processing finished or not (Step n407) and not having finished about all the region divisions of a key image, In order that the next of a key image may carry out region division ***** processing, when it returned and (Step n408) finishes with Step n404, When judging whether it ended or not (Step n407) and not having ended about all the object images, In order to process the following object image, when it returned and (Step n409) ends to Step n404, in quest of similarity of a region division of a key image, and a region division where an object image corresponds, the target picture is searched like the above-mentioned drawing 13 flow chart.

[0086]Width (for example, **1 pixel) on a boundary of a region division may be given, and it may refer to other embodiments of this invention in quest of similarity also about a field which expanded a region division, or a reduced field. According to this, it can search in consideration of gap of a key image and ***** A certain width may be set up on a system and is made to carry out input setting of the user.

[0087]As other embodiments of this invention, as shown in drawing 16, about the isolated small region 20 which is not integrated but remained, it may remove from a retrieval object, for

example.

[0088]A user is made to carry out input setting of the field removed from a retrieval object.

[0089]Although it applied to area division and image retrieval of a color picture and each above-mentioned embodiment explained, This invention may not be restricted to a color picture, it may apply to a monochrome shade image, and concentration produced by dividing a black pixel number of a small region by a total pixel number of a small region, for example may be used as characteristic quantity of a small region in this case.

[0090]In this invention, it may face unifying a small region, characteristic quantity may unify in the same small region, and it may unify in the small region which falls within a range with characteristic quantity.

[0091]

[Effect of the Invention]According to this invention, the following effect is done so as mentioned above.

[0092]That is, according to Claim 1 and this invention of 5 or 9, according to a picture, a region division will be changed dynamically, and it can divide for every region division where characteristic quantity is common, and can divide in the field which expressed the feature well according to a picture compared with the conventional example to which the region division was being fixed.

[0093]According to Claim 2 and this invention of 6 or 10, a picture can be divided in the field which expressed the feature of the picture well in the continuous thing in which characteristic quantity is common, and which is divided for every region division.

[0094]According to Claim 3 and this invention of 7 or 11, a color picture can be divided for every region division where a mean color or a representative color is common, Or a shade image can be divided for every region division where concentration is common, and a color picture or a shade image can be divided in the field which expressed the feature well.

[0095]When judged with the division width of a picture not being suitable according to Claim 4 and this invention of 8 or 12, since it divides to two or more small regions again, there are many colors which constitute a small region, for example — moreover — the pixel number of each color — abbreviation, when it is equal and the feature of the picture does not appear in the small region well, The small region which re-divides a picture and where the feature of a picture appears well will be formed, and it can divide into the region division where the feature of the picture appeared well eventually.

[0096]Since according to Claim 13 and this invention of 15 or 17 a key image can be divided in the region division which expressed that feature well and the target picture is searched in quest of the similarity of this region division and the region division where an object image corresponds, High-precision search can be performed compared with the conventional example which was being divided and searched in the region division which fixed the key image.

[0097]Since according to Claim 14 and this invention of 16 or 18 a key image and an object image can be divided in the region division which expressed that feature well, respectively and the target picture is searched in quest of the similarity of this region division, High-precision

search can be performed compared with the conventional example which was being divided and searched in the region division which fixed the key image and the object image.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a block diagram of the image retrieval system concerning this invention.

[Drawing 2] It is a functional block diagram of the embodiment of drawing 1.

[Drawing 3] It is a figure showing an example of a key image.

[Drawing 4] It is a flow chart with which explanation of characteristic quantity extraction of operation is presented.

[Drawing 5] It is a figure showing the picture which extracted the characteristic quantity divided into the small region.

[Drawing 6] It is a flow chart with which explanation of the characteristic quantity extraction concerning other embodiments of operation is presented.

[Drawing 7] It is a flow chart with which explanation of the characteristic quantity extraction concerning other embodiments of operation is presented.

[Drawing 8] It is a flow chart corresponding to drawing 4 concerning other embodiments of this invention.

[Drawing 9] It is a flow chart with which explanation of the characteristic quantity extraction concerning other embodiments of operation is presented.

[Drawing 10] It is a figure for explaining integration of a small region.

[Drawing 11] It is a flow chart with which explanation of integration of a small region of operation is presented.

[Drawing 12] It is a figure showing the picture in which the region division which unified the small region was formed.

[Drawing 13] It is a flow chart with which explanation of image retrieval of operation is presented.

[Drawing 14] It is a figure for explaining the correspondence relation of a division picture.

[Drawing 15] It is a flow chart with which explanation of the image retrieval concerning other embodiments of operation is presented.

[Drawing 16] It is a figure for explaining processing of the isolated small region.

[Explanations of letters or numerals]

3 Image database

4 Key image

5 Area dividing means

6 Similarity calculation means

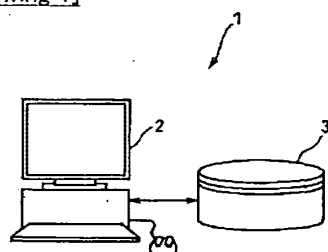
8 Search means

9 Small region

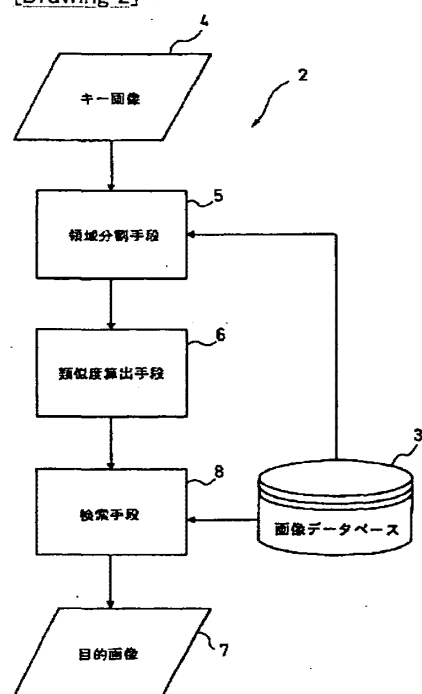
14-18 Region division

DRAWINGS

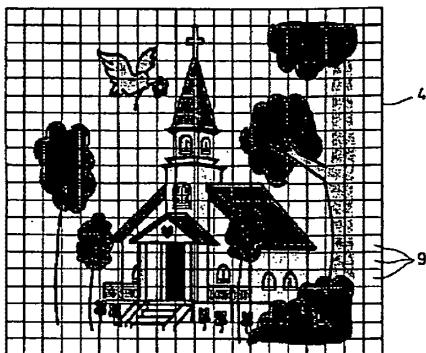
[Drawing 1]



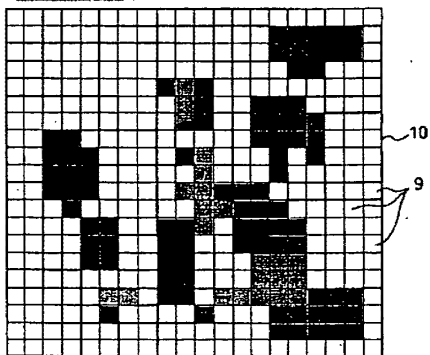
[Drawing 2]



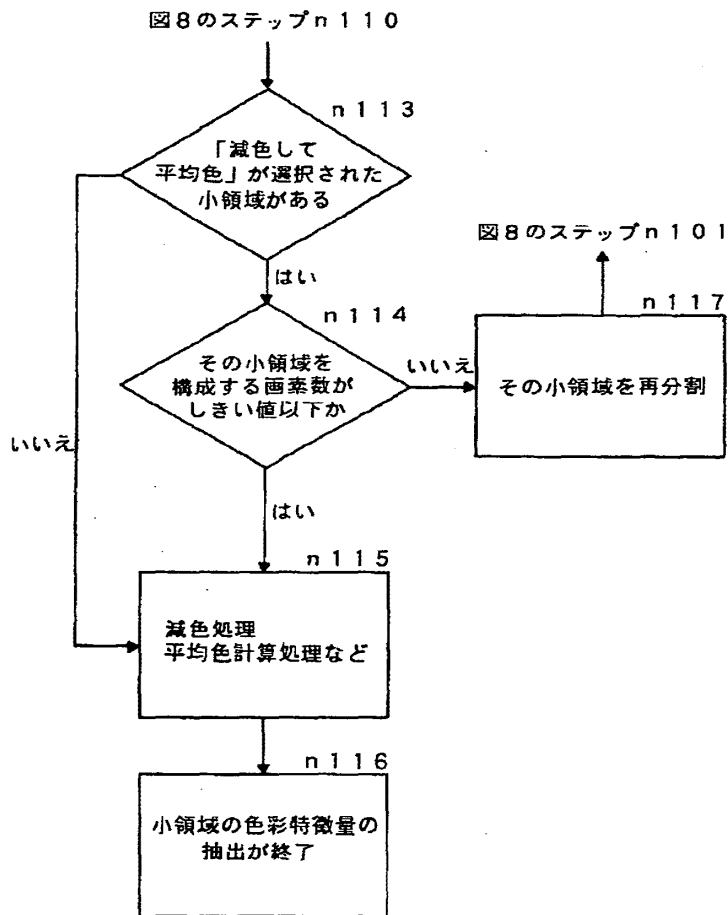
[Drawing 3]



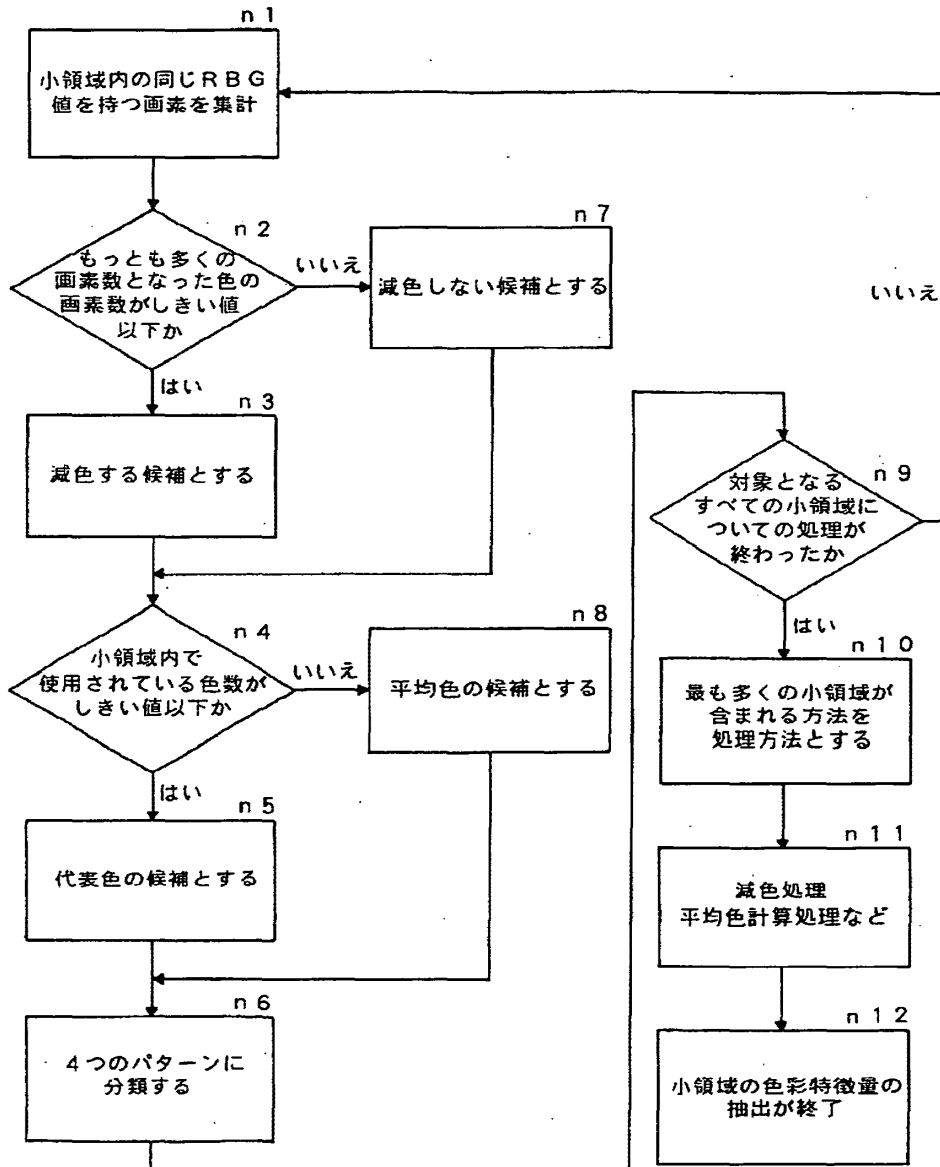
[Drawing 5]



[Drawing 9]

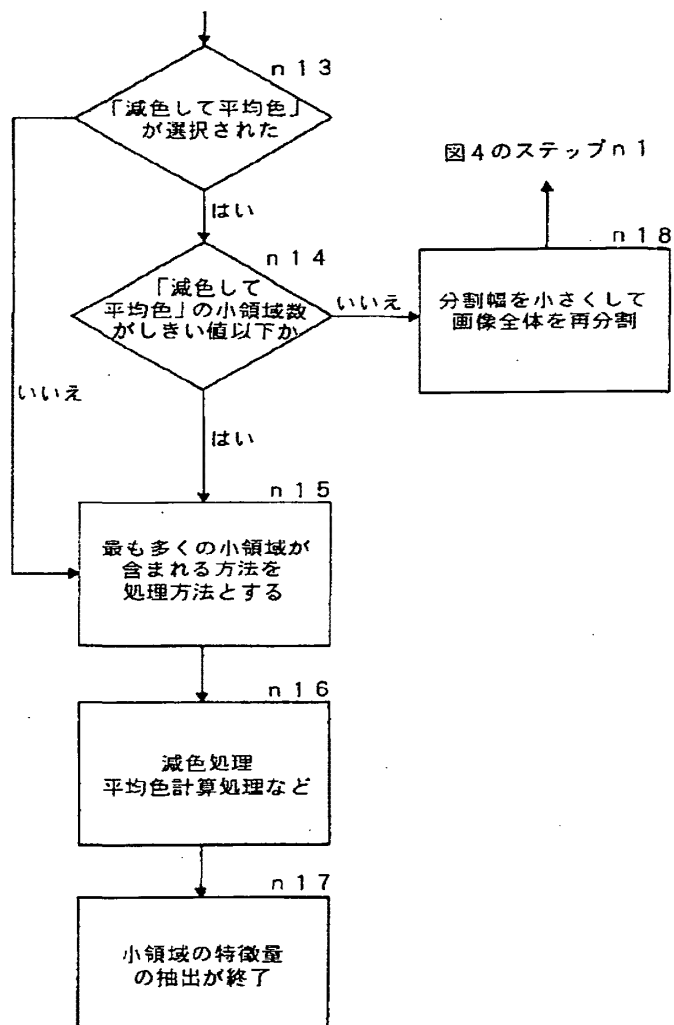


[Drawing 4]

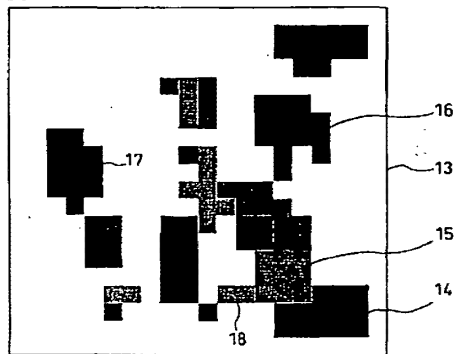


[Drawing 6]

図4のステップn9



[Drawing 12]



[Drawing 7]

図4のステップn9

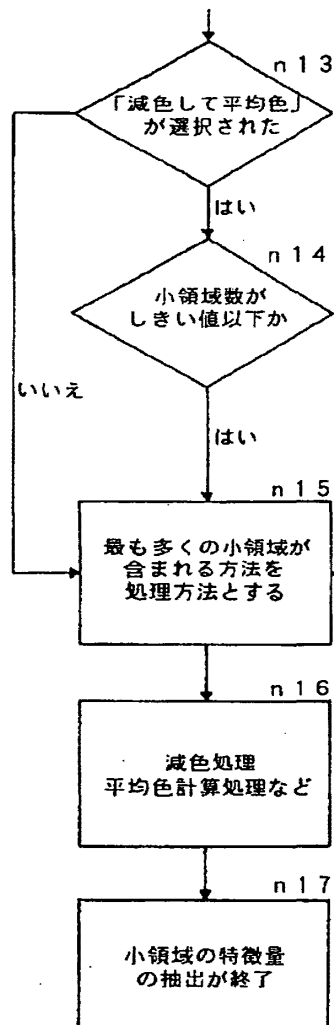
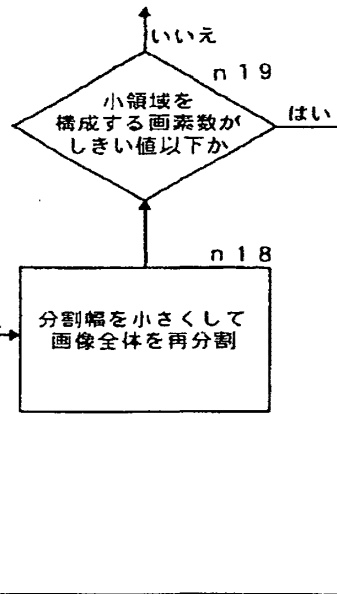
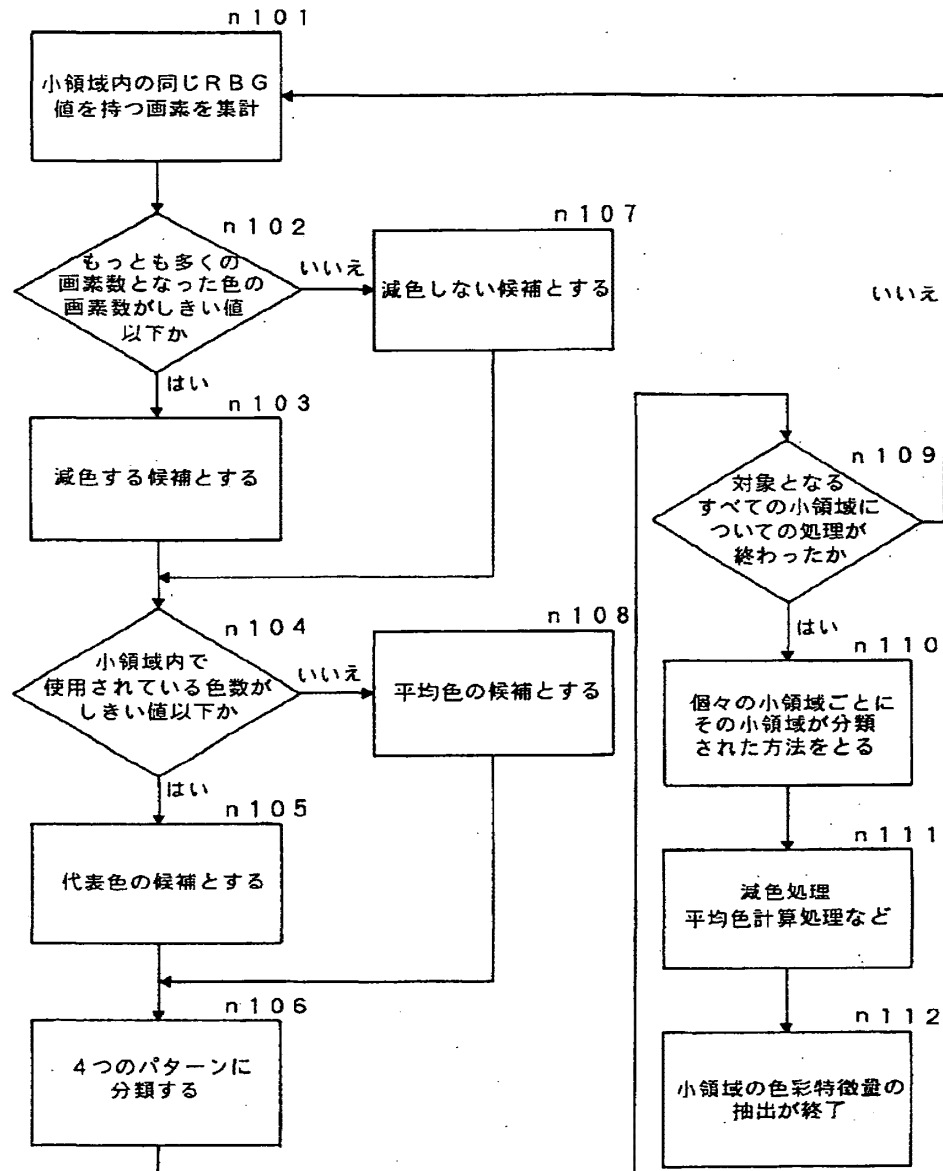


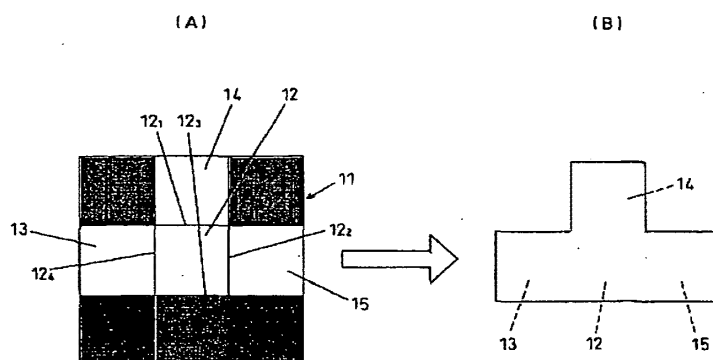
図4のステップn1



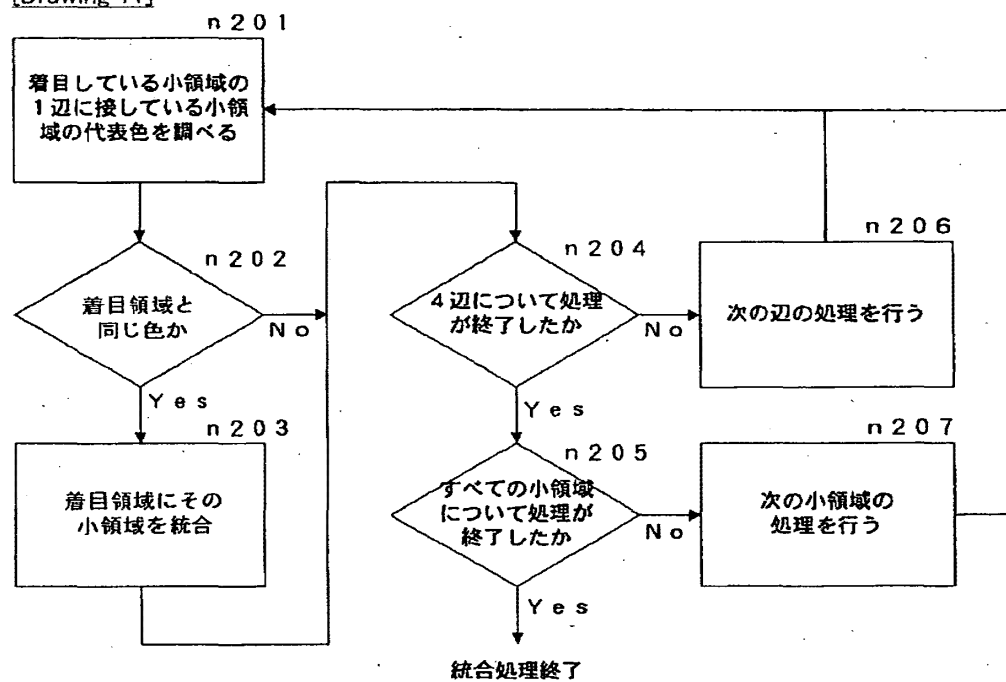
[Drawing 8]



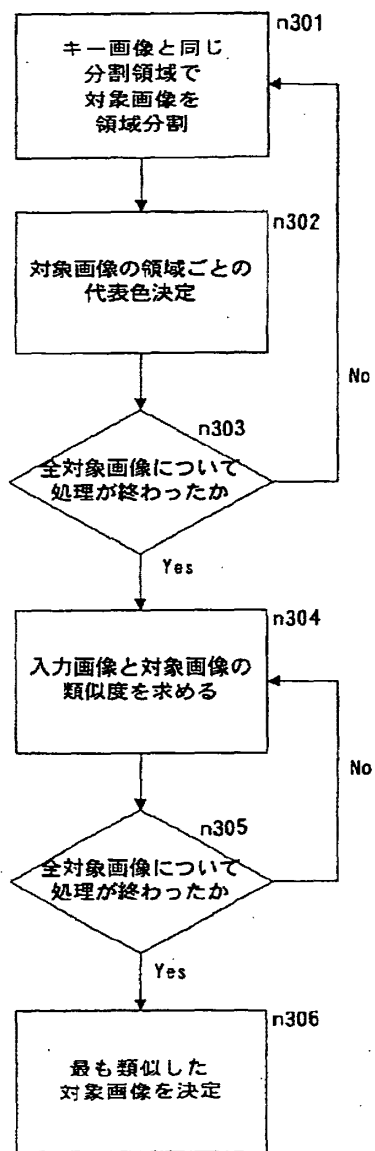
[Drawing 10]



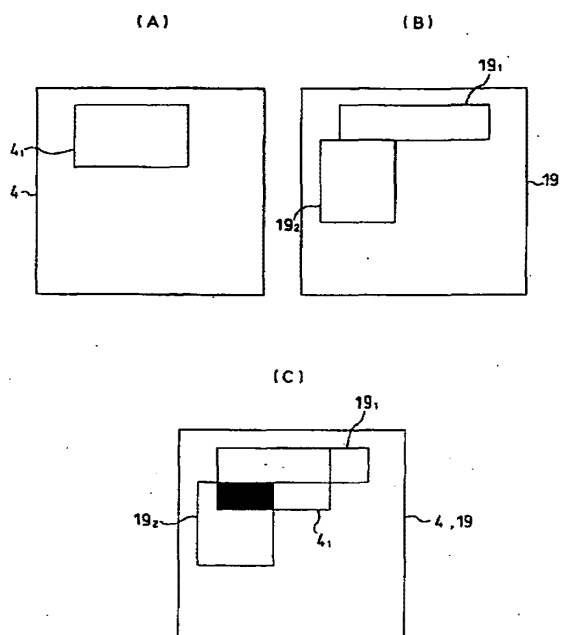
[Drawing 11]



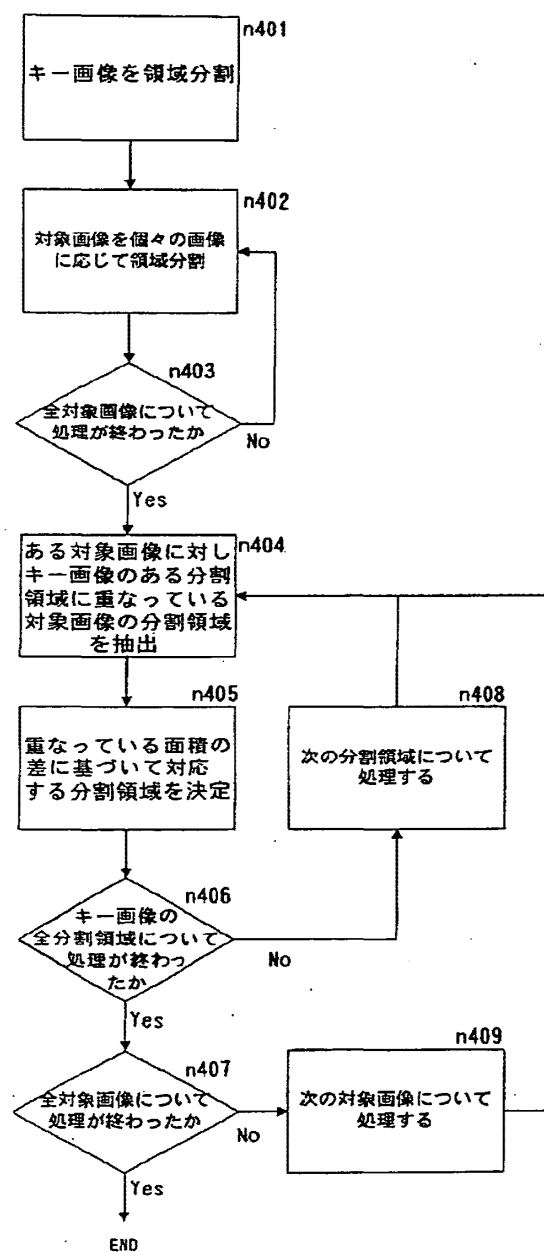
[Drawing 13]



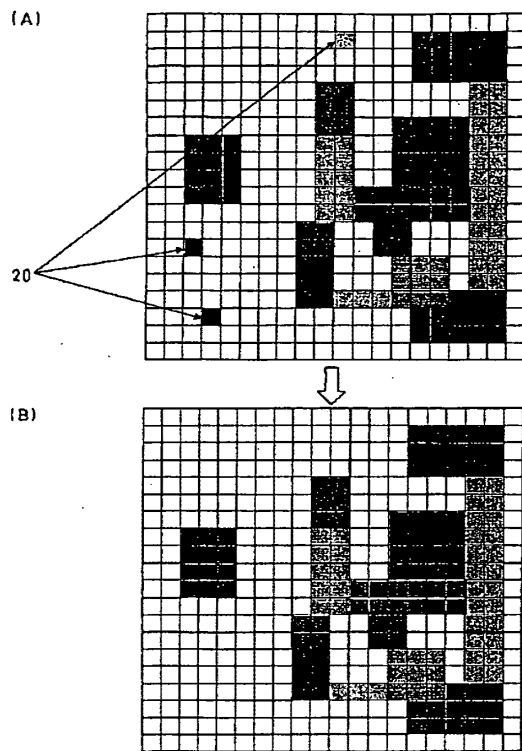
[Drawing 14]



[Drawing 15]



[Drawing 16]



METHOD FOR HIERARCHICALLY CLASSIFYING IMAGE AND DEVICE FOR CLASSIFYING AND RETRIEVING PICTURE AND RECORDING MEDIUM WITH PROGRAM FOR EXECUTING THE METHOD RECORDED THEREON

Publication number: JP2001160057 (A)

Publication date: 2001-06-12

Inventor(s): SATO MICHIOYOSHI; AKAMA HIROKI; KUSHIMA KAZUHIKO; YAMAMURO MASASHI +

Applicant(s): NIPPON TELEGRAPH & TELEPHONE +

Classification:

- international: **G06F17/30; G06T1/00; G06T7/00;** (IPC1-7): G06F17/30; G06T1/00

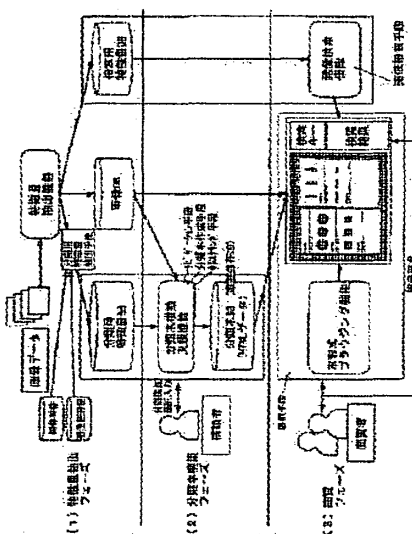
- European:

Application number: JP19990344338 19991203

Priority number(s): JP19990344338 19991203

Abstract of JP 2001160057 (A)

PROBLEM TO BE SOLVED: To realize efficient image DB(database) management and utilization by applying a picture classification tree structuring method, an image classification presenting method, and picture retrieval integrating means for capturing whole image in an image DB. **SOLUTION:** Large classification points of views, such as an area color, a straight line, an object, and an image dictionary are presented from a system to a user for an image group in the middle of navigation. When a user selects the image dictionary, the system presents the classification points of view as 'a human face', 'sky', and 'roof'. When the user selects 'a human face', this system presents the set of portraits. In the same way, small classification points of view such as an area color, a straight line, an object, and an image dictionary are presented to the user for the image set, and the classification according to the selection of the classification points of view is conducted hierarchically. The history of the navigation is made valid for the classification of an image DB, and stored in this system as the classification tree information. The whole images of the stored classification tree are read by using a keyword, a composited image, or a sample image so that the image DB can be observed.



(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2001-160057

(P2001-160057A)

(43) 公開日 平成13年6月12日 (2001.6.12)

(51) Int.Cl. ⁷	識別記号	F I	テーマート* (参考)
G 0 6 F 17/30		C 0 6 F 15/401	3 1 0 D 5 B 0 5 0
G 0 6 T 1/00		15/40	3 7 0 C 5 B 0 7 0
7/00		15/401	3 2 0 C 5 L 0 9 6
		15/419	3 1 0
		15/62	P
審査請求 未請求 請求項の数16 O L (全 16 頁) 最終頁に続く			

(21) 出願番号 特願平11-344338

(22) 出願日 平成11年12月3日 (1999.12.3)

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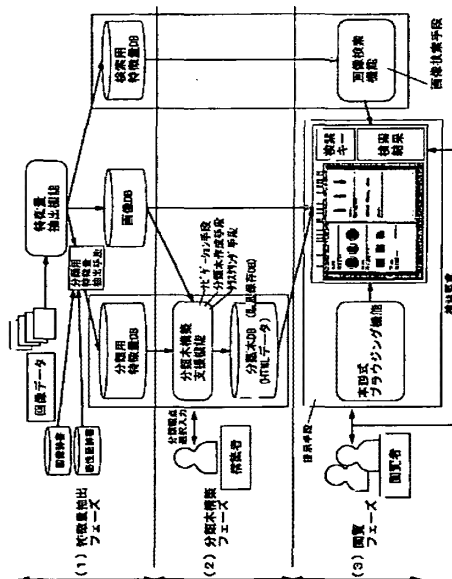
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(54) 【発明の名称】 画像の階層的分類方法、および画像の分類・検索装置、およびこの方法を実行するプログラムを記録した記録媒体

(57) 【要約】

【課題】 画像DB内の全体像把握のための画像分類木構築法、画像分類の提示法、及び画像検索との統合法を与え、効率的な画像DB管理・活用を実現する。

【解決手段】 ナビゲーションの途中の画像集合に対し、領域色、直線、オブジェクト、画像辞書という大分類観点がシステムから利用者に提示される。利用者が画像辞書を選択すると、システムは「人の顔」、「空」、「屋根」といった分類観点を提示する。利用者が「人の顔」を選択すると、システムは人物画の集合を提示し、同様にその画像集合に対し、領域色、直線、オブジェクト、画像辞書という小分類観点が利用者に提示され、分類観点の選択による分類が階層的に行われる。このナビゲーションの履歴は、画像DBの分類に有効なので、システムに分類木情報として蓄積される。蓄積された分類木の全体像をキーワードや合成画、サンプル画像を用いて閲覧することで、画像DBが概観できる。



【特許請求の範囲】

【請求項1】 任意の画像集合を分類対象とし、指定された分類観点により分類した分類結果を提示し、前記分類結果に対し、続いて指定された分類観点によりさらに分類した分類結果を提示する過程を1回、または複数回繰り返して行うことを特徴とする画像の階層的分類方法。

【請求項2】 画像の概念を表す言葉と、該言葉に相当する概念を定義した画像オブジェクト、画像内領域、および、画像内直線の特徴量の条件の組とを対応づけた表を持ち、これらと言葉のシソーラスとを関係づけた画像辞書を用いて、画像を分類するための情報を抽出し、前記抽出した情報を分類観点の一つとして画像を分類することを特徴とする請求項1記載の画像の階層的分類方法。

【請求項3】 画像および画像を分割した領域の面積により正規化した代表色Y個の色ヒストグラムを求め、明るい色の方が暗い色より小さな閾値を持ち、前記色ヒストグラムにおいて該閾値を超える色がある場合は、その色の中で最大の値を持つ色を対象領域の代表領域色として抽出し、該閾値を超える色がない場合は代表領域色を持たない領域とし、前記決定した代表領域色を分類観点として画像を分類することを特徴とする請求項1記載の画像の階層的分類方法。

【請求項4】 画像および画像を分割した領域の面積により正規化した代表色Y個の色ヒストグラムを求め、前記ヒストグラム値が高いものから順に第1主要色、第2主要色、…、第Y主要色とし、これらの主要色を分類観点として画像を分類することを特徴とする請求項1記載の画像の階層的分類方法。

【請求項5】 代表領域色を分類観点として画像を分類する際、ある代表領域色に属する画像枚数が一定枚数Aより少ない場合はその画像集合を類似した色相を持つ他の集合に統合し、逆にある代表領域色に属する画像が一定枚数B（ $B > A$ ）より多い場合はより細かい色相の代表領域色に分割することを特徴とする請求項1または3または4記載の画像の階層的分類方法。

【請求項6】 感性語とその感性語からイメージされる色の特徴量を対応付けた感性語辞書を分類観点として用い、前記感性語辞書の感性語特徴量と、対象画像から抽出される色特徴量との距離計算を行ない、最も類似する感性語に前記対象画像を分類することを特徴とする請求項1記載の画像の階層的分類方法。

【請求項7】 画像より直線の長さ、角度、本数、および、複数直線間の関係といった特徴量を抽出し、前記抽出した特徴量を分類観点とすることを特徴とする

請求項1記載の画像の階層的分類方法。

【請求項8】 画像より抽出される画像内オブジェクト、その個数、複数の画像内オブジェクトの位置関係、および、画像内オブジェクトの分布といった特徴量を分類観点とすることを特徴とする請求項1記載の画像の階層的分類方法。

【請求項9】 予め基本として登録した代表形状を分類観点とし、分類対象の画像内より抽出される画像内オブジェクトの形状特徴量を抽出し、それらのヒストグラム間の距離計算によって最も類似する代表形状に前記画像を分類することを特徴とする請求項1記載の画像の階層的分類方法。

【請求項10】 分類観点の指示は、複数の分類観点を組み合わせて提示した中から選択させるナビゲーションにより行われることを特徴とする請求項1から9までのいずれか1項記載の画像の階層的分類方法。

【請求項11】 分類観点を提示する際には、該当する画像を持たない分類観点は提示対象から除き、残る提示対象の分類観点については、各分類観点到該当する画像の枚数が多い分類観点から順に利用者に推薦提示することで分類木構築者をナビゲートすることとを特徴とする請求項10記載の画像の階層的分類方法。

【請求項12】 ナビゲーションによる画像の階層的分類の過程での利用者からの分類観点の選択を分類履歴として保持し、前記分類履歴から分類木を生成することを特徴とする請求項10または11記載の画像の階層的分類方法。

【請求項13】 ナビゲーションにより画像を階層的に分類する場合、予め代表的な分類項目の例をいくつか決めておき、最も近い分類項目に個々の画像を分類する請求項3から9までのいずれか1項記載の画像の階層的分類方法と、各領域の色特徴量、形状特徴量などの画像の特徴量をクラスタリング手法を用いて類似する集合に分類するクラスタリング分類方法とを有し、それらを自由に組み合わせて画像を分類することを特徴とする画像の階層的分類方法。

【請求項14】 ナビゲーションの過程での利用者からの分類観点の指示をナビゲーション履歴として保持する履歴蓄積手段と、そのナビゲーション履歴から分類木を構成する画像分類木生成手段と、

前記生成された分類木を提示する提示手段と、利用者から検索要求がなされた場合には、前記分類木から画像の内容検索を連携して行なう検索手段とを、具備することを特徴とする画像の分類・検索装置。

【請求項15】 前記分類木の提示手段は、電子本を利用し、該電子本上に分類結果を表現するために分類木のノードを本の章・節の形で展開し、

前記ノードの表現には、章や節を簡潔に表現するために分類観点、合成画、代表サンプルを組み合わせて表現し、

最も末端のリーフにはそのリーフに含まれる全画像の概要を表示し、

前記検索手段は、

前記電子本から任意の画像の概要が選択された場合、その画像の概要を検索キーとして画像を検索することの特徴とする請求項14記載の画像の分類・検索装置。

【請求項16】 請求項1から13までのいずれか1項記載の画像の階層的な分類方法における処理手順をコンピュータで実行するプログラムを、該コンピュータが読み取り可能な記録媒体に記録したことを特徴とする画像の階層的な分類方法を実行するプログラムを記録した記録媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、大量の画像を有する画像DB（データベース）システム、映像DBシステムなどのマルチメディアシステムを効率的に運用し、有効に活用する際に使用する画像の階層的な分類方法、および装置に関するものである。

【0002】

【従来の技術】これまで、多数の画像管理システムが実現されている。その管理方法には、主に検索と分類という二つの方法が存在する。

【0003】#画像検索

画像検索には画像に付加されたテキスト情報（キーワードや説明文など）によって検索を行う方法と、画像の内容情報（色やテクスチャなどの特徴量）の類似度によって検索を行う方法が存在する。

【0004】画像の内容情報を用いた類似検索システムとしては、Informix社のVIRやNTTのEx Sightがある。Ex Sightでは、画像全体の色、模様や、画像内のオブジェクトの色、形、位置、および、画像内の直線の長さ、傾き、位置のような特徴量での検索を可能にしている。

【0005】#画像分類

画像の分類にも、画像に付加されたテキスト情報を利用して分類を行う方法と、画像の内容情報を用いて分類を行う方法がある。

【0006】画像の内容情報を用いた分類システムとしては、California大のNetraや神戸大の類似シーン分類システムが存在し、それらは画像全体や画像のブロック分割領域の色やテクスチャの特徴量によってクラスタリングする。

【0007】#テキスト・ナビゲーション

テキスト検索の分野では、情報の絞り込みに際し、与えられた集合をさらに分類する観点（キーワード）を自動提示することで、利用者の情報の絞り込みを支援するナ

ビゲーション手法が提案されている。

【0008】

【発明が開発しようとする課題】画像へのテキスト情報の付与には、

・付与を手作業に頼らざるを得ないため、コストと時間がかかること、

・付与者によるバラツキが大きくDB全体に一貫したテキスト情報を付与するのが難しいこと、

・テクスチャ画像のように、テキスト情報（模様名）の付与が難しいものが存在すること、

等の解決すべき課題が存在した。

【0009】そこで、画像の内容検索の技術が開発されてきたが、

・本に索引と目次があるように、検索だけでは画像DBの概観が把握できず、その結果として、検索結果の良否についても判断できなくなること、

・検索キー画像の取得方法としてスケッチ入力やデジタルカメラ入力等が存在するがそれらを利用したとしても検索キーを与えることが難しい、

等の解決すべき課題が存在した。

【0010】また、画像の内容分類技術が近年開発されつつあるが、

・これまで開発されたものは、航空写真画像や雲画像のように特殊な領域の画像に対する専用システムであり、特殊な特徴量を利用するため一般的な画像に適用できないこと、

・一般的な画像に適用可能な場合でも、単にクラスタリングを行うだけでは階層的な分類木の構成にはなっておらず、結局、画像数が増えた場合には分類として機能しない、

等の解決すべき課題が存在した。

【0011】本発明の課題は、画像DB内の全体像を把握するための、画像分類木構築法、画像分類の提示法、および、画像検索システムとの統合法を与え、効率的な画像DB管理・活用法を実現することである。

【0012】

【課題を解決するための手段】本発明は、以下に列記する発明により上記の課題を解決する。

【0013】第1の発明は、任意の画像集合を分類対象とし、指定された分類観点により分類した分類結果を提示し、前記分類結果に対し、続いて指定された分類観点によりさらに分類した分類結果を提示する過程を1回、または複数回繰り返して行うことを特徴とする画像の階層的な分類方法である。

【0014】この発明は、以下の発明の基本となるものであり、分類観点の指示と、それに基づいた分類の実行の繰り返しにより、画像の階層的な分類と、分類木の構築が実現される。

【0015】第2の発明は、画像の概念を表す言葉と、該言葉に相当する概念を定義した画像オブジェクト、画

像内領域、および、画像内直線の特徴量の条件の組とを対応づけた表を持ち、これらと言葉のシソーラスとを関係づけた画像辞書を用いて、画像を分類するための情報を抽出し、前記抽出した情報を分類観点の一つとして画像を分類することを特徴とする画像の階層的な分類方法である。

【0016】テキストのシソーラスは、「言葉」の持つ概念関係を表したものである。画像内に写る言葉で表現できる被写体を部分画、オブジェクト、直線など画像の特徴を組み合わせて定義することにより被写体を表現する「言葉」を画像特徴量を用いて表現することができる。ここでキーワードシソーラスの概念関係を用いれば、定義された画像間に関連性もたせることができ、これらの情報をまとめることで画像辞書が形成され、分類観点の抽出に利用できる。

【0017】第3の発明は、画像および画像を分割した領域の面積により正規化した代表色Y個の色ヒストグラムを求め、明るい色の方が暗い色より小さな閾値を持ち、前記ヒストグラムにおいて該閾値を超える色がある場合は、その色の中で最大の値を持つ色を対象領域の代表領域色として抽出し、該閾値を超える色がない場合は代表領域色を持たない領域とし、前記決定した代表領域色を分類観点として画像を分類することを特徴とする画像の階層的な分類方法である。

【0018】例えば画像をY個の代表色に減色し、同じ面積にてX分割された個々の領域における色のヒストグラムを作成する。このとき、ヒストグラムの最大値が特定の閾値を超える場合は、最大値に相当する色をその領域における代表領域色とする。もし、その閾値を満たす色がない場合はその領域には代表領域色がないとみなす。なお、人の目には暗くて地味な色より明るく派手な色の方が目につきやすいので、明るい色の方が暗い色より閾値を低く設定する。上記した方法により抽出される代表領域色は利用者が分類を行なう際の詳細な分類観点として用いられ、この観点に基づいた階層的な分類が行なわれる。

【0019】第4の発明は、画像および画像を分割した領域の面積により正規化した代表色Y個の色ヒストグラムを求め、前記ヒストグラム値が高いものから順に第1主要色、第2主要色、…、第Y主要色とし、これらの主要色を分類観点として画像を分類することを特徴とする画像の階層的な分類方法である。

【0020】画像全体について代表的な色は必ずしも1色ではなく、複数の支配的な色が存在するケースがほとんどである。そこで画像全体領域の色ヒストグラム値の高いものから順に第1主要色、第2主要色、…とする。これは画像全体領域に限らず、任意の画像領域にも拡張可能である。この結果は利用者が分類を行なう際の分類観点として用いられ、観点に基づいた階層的な分類が行なわれる。

【0021】第5の発明は、代表領域色を分類観点として画像を分類する際、ある代表領域色に属する画像枚数が一定枚数Aより少ない場合はその画像集合を類似した色相を持つ他の集合に統合し、逆にある代表領域色に属する画像が一定枚数B（ $B > A$ ）より多い場合はより細かい色相の代表領域色に分割することを特徴とする画像の階層的な分類方法である。

【0022】代表領域色を用いた画像分類において、分類対象となる画像の枚数が少なかったり、階層的な分類を繰り返すことで1つの分類集合に含まれる画像枚数が徐々に減少してきた場合、予め規定された代表色数を用いて分類すると数枚しか画像を含まない分類集合が形成されることがある。このような分類は分類木構造を無意味に複雑化させる。そこで、ある代表色に属する画像枚数が一定枚数Aより少ない場合はその集合を類似した色相を持つ他の集合に統合し、分類木構造を簡単にする。逆に分類画像数が多い場合は、予め固定された代表色を用いて分類しても1つの分類集合が非常に大きくなる場合がある。そこで1度代表色で分類された後もある色相を持つ画像が一定枚数Bよりも多い場合は、次の分類により細かく色相分割された代表色を用いて1つの分類集合を細分化できる詳細分類観点を追加提供する。

【0023】第6の発明は、感性語とその感性語からイメージされる色の特徴量を対応付けた感性語辞書を分類観点として用い、前記感性語辞書の感性語特徴量と、対象画像から抽出される色特徴量との距離計算を行ない、最も類似する感性語に前記対象画像を分類することを特徴とする画像の階層的な分類方法である。

【0024】画像から受ける「かわいらしい」、「さわやかな」といった感性を用いて分類を行うために、感性語とその感性語からイメージされる色の特徴量を対応付けた感性語辞書を用いた分類を行う。画像から抽出される色情報と各感性語が持つ特徴量との距離計算を行い、最も距離が短かった感性語に対して画像を一意に振り分け分類する。

【0025】第7の発明は、画像より直線の長さ、角度、本数、および、複数直線間の関係といった特徴量を抽出し、前記抽出した特徴量を分類観点とすることを特徴とする画像の階層的な分類方法である。

【0026】画像内からエッジの情報をもとに抽出される直線は画像の構図を反映するものが多い。しかし、始点と終点の情報からなる個々の直線情報のままでは、その画像内の構図の情報として分類に用いることはできない。そこで、直線の本数や長さ、本数、複数直線間の関係などを用いて、1枚の画像内から抽出された直線がどのような構図を反映する情報を持っているのか、また、直線同士がどのような係わり合いを持っているのかを調べる。この結果は、利用者が分類を行なう際の分類観点として用いられ、観点に基づいた階層的な分類が行なわれる。

【0027】第8の発明は、画像より抽出される画像内オブジェクト、その個数、複数の画像内オブジェクトの位置関係、および、画像内オブジェクトの分布といった特徴量を分類観点とすることを特徴とする画像の階層的な分類方法である。

【0028】画像内より抽出されるオブジェクトの個数やその重心位置の分布は画像によって異なり、この情報も画像の構図情報を反映する。そこで、オブジェクトの個数や重心位置をもとに1枚画内のどのあたりに多くの被写体が写っているのかといった分布状況を抽出する。この結果は利用者が分類を行なう際の分類観点として用いられ、観点に基づいた階層的な分類が行なわれる。

【0029】第9の発明は、予め基本として登録した代表形状を分類観点とし、分類対象の画像内より抽出される画像内オブジェクトの形状特徴量を抽出し、それらのヒストグラム間の距離計算によって最も類似する代表形状に前記画像を分類することを特徴とする画像の階層的な分類方法である。

【0030】クリップアートのように1画像中に1画像内オブジェクトをもつ画像集合を分類する場合、形状は非常に重要な特徴となる。そこで、予め丸や正方形、長方形といった基本となる代表形状を数種類設定し、最も類似する代表形状に一意に分類する。具体的には、対象画像と代表形状の形状特徴量間の距離計算を行い、最も距離が短かった代表形状に分類する。

【0031】第10の発明は、分類観点を指示は、複数の分類観点を提示した中から選択させるナビゲーションにより行われることを特徴とする画像の階層的な分類方法である。

【0032】階層的な分類を実現するために、利用者が領域色、直線、オブジェクト、画像辞書の観点を選択しながら分類を実現する。まず領域色、直線、オブジェクト、画像辞書といった大まかな分類観点（大分類観点）を提示する。利用者がこの中から分類観点を選択すると、システムは、さらに先の選択観点に基づき該当画像を絞り込み、さらに細かい選択条件（小分類観点）に基づき集計を行なう。その結果は各小分類観点に該当する画像サンプルと共に選択条件として利用者に提示される。利用者がこの小分類観点を選択することにより実際に分類が実行され、分類集合が作成される。このような分類観点の提示により利用者をナビゲートしながら階層的な分類を繰り返し、画像の絞り込みを行なっていく。

【0033】第11の発明は、分類観点を提示する際には、該当する画像を持たない分類観点は提示対象から除き、残る提示対象の分類観点については、各分類観点に該当する画像の枚数が多い分類観点から順に利用者に推薦提示することで分類木構築者をナビゲートすることを特徴とする画像の階層的な分類方法である。

【0034】ナビゲーションにおいて、たくさんの分類観点がありすぎると、利用者はどれを次の分類観点とし

て選択していいかわからないので、不必要な分類観点は削除するとともに、推薦する観点の候補を提示する。すなわち、画像データベースに格納されるすべての画像に対して領域色、直線、オブジェクトによる分類を行なった場合、適用する画像データによっては分類観点に対して該当するものが存在しないことがある。このような結果を分類選択項目として提示しても意味がない。そこで、このような分類観点は分類選択候補から予め削除し、かつ該当する分類観点が多い順に提示順序を並び替えて推薦する分類候補として利用者に提示する。

【0035】第12の発明は、ナビゲーションによる画像の階層的な分類の過程での利用者からの分類観点の選択を分類履歴として保持し、前記分類履歴から分類木を生成することを特徴とする画像の階層的な分類方法である。

【0036】上記のナビゲーション時に、利用者が選択した分類観点の履歴を保存しておく。この分類履歴から、対象とする画像DBを概観する静的な分類木が出来る。

【0037】第13の発明は、ナビゲーションにより画像を階層的に分類する場合、予め代表的な分類項目の例をいくつか決めておき、最も近い分類項目に個々の画像を分類する上記の画像の階層的な分類方法と、各領域の色特徴量、形状特徴量などの画像の特徴量をクラスタリング手法を用いて類似する集合に分類するクラスタリング分類方法とを有し、それらを自由に組み合わせて画像を分類することを特徴とする画像の階層的な分類方法である。

【0038】種々雑多な画像を分類する場合、できるだけ多くの観点を用いて分類ができることが望ましい。そこで、本発明3～9の画像の階層的な分類方法のように予め代表的な分類の例をいくつか決めておき、最も近い項目に個々の画像を割り当てる「代表分類手法」と、各領域の色特徴量、形状特徴量といった特徴量をクラスタリングすることで分類する「クラスタリング分類手法」の2種類をユーザが状況に応じて選択し分類する。このような「複合分類手法」を用いることで分類の階層化がしやすく、また、意味のある集合を形成しやすくなる。

【0039】第14の発明は、ナビゲーションの過程での利用者からの分類観点の指示をナビゲーション履歴として保持する履歴蓄積手段と、そのナビゲーション履歴から分類木を構成する画像分類木生成手段と、前記生成された分類木を提示する提示手段と、利用者から検索要求がなされた場合には、前記分類木から画像の内容検索を連携して行なう検索手段とを、具備することを特徴とする画像の分類・検索装置である。

【0040】上記のナビゲーション時に、利用者が選択した分類観点の履歴を保存しておく。この分類履歴から、対象とする画像DBを概観する静的な分類木が出来る。この静的な分類木を、閲覧する機能手段を設け、階層分類と類似検索を連携させ、利用者の要望に応

じて分類と検索を切り替えながら画像を絞り込んでいくことが可能となる。

【0041】第15の発明は、前記分類木の提示手段は、電子本を利用し、該電子本上に分類結果を表現するために分類木のノードを本の章・節の形で展開し、前記ノードの表現には、章や節を簡潔に表現するために分類観点、合成画、代表サンプルを組み合わせて表現し、最も末端のリーフにはそのリーフに含まれる全画像の概要を表示し、前記検索手段は、前記電子本から任意の画像の概要が選択された場合、その画像の概要を検索キーとして画像を検索することを特徴とする画像の分類・検索装置である。

【0042】分類結果を利用者に提供する手段として、日常なじみの深い本の形式を利用し、分類した結果構築される分類木のノードを本の章・節の形で表現する。電子本の閲覧者に個々の章・節を分かりやすく表現するためには、ノード表現として代表画を表示したり、分類観点を言葉で表記したり、合成画を表示したりする。分類木の末端リーフを表現するときは、そのリーフに含まれる全画像を表示する。各章や節にはそれらの下層の節へ移動するためリンクが張られており、そのリンクをクリックすることで容易に下層の節を表示するページヘジャンプすることができる。出来上がった電子本から任意の画像を選択すると、その画像を検索キーとした画像検索を行なうことが出来る。また、検索結果の中から好みの画像を選択すると電子本でその画像が掲載されたページが開かれる。上記のノード表現は、ナビゲーションによる階層的な分類実行している最中や、画像目録の分類木構造を利用者に対して視覚化する際にも、分類木のノードをうまく表現することが可能となる。

【0043】第16の発明は、上記の画像の階層的な分類方法における処理手順をコンピュータで実行するプログラムを、該コンピュータが読み取り可能な記録媒体に記録したことを特徴とする画像の階層的な分類方法を実行するプログラムを記録した記録媒体である。

【0044】この記録媒体を用いれば、本発明の画像の階層的な分類方法を記録媒体として配布したり、保存したりすることが可能となり、コンピュータを用いて本発明の方法を実現することが可能となる。

【0045】

【発明の実施の形態】以下、本発明の実施の形態について図を用いて詳細に説明する。

【0046】図1は、本発明による画像分類方法を実現するシステムあるいは装置の機能ブロック構成を示している。以下の各実施形態例では、これらの機能手段を適宜に用いて本発明の方法を実現する。本発明による画像分類方法は、(1)特徴量抽出フェーズ、(2)分類木構築フェーズ、(3)閲覧フェーズに分けられる。

【0047】特徴量抽出フェーズでは、入力された画像集合の各画像から検索用特徴量が抽出されて検索用特徴

量DBに格納されるとともに、各画像データは画像DBに格納される。一方、分類用特徴量抽出手段により画像から以下の実施形態例で述べる分類用特徴量が抽出されて分類用特徴量DBに格納される。この分類用特徴量の抽出の際には、画像辞書や感性語辞書が用いられることもある。

【0048】分類用木構築フェーズでは、分類木構築支援機能により、構築者からの分類観点の指示とそれによる画像の分類を繰り返し行われて、階層的な分類がなされ、その分類履歴から分類木が構築されて、分類木DBに格納される。分類木構築支援機能は、ナビゲーション手段、分類木作成手段、およびクラスタリング手段などで実現される。

【0049】閲覧フェーズでは、提示手段によるブラウジング機能によって、分類結果(分類木)が本形式で提示される。この提示により利用者が検索要求を発すると、画像検索手段は、分類木に基づいて検索を行い、検索結果を提示手段で提示する。

【0050】[実施形態例1] #画像辞書の構成
図2(a)、(b)、(c)は、画像辞書を説明する図である。

【0051】図2(a)は、空に関する辞書の例を示している。例えば「青空」は、画像の上部の大きな領域の代表色が青である、または、画像の上部に存在する面積の大きな画像オブジェクトの代表色が青であると定義できる。同様に「曇り空」、「夜空」が定義できる。さらに、空に関するシソーラスと組み合わせることで、「空」という概念に対応する画像辞書を構成することができる。

【0052】図2(b)は、「人の顔」に関する辞書の例を示している。「人の顔」は、丸い画像オブジェクトで、肌色のものと定義できる。

【0053】図2(c)は、「屋根」に関する辞書の例を示している。「屋根」は2本の直線が存在し、それらの位置関係が山型になっていると定義できる。これらの概念を表す言葉とその特徴量の組み合わせ、および、シソーラスの組み合わせで図3のような画像辞書を構成することができる。

【0054】[実施形態例2] #領域色の抽出

図4は、画像の代表領域色抽出の例を示した図である。例えば、図のように7パターン、24個の領域に分割する。これが領域に関する分類観点となる。さらに各領域の色に関する分布をヒストグラム化し、その上で特定の閾値を越えた最頻出色をその領域の代表領域色として決定する。閾値を越える色がないときは、その領域に関して代表領域色なしとする。この代表領域色の算出過程を図5にフローチャート化する。なお、その閾値は、個々の色毎に異なっていて構わず、明るい色の方が暗い色より小さな閾値を持つようにすると、明るい色が強調され、人間の主観により近づく。

【0055】領域とその代表色の情報は、分類用特徴量DBに蓄積される。DB中の画像は領域とその代表領域色により分類されることになる。なお、分割領域はさらに細かな領域でも、対角線を利用し分割される領域などでも構わない。

【0056】〔実施形態例3〕 #直線分類観点の抽出
図6(a)～(f)は、直線を使った分類観点の例である。画像または画像領域毎に各分類観点の直線の長さ、角度、本数、複数の直線間の関係に関する特徴量を抽出し、分類用特徴量DBに格納する。この直線分類観点の算出のフローチャートを図7に示す。

【0057】〔実施形態例4〕 #推薦分類候補の提示
図8は、領域色における推薦分類候補提示の処理フローを示している。データベースに登録されている任意の画像集合に対し各領域毎に代表領域色が決定された後、各領域毎に代表領域色がない画像の枚数Xが集計される。

【0058】この枚数Xが少ない領域順に並び替えられた結果が推薦分類候補として利用者に提示される。直線やオブジェクトも直線パターンやオブジェクト分布パターンを用いて同様な方法にて処理できる。

【0059】このような推薦候補により利用者の分類をナビゲートすることにより、分類木構築作業を容易にする。

【0060】〔実施形態例5〕 #分類観点の提示によるナビゲーション、履歴の利用
図9に、分類観点の提示によるナビゲーションの例、図10にそのフローチャートを示す。

【0061】ナビゲーションでは検索条件を追加しながら、検索対象を絞り込んでいく（一般には絞り込みだが、場合によっては検索対象の修正等もある）。

【0062】さらに、従来のテキスト・ナビゲーションと同様に次の絞り込みを支援するため、分類観点を提示する。ただし、その分類観点はテキスト（言葉）ではなく、画像辞書、領域色、画像内直線、画像内オブジェクトなどとなる。

【0063】図9では、ナビゲーションの途中の画像集合に対し、領域色、直線、オブジェクト、画像辞書という検索観点がシステムから利用者に提示され、利用者は画像辞書を選択し、さらにシステム（あるいは装置）は「人の顔」、「空」、「屋根」を提示し、利用者は「人の顔」を選択し、人物画の集合を得ている。

【0064】さらに次のステップとして、直前のステップと同様にその画像集合に対し、領域色、直線、オブジェクト、画像辞書という検索観点がシステムから利用者に提示される。このように1回の画像の絞り込みは、画像辞書、領域色、画像内直線、画像内オブジェクトといった大まかな分類観点（大分類観点）と、それらを詳細化した分類観点（小分類観点）の2種類の観点を選択することにより実行される。大分類観点の1つである領域色における推薦分類観点提示に関しては、図9に示した

通りである。また大分類観点として領域色を選択時に提示される小分類観点と分類概要については、図11にそのフローチャートを示す。

【0065】図11では、利用者から入力された領域Aに対して各代表色（N色）に属する枚数 X_i （ $0 \leq i \leq N$ ）を算出し、その枚数が多い順に並び替えを行い、枚数が多い順に登録画像データの中からサンプルを取得し、枚数とともに提示する。

【0066】図9の例では2回目の絞り込みとして、利用者は22番の領域色を選択し、さらにシステムは22番の領域色の分類概要（その分類に関する統計情報等）を提示し、利用者は白を選択し、白い服の人物画の集合を得ている。

【0067】このナビゲーションの履歴として、「人の顔」や「22番の領域が白」が現在使用中の画像DBの分類に有効であることが分かるので、その履歴をシステム（あるいは装置）に静的な分類木情報として蓄積する。蓄積された静的な分類木の全体像をキーワードや合成画、サンプル画像を用いて閲覧することで画像DBが概観できる。

【0068】図12のように画像分類と類似検索を連携する。画像を分類により絞り込んでいく過程で、その時点における分類集合の中からより具体的な被写体の写る画像を取得したい場合には、キー画像を入力し類似検索を行なう。例えば、図9の分類集合Dの白い服の人物画集合において「りんご」をキー画像として入力することで「白い服の人物とりんごが共に写る写真」を得ることができる。また、逆に検索から分類への切り替えも可能にする。

【0069】〔実施形態例6〕 #複合分類法（クラスタリング分類と代表分類の融合）
ナビゲーションにより画像を階層的に分類する場合、予め代表的な分類項目の例をいくつか決めておき、最も近い分類項目に個々の画像を分類する上記実施形態例の画像の階層的な分類方法と、各領域の色特徴量、形状特徴量などの画像の特徴量をクラスタリング手法を用いて類似する集合に分類するクラスタリング分類方法とを有し、それらを自由に組み合わせて画像を分類する。

【0070】種々雑多な画像を分類する場合、できるだけ多くの観点をを用いて分類ができることが望ましい。そこで、上述の画像の階層的な分類方法のように予め代表的な分類の例をいくつか決めておき、最も近い項目に個々の画像を割り当てる「代表分類手法」と、各領域の色特徴量、形状特徴量といった特徴量をクラスタリングすることによって分類する「クラスタリング分類手法」の2種類を利用者が状況に応じて選択し分類する。このような「複合分類手法」を用いることで分類の階層化がしやすく、また、意味のある集合を形成しやすくなる。具体的には、クラスタリングを分類観点の一つとし、例えば図9において画像集合に対して提示される分類観点の中に色

クラスタリングなどとして提示される。この色クラスタリングが選択、指示されると、色特徴量によるクラスタリングが実行され、一般には複数の画像集合に分類されるので、その一つを選択し、次の分類のステップへ移行する。

【0071】〔実施形態例7〕 #代表色の縮退・細分化

図13は、代表色の縮退を説明する図である。

【0072】実施形態例2の手法を用いて、ある領域の領域色が予め設定された代表色または代表色なしのいずれかに決定される。例えば1000枚の画像を図のように13色の代表色に分類したとき、薄緑色となる画像が2枚しかなかったとする。一般に分類木のリーフ数が多くなると、構成された分類木のどこに所望する画像が含まれているかわかりづらくなるため、できるだけシンプルな分類木を構成するほうがよい。よって、ある閾値を設け、1つのリーフに閾値以下の画像しか存在しない場合はそれに類似する色と統合する。例えば図13のように2枚しか薄緑色が存在しない場合は、色相の近い緑色と統合する。統合できた緑の集合がまだ閾値より少ない画像枚数である場合は、さらに青の分類と結合する。このような手法を用いることでシンプルな分類木が形成される。

【0073】一方、ある色に分類される画像の枚数がある一定枚数よりも多い場合は、次の分類観点として、よりその色を詳細に分けることが出来る分類観点を追加提供する。図14は、代表色「青」の場合の詳細色分類の例を示している。基準となる代表色「青」を「薄い青」から「濃い青」の数段階の色で分類できるようにする。

【0074】〔実施形態例8〕 #第N主要色の抽出
図15は、第N主要色の抽出を説明する図である。

【0075】上述の実施形態例2の手法を用いて全体領域の代表色分類を行なうことが出来るが、画像によっては全体領域において代表的な色は必ずしも1色ではなく、複数の支配的な色が存在する。そこで図15のように画像全体領域の色ヒストグラム値の高いものから順に第1主要色、第2主要色、…とし、これらの主要色を用いた分類を実現する。これは画像全体領域に限らず、任意の画像領域にも拡張可能である。

【0076】〔実施形態例9〕 #代表形状分類

図16に、代表形状の例を、図17に、代表形状分類のフローチャートを示す。

【0077】形状に基づいた分類を実現するために、予め図16のような丸や正方形、長方形といった基本的な画像を用意する。これらの代表形状は、分類対象となる画像の種類により利用者が任意の画像に入れ換えることが可能である。これらの代表形状と入力された分類対象画像から図17に示すように特徴抽出と形状特徴量の距離計算を行なった上で最も距離が短かった代表形状に分類する。

【0078】〔実施形態例10〕 #感性語分類法

図18に、感性語分類のフローチャートを示す。

【0079】システム（あるいは装置）は感性語とその感性語から受ける色を対応付けた感性語辞書を持っている。登録される感性語は利用者が任意に選択することが出来る。分類対象画像が入力されると色をもとにする感性語特徴量が抽出され、感性語辞書に登録されている全感性語との距離計算が行なわれる。その中で最も距離が近かった感性語対して入力画像が一意に分類される。

【0080】〔実施形態例11〕 #電子本システム（あるいは装置）

図19に、電子本システム（あるいは装置）の例を示す。

【0081】分類を繰り返すことで構築される分類木のノードを本の章・節の形で表現し、分類結果全体を把握しやすいように、電子本のはじめに目次ページを設ける。電子本の閲覧者に個々の章・節の内容を簡潔に分かりやすく表現するためには、説明した代表画を表示したり、分類観点を言葉で表記したりする。分類木の末端リーフのみは、そのリーフに含まれる全画像を表示するページを作成する。

【0082】上記方法で出来上がる電子本は、実際の本のようにべらべらめくって閲覧することが出来る。また、各章や節にはそれらの下層の節へ移動するためのリンク機能を設けることで、図19の(1)のように容易に下層の節を表示するページへ一発ジャンプできる。

【0083】出来上がった電子本から任意の画像を選択した場合は、図19の(2)のようにその画像を検索キーとした検索が行なわれる。また、図19の(3)のように検索結果の中から好みの画像を選択すると、電子本でその画像が掲載されたページが開かれる。上記のような分類→検索、検索→分類の各手法へのシームレスな行き来は目的とする画像が見つかるまで何度試してもよい。

【0084】〔実施形態例12〕 #階層的な分類を実行するコンピュータプログラムの記録媒体

図1で示した機能ブロック構成の一部もしくは全部の機能を、コンピュータを用いて実現することができること、あるいは、図5、図7、図8、図10、図11、図12、図17、図18、図19などで示した処理手順をコンピュータで実行することができることは言うまでもなく、コンピュータでその各部の機能を実現するためのプログラム、あるいは、コンピュータでその処理手順を実行するためのプログラムを、そのコンピュータが読み取り可能な記憶媒体、例えば、FD（フロッピーディスク）や、MO、ROM、メモ리카ード、CD、DVD、リムーバブルディスクなどに記録し、提供し、配布することが可能である。

【0085】

【発明の効果】本発明1によれば、画像を階層的に分類

でき、分類木が容易に構築できる。

【0086】本発明2によれば、画像の被写体または概念に基づいた階層的な分類が実現できる。また、人間の分類感覚に近い分類順序で分類木が作成できる。

【0087】本発明3によれば、人が画像から受ける色の印象に近い代表色による階層的な分類が可能になる。

【0088】本発明4によれば、複数の支配的な色をもつ画像の分類が可能になる。

【0089】本発明5によれば、集合体の規模に応じた階層的な代表領域色分類結果が得られる。

【0090】本発明6によれば、人の感性に基づいた階層的な画像分類が可能になる。

【0091】本発明7によれば、画像の直線的な構図を反映した階層的な分類が可能になる。

【0092】本発明8によれば、画像のオブジェクト分布による構図を反映した階層的な分類が可能になる。

【0093】本発明9によれば、類似形状による階層的な分類が可能になる。

【0094】本発明10によれば、階層的に画像を分類する過程における画像の絞り込みが容易になる。

【0095】本発明11によれば、多数の分類観点のうち有望な分類観点を上位に提示することが可能になり、利用者の負担を軽減させることができる。

【0096】本発明12によれば、画像の分類木が容易に作成できる。

【0097】本発明13によれば、所望する画像を見つけやすい分類木の作成が可能になる。

【0098】本発明14によれば、画像の分類木が容易に作成でき、データベース内に登録されている画像の全体像を概観することができ、画像DBの概観を把握しながらの検索が行なえる。これにより、検索結果からもれていた画像の発見も可能になる。

【0099】本発明15によれば、利用者が容易に画像の分類木を一覧でき、電子本でばらばらページをめくりながら画像を探し出せる。また、分類・検索の両機能を用いたシームレスな画像の絞り込みが出来る。

【0100】本発明16によれば、画像の階層的な分類方

法をコンピュータプログラムとして保存したり、提供したり、配布したりすることができ、画像の階層的な分類をコンピュータを用いて実行できる。

【図面の簡単な説明】

【図1】本発明による画像の階層的な分類方法を実現するためのシステム（あるいは装置）の機能ブロック構成図である。

【図2】(a)は画像辞書構築の例、(b)は画像辞書構築の例、(c)は画像辞書構築の例を示す図である。

【図3】画像辞書の構成例を示す図である。

【図4】画像の代表領域色抽出の例を示す図である。

【図5】代表領域色の算出フローチャートである。

【図6】(a)、(b)、(c)、(d)、(e)、(f)は、直線分類候補の例を示す図である。

【図7】直線分類観点の算出フローチャートを示す図である。

【図8】領域色における推薦分類観点提示のフローチャートである。

【図9】分類観点を利用した画像DBのナビゲーション分類の例を示す図である。

【図10】分類観点の提示によるナビゲーションのフローチャートである。

【図11】領域における分類概要提示のフローチャートである。

【図12】画像分類と画像検索連携処理のフローチャートである。

【図13】代表色の縮退例を示す図である。

【図14】代表色の詳細色分類例（「青」の場合）を示す図である。

【図15】第N主要色の抽出を説明する図である。

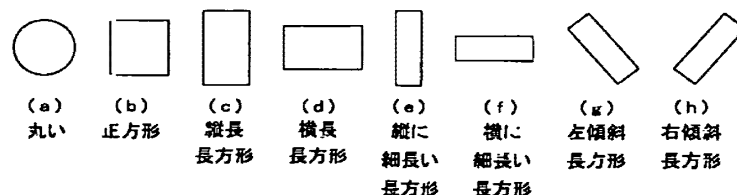
【図16】(a)、(b)、(c)、(d)、(e)、(f)、(g)、(h)は、代表形状の例を示す図である。

【図17】代表形状分類のフローチャートである。

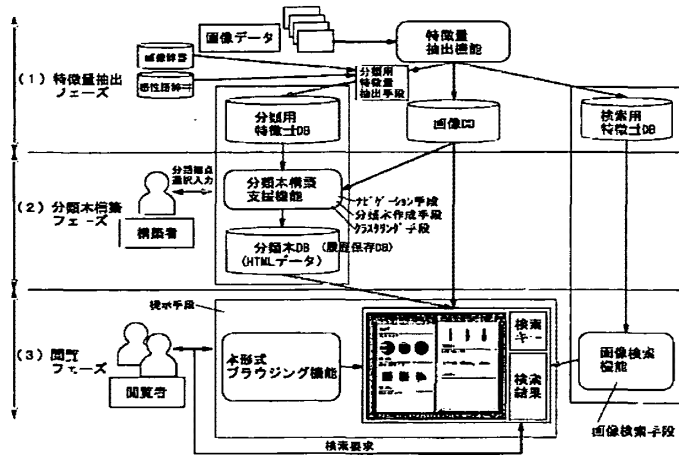
【図18】感性語分類のフローチャートである。

【図19】電子本システム（あるいは装置）の例を説明する図である。

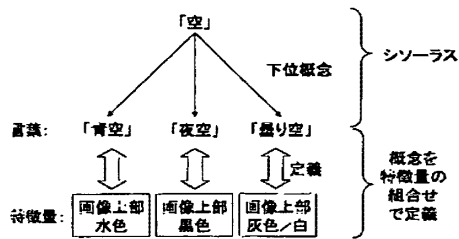
【図16】



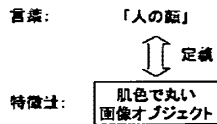
【図1】



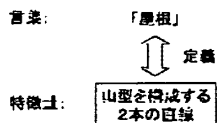
【図2】



(a) 画像辞書の例

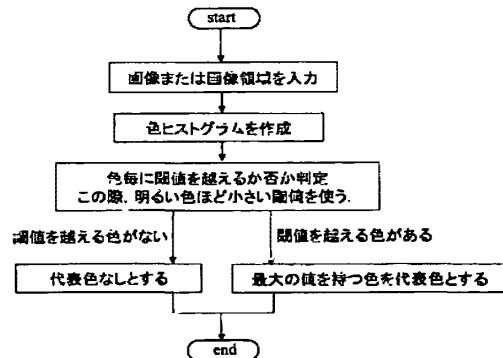


(b) 画像辞書の例

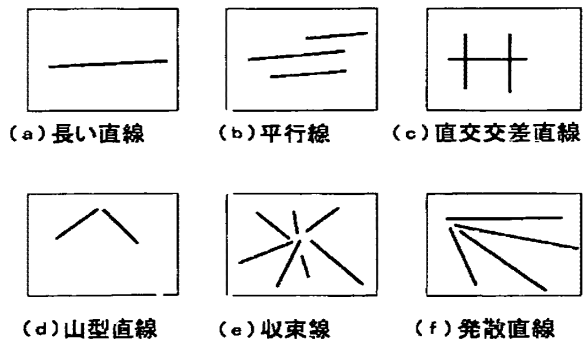


(c) 画像辞書の例

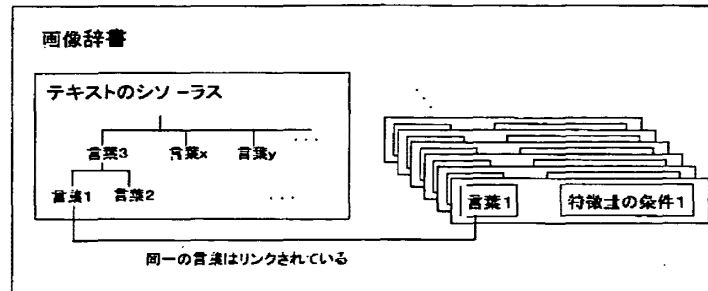
【図5】



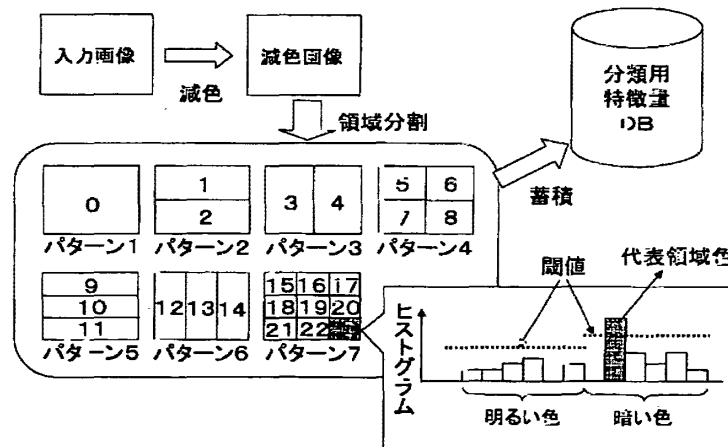
【図6】



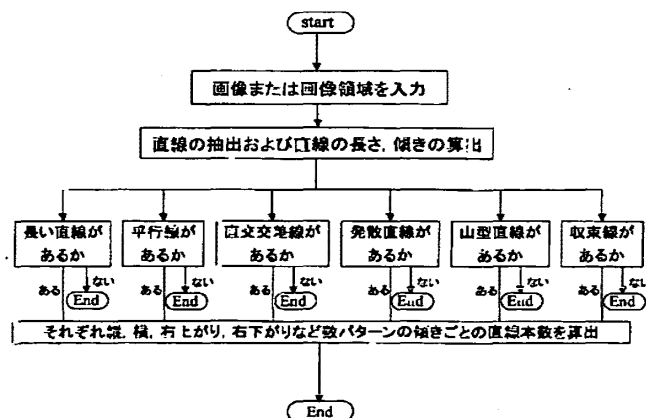
【図3】



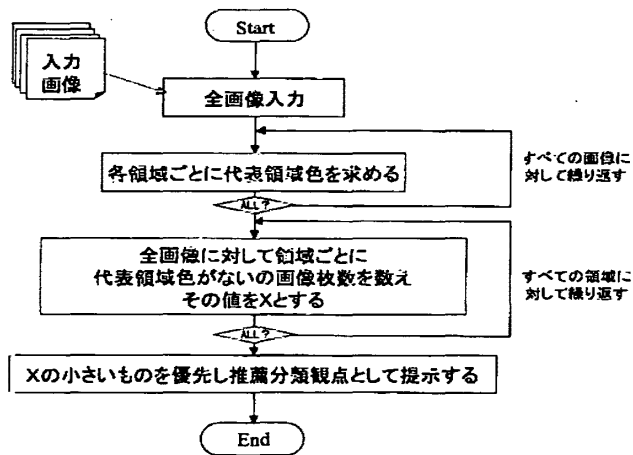
【図4】



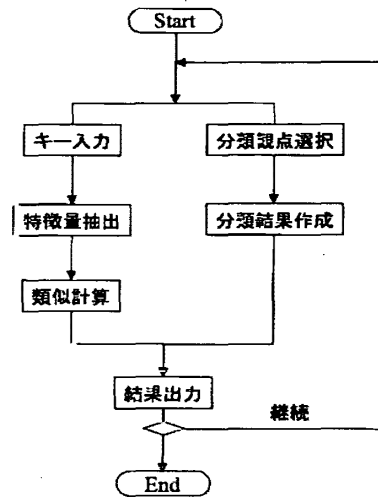
【図7】



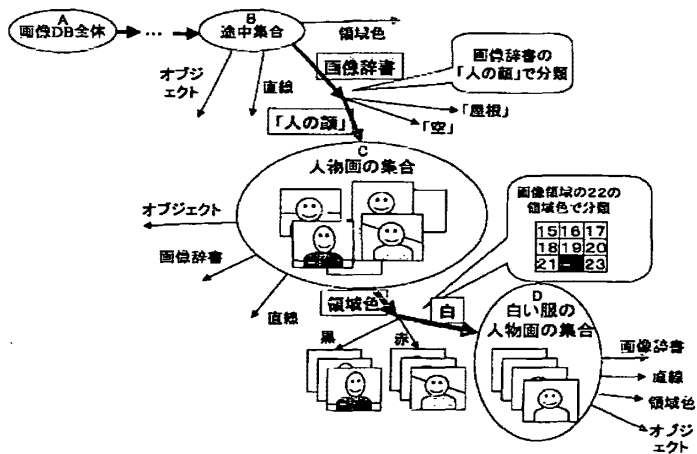
【図8】



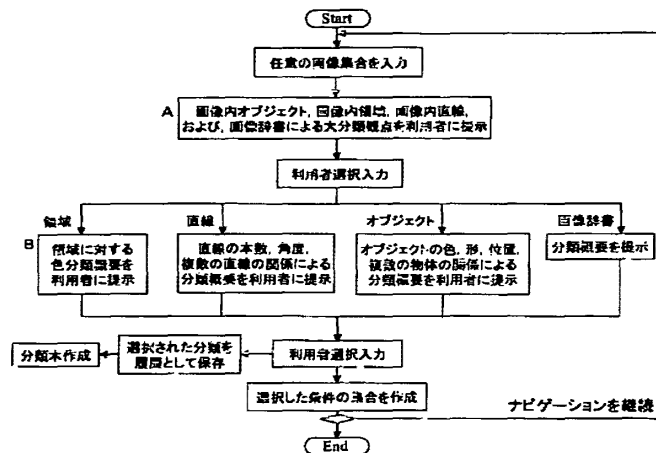
【図12】



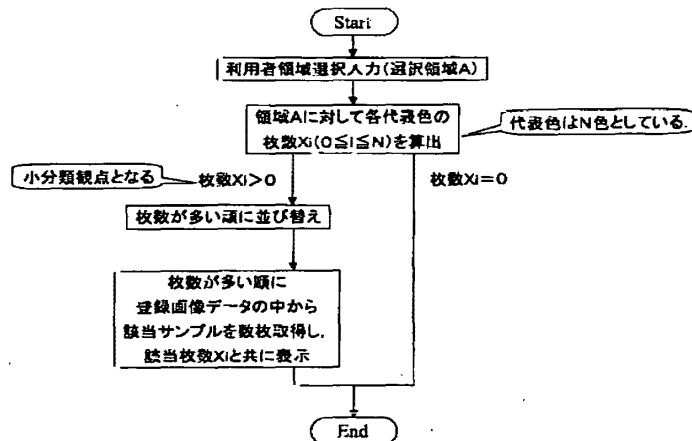
【図9】



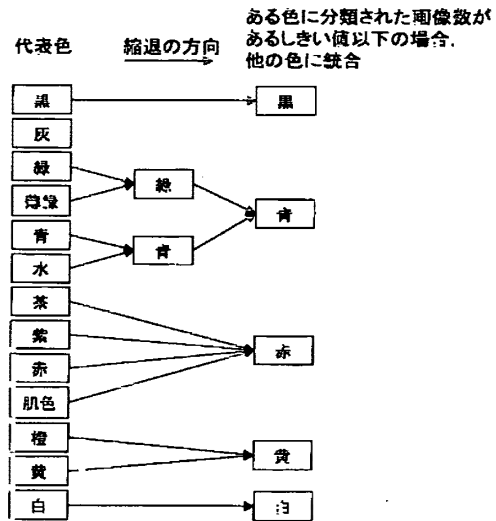
【図10】



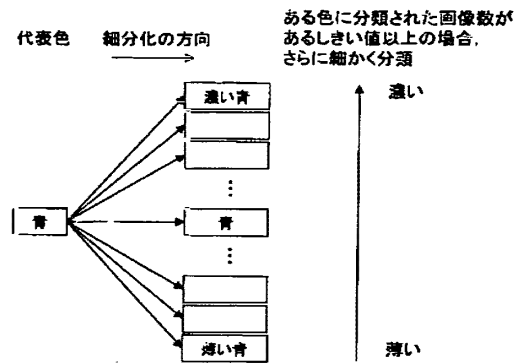
【図11】



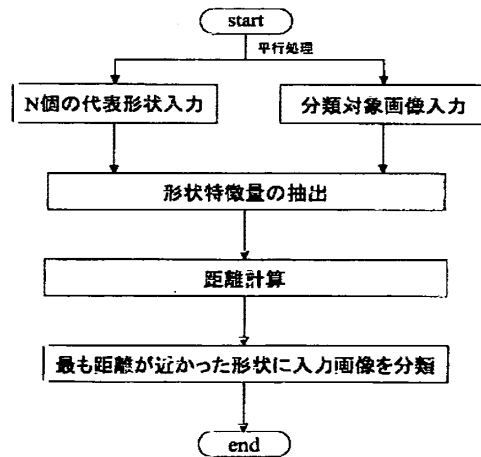
【図13】



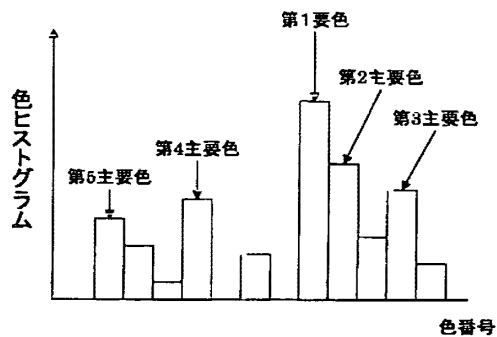
【図14】



【図17】



【図15】



(註 6)) 01-160057 (P2001-160057A)

Fターム(参考) 5B050 EA09 EA18 FA19 GA08
5B075 ND06 ND35 NK02 NK06 NR12
PP30 PQ02 QP03
5L096 AA01 FA03 FA04 FA05 FA15
GA38 MA07

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]A hierarchical classification method of a picture which makes 1 time a process in which make arbitrary image sets into a sorting object, show a classification result classified according to specified classification viewpoints, and a classification result further classified according to classification viewpoints specified continuously is shown, to said classification result, and is characterized by carrying out repeatedly two or more times.

[Claim 2]An image object which defined a concept equivalent to language showing a concept of a picture, and this language, It has a picture inner area and the table which matched a group of conditions of characteristic quantity of a straight line within a picture, A hierarchical classification method of the picture according to claim 1 extracting information for classifying a picture using an image dictionary which connected these and a thesaurus of language, and classifying a picture for said extracted information as one of the classification viewpoints.

[Claim 3]It asks for a color histogram of Y representative colors normalized with area of a field which divided a picture and a picture, When there is a color which a direction of a bright color has a threshold value smaller than a dark color, and exceeds this threshold value in said color histogram, A hierarchical classification method of the picture according to claim 1 extracting a color with the greatest value in the color as a representative area color of an object domain, considering it as a field without a representative area color when there is no color exceeding this threshold value, and classifying a picture by making said determined representative area color into classification viewpoints.

[Claim 4]It asks for a color histogram of Y representative colors normalized with area of a field which divided a picture and a picture, A hierarchical classification method of the picture according to claim 1 characterized by the 1st main colors, the 2nd main colors, —, considering it as the Yth main colors and classifying a picture by making these main colors into classification viewpoints from a thing with said high histogram value at order.

[Claim 5]It unifies to other sets with hue which was similar in the image set when having classified a picture by making a representative area color into classification viewpoints and there was less picture number of sheets belonging to a certain representative area color than the fixed

number of sheets A, Conversely, Claim 1 dividing into a representative area color of hue finer when there are more pictures belonging to an existing representative area color than the fixed number of sheets B ($B > A$) or a hierarchical classification method of a picture given in 3 or 4.

[Claim 6]Characteristic quantity of a color imagined from a sensibility word and its sensibility word, using a matched sensibility word dictionary as classification viewpoints Sensibility word characteristic quantity of said sensibility word dictionary, A hierarchical classification method of the picture according to claim 1 classifying said object image into a sensibility word which performs distance calculation with the amount of color features extracted from an object image, and is most similar.

[Claim 7]A hierarchical classification method of the picture according to claim 1 extracting the linear length, an angle, a number, and characteristic quantity called a relation between two or more straight lines, and making said extracted characteristic quantity into classification viewpoints from a picture.

[Claim 8]Physical relationship of an object within a picture extracted from a picture, its number, and two or more objects within a picture, and a hierarchical classification method of the picture according to claim 1 making characteristic quantity called distribution of an object within a picture into classification viewpoints.

[Claim 9]A hierarchical classification method of the picture according to claim 1 classifying said picture into representation form which makes classification viewpoints representation form beforehand registered as foundations, extracts the amount of shape facilities of an object within a picture extracted from inside of a picture of a sorting object, and is most similar by distance calculation between those histograms.

[Claim 10]A hierarchical classification method of a picture given [from Claim 1, wherein directions of classification viewpoints are performed by navigation made to choose from from while showing combining two or more classification viewpoints to 9] in any 1 clause.

[Claim 11]When showing classification viewpoints, remove classification viewpoints without an applicable picture from a candidate for presentation, and about classification viewpoints for [which remains] presentation. A hierarchical classification method of the picture according to claim 10 characterized by navigating a sorting tree construction person by carrying out recommendation presentation to a user at order from classification viewpoints with much number of sheets of a picture applicable to each classification viewpoints.

[Claim 12]A hierarchical classification method of the picture according to claim 10 or 11 holding selection of classification viewpoints from a user in a process of hierarchical classification of a picture by navigation as a classification history, and generating a sorting tree from said classification history.

[Claim 13]A hierarchical classification method of a picture given [from Claim 3 which determines some examples of a typical classification item beforehand, and classifies each picture into the nearest classification item when classifying a picture according to navigation hierarchical to 9] in any 1 clause, A hierarchical classification method of a picture having a clustering classifying method which classifies characteristic quantity of pictures, such as the amount of color features

of each field, and the amount of shape facilities, into a set similar using the clustering technique, and classifying a picture combining them freely.

[Claim 14] A history accumulation means which holds directions of classification viewpoints from a user in a process of navigation as a navigation history, A classification and a retrieval device of a picture possessing an image classification tree creating means which constitutes a sorting tree from the navigation history, a presenting means which presents said generated sorting tree, and a search means to cooperate and to perform content retrieval of a picture from said sorting tree when retrieval required is made from a user.

[Claim 15] In a form of a chapter and a paragraph of a book, develop, in order that a presenting means of said sorting tree may use an electronic book and may express a classification result on this electronic book, and a node of a sorting tree for expression of said node. In order to express a chapter and a paragraph briefly, express combining classification viewpoints, synthetic drawing, and a representative sample, display most an outline of all the pictures included in the leaf on a leaf of an end, and said search means, A classification and a retrieval device of the picture according to claim 14 searching a picture by using an outline of the picture as a search key when an outline of arbitrary pictures is chosen from said electronic book.

[Claim 16] A recording medium which recorded a program which performs a hierarchical classification method of a picture recording a program which performs procedure in a hierarchical classification method of a picture given [from Claim 1 to 13] in any 1 clause by computer on a recording medium which this computer can read.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention employs efficiently multi-media systems which have a lot of pictures, such as a picture DB (database) system and an image DB system, and relates to the hierarchical classification method of the picture used when utilizing effectively, and equipment.

[0002]

[Description of the Prior Art] Until now, many image management systems are realized. Two methods of search and a classification mainly exist in the management method.

[0003] # The method of searching by the text information (a keyword, an explanatory note, etc.) added to the picture, and the method of searching by the similarity of the contents information (characteristic quantity, such as a color and a texture) of a picture exist in image retrieval image retrieval.

[0004] There are VIR of Informix and ExSight of NTT as a similar retrieval system using the contents information of the picture. In ExSight, the length of the straight line within the color of the whole picture, a pattern, the color of the object within a picture, a form, a position, and a picture, inclination, and search with characteristic quantity like a position are enabled.

[0005] # There are a method of classifying using the text information added to the picture, and a

method of classifying using the contents information of a picture also in the classification of an image classification picture.

[0006]As a classification system using the contents information of the picture, the similar scene classification system of Netra of California size or Kobe University exists, and they are clustered with the color of the block region division of the whole picture or a picture, or the characteristic quantity of a texture.

[0007]# The navigation technique which supports narrowing down of a user's information is proposed by showing automatically the viewpoint (keyword) which classifies the given set in the field of text navigation text browsing further when narrowing down information.

[0008]

[SUBJECT which invention tends to develop] Since it cannot but depend for – grant on grant of the text information to a picture at handicraft, Like that it takes cost and time, that it is difficult for the variation by – grant person to give the text information text information and the whole DB cohered greatly, and – texture image, the issues which should be solved, like what has difficult grant of text information (pattern name) exists existed.

[0009]Then, although the technology of the content retrieval of a picture has been developed, – As a book has an index and a table of contents, cannot grasp a general view of the picture DB only by search, but as the result, Although a sketch drawing input, a digital camera input, etc. existed as an acquisition method of that it becomes impossible to judge also about the quality of search results, and – search key picture, even if it used them, the issue which should solve that it is difficult to give a search key etc. existed.

[0010]Although the contents classification technology of a picture is being developed in recent years, – Since it is the dedicated system to the picture of a special field which was developed until now like an aerial photo image or a cloud picture and special characteristic quantity is used, are inapplicable to a general picture, – It did not become the composition of the hierarchical sorting tree only by clustering, even when it can apply to a general picture, but after all, when the number of pictures increased, the issue which does not function as a classification and which should solve ** existed.

[0011]SUBJECT of this invention is giving the image classification tree building method for grasping the overview within the picture DB, the method of showing an image classification, and the method of unifying an image retrieval system, and realizing the efficient method of picture DB managing / utilizing.

[0012]

[Means for solving problem]This invention solves above-mentioned SUBJECT by invention listed below.

[0013]The 1st invention makes arbitrary image sets a sorting object, and the classification result classified according to the specified classification viewpoints is shown, It is the hierarchical classification method of the picture which makes 1 time the process in which the classification result further classified according to the classification viewpoints specified continuously is shown, to said classification result, and is characterized by carrying out repeatedly two or more

times.

[0014] This invention is to the foundations of the following invention, and hierarchical classification of a picture and construction of a sorting tree are realized by directions of classification viewpoints, and repetition of execution of the classification based on it.

[0015] The image object which defined the concept equivalent to the words with which the 2nd invention expresses the concept of a picture, and this language, It has a picture inner area and the table which matched the group of the conditions of the characteristic quantity of the straight line within a picture, It is the hierarchical classification method of the picture extracting the information for classifying a picture using the image dictionary which connected these and the thesaurus of language, and classifying a picture for said extracted information as one of the classification viewpoints.

[0016] The thesaurus of a text expresses the concept relation which "language" has. The "language" expressing a photographic subject can be expressed using image characteristic quantity by defining the photographic subject which can be expressed in the language reflected in a picture combining the feature of pictures, such as partial drawing, an object, and a straight line. between the pictures defined when using the concept relation of the keyword thesaurus here — relevance — ***** — things are made, an image dictionary is formed by summarizing these information, and it can use for extraction of classification viewpoints.

[0017] The 3rd invention asks for the color histogram of Y representative colors normalized with the area of the field which divided the picture and the picture, When there is a color which the direction of a bright color has a threshold value smaller than a dark color, and exceeds this threshold value in said color histogram, It is the hierarchical classification method of the picture extracting a color with the greatest value in the color as a representative area color of an object domain, considering it as a field without a representative area color when there is no color exceeding this threshold value, and classifying a picture by making said determined representative area color into classification viewpoints.

[0018] For example, the color of a picture is decreased to the representative color of Y pieces, and the histogram of the color in each field of which X division was done in the same area is created. When the maximum of a histogram exceeds a specific threshold value at this time, let the color equivalent to the maximum be a representative area color in that field. When there is no color by which the threshold value is fulfilled, it is considered that there is no representative area color in the field. Since a showy color brighter than a dark and simple color tends to stand out to people's eyes, a threshold value is low set up from a color with the bright darker color. The representative area color extracted by the above-mentioned method is used as detailed classification viewpoints at the time of a user classifying, and the hierarchical classification based on this viewpoint is performed.

[0019] The 4th invention asks for the color histogram of Y representative colors normalized with the area of the field which divided the picture and the picture, It is the hierarchical classification method of the picture characterized by the 1st main colors, the 2nd main colors, —, considering it as the Yth main colors and classifying a picture by making these main colors into classification

viewpoints from a thing with said high histogram value at order.

[0020]The case of a color typical about the whole picture where not one color but two or more dominant colors not necessarily exist is almost the case. Then, it is considered as the 1st main colors, the 2nd main colors, and — at order from the thing of the whole picture field which has a high color histogram value. This is extensible not only to the whole picture field but arbitrary imaging ranges. As for this result, it is used as classification viewpoints at the time of a user classifying, and the hierarchical classification based on a viewpoint is performed.

[0021]It unifies to other sets with the hue which was similar in the image set when the 5th invention made a representative area color classification viewpoints, a picture was classified and there was less picture number of sheets belonging to a certain representative area color than the fixed number of sheets A, Conversely, when there are more pictures belonging to the existing representative area color than the fixed number of sheets B ($B > A$), it is the hierarchical classification method of the picture dividing into the representative area color of finer hue.

[0022]In the image classification using a representative area color, there is little number of sheets of the picture used as a sorting object, or. When the picture number of sheets contained in one classification set by repeating a hierarchical classification has decreased gradually, and it classifies using the number of representative colors specified beforehand, the classification set which does not include only several pictures may be formed. Such a classification makes sorting tree structure complicate unnecessarily. Then, when there is less picture number of sheets belonging to a certain representative color than the fixed number of sheets A, it unifies to other sets with the hue which was similar in the set, and sorting tree structure is simplified.

Conversely, when there are many classification pictures, even if it classifies using the representative color fixed beforehand, one classification set may become very large. Then, when there are more pictures with a certain hue than the fixed number of sheets B even after being once classified according to a representative color, additional offer of the specific classification viewpoint which can subdivide one classification set using the representative color hue division was finely carried out by the next classification of is made.

[0023]The 6th invention characteristic quantity of a color imagined from a sensibility word and its sensibility word, using a matched sensibility word dictionary as classification viewpoints Sensibility word characteristic quantity of said sensibility word dictionary, It is the hierarchical classification method of a picture classifying said object image into a sensibility word which performs distance calculation with the amount of color features extracted from an object image, and is most similar.

[0024]In order to classify using "it is pretty" and sensibility "it is fresh" which are received from a picture, a classification using a sensibility word dictionary which matched characteristic quantity of a color imagined from a sensibility word and its sensibility word is performed.

Distance calculation of a color information extracted from a picture and characteristic quantity which each sensibility word has is performed, and to a sensibility word which was the shortest, a picture is distributed to a meaning and classified.

[0025]It is the hierarchical classification method of a picture, wherein the 7th invention extracts

the linear length, an angle, a number, and characteristic quantity called a relation between two or more straight lines and makes classification viewpoints said extracted characteristic quantity from a picture.

[0026]A straight line extracted from the inside of a picture based on information on edge has many things reflecting composition of a picture. However, with each linear information which consists of information on the starting point and a terminal point, it cannot use for a classification as information on composition within the picture. Then, it is investigated what kind of relation **** straight lines have for whether it has the information in which a straight line extracted from among [picture] one sheet reflects what kind of composition using a relation between a linear number, length and a number, and two or more straight lines, etc. again. As for this result, it is used as classification viewpoints at the time of a user classifying, and a hierarchical classification based on a viewpoint is performed.

[0027]The 8th invention is the hierarchical classification method of the picture making into classification viewpoints characteristic quantity, such as physical relationship of the object within a picture extracted from a picture, its number, and two or more objects within a picture, and distribution of the object within a picture.

[0028]The number of the object extracted from the inside of a picture and distribution of that centroid position change with pictures, and this information also reflects the composition information of a picture. Then, the distributed situation which hit in one-sheet drawing many photographic subjects are reflected based on the number and the centroid position of an object is extracted. As for this result, it is used as classification viewpoints at the time of a user classifying, and the hierarchical classification based on a viewpoint is performed.

[0029]The 9th invention makes classification viewpoints representation form beforehand registered as foundations, and the amount of shape facilities of the object within a picture extracted from the inside of the picture of a sorting object is extracted. It is the hierarchical classification method of the picture classifying said picture into most similar representation form according to the distance calculation between those histograms.

[0030]When classifying the image set which has an object within 1 picture in 1 picture like a clip art, form serves as the very important feature. Then, several kinds of representation form which is to foundations, such as a round head, a square, and a rectangle, beforehand is set up, and it classifies into most similar representation form at a meaning. Distance calculation between the amounts of shape facilities of an object image and representation form is performed, and, specifically, it classifies into the representation form whose distance was the shortest.

[0031]The 10th invention is the hierarchical classification method of a picture, wherein directions of classification viewpoints are performed by the navigation made to choose from from while showing two or more classification viewpoints.

[0032]In order to realize a hierarchical classification, a classification is realized while a user chooses the viewpoint of an area color, a straight line, an object, and an image dictionary. Rough classification viewpoints (main class viewpoint), such as an area color, a straight line, an object, and an image dictionary, are shown first. If a user chooses classification viewpoints from this

inside, a system will narrow down image corresponding based on a previous selection viewpoint further, and will total based on a still finer selection condition (minor class viewpoint). A user is shown the result as a selection condition with the image sample applicable to each minor class viewpoint. When a user chooses this minor class viewpoint, a classification is actually performed and a classification set is created. A hierarchical classification is repeated navigating a user by presentation of such classification viewpoints, and the picture is narrowed down.

[0033]When the 11th invention presents classification viewpoints, It is the hierarchical classification method of the picture which removes the classification viewpoints without an applicable picture from the candidate for presentation, and is characterized by navigating a sorting tree construction person by carrying out recommendation presentation to a user at order about the classification viewpoints for [which remains] presentation from classification viewpoints with much number of sheets of the picture applicable to each classification viewpoints.

[0034]In navigation, since a user does not know anything I may choose as following classification viewpoints if there are many classification viewpoints too much, unnecessary classification viewpoints present a candidate of a viewpoint who recommends while deleting them. That is, when a classification by area color, straight line, and an object is performed to all the pictures stored in an image database, what corresponds to classification viewpoints depending on image data to apply may not exist. It is meaningless even if it shows such a result as classification selections. Then, such classification viewpoints are shown to a user as a classification candidate who deletes from a classification selected candidate beforehand, and rearranges and recommends presentation order to order with many applicable classification viewpoints.

[0035]The 12th invention is the hierarchical classification method of a picture holding selection of classification viewpoints from a user in a process of hierarchical classification of a picture by navigation as a classification history, and generating a sorting tree from said classification history.

[0036]A history of classification viewpoints which a user chose is saved at the time of the above-mentioned navigation. A static sorting tree which surveys the picture DB made into an object from this classification history is done.

[0037]A hierarchical classification method of the above-mentioned picture of the 13th invention determining some examples of a typical classification item beforehand when classifying a picture according to navigation hierarchical, and classifying each picture into the nearest classification item, It is the hierarchical classification method of a picture having a clustering classifying method which classifies characteristic quantity of pictures, such as the amount of color features of each field, and the amount of shape facilities, into a set similar using the clustering technique, and classifying a picture combining them freely.

[0038]When classifying a miscellaneous picture, it is desirable for a classification to be possible using as many viewpoints as possible. Then, a "representation classification method" which determines some examples of a typical classification beforehand like a hierarchical classification method of a picture of this inventions 3-9, and assigns each picture to the nearest item, A user

chooses and classifies two kinds of "clustering classification methods" classified according to clustering characteristic quantity, such as the amount of color features of each field, and the amount of shape facilities, according to a situation. It becomes easy to form a set which is easy to carry out hierarchization of a classification by using such a "compound classification method", and is meaningful.

[0039]A history accumulation means in which the 14th invention holds directions of classification viewpoints from a user in a process of navigation as a navigation history. An image classification tree creating means which constitutes a sorting tree from the navigation history, a presenting means which presents said generated sorting tree, and when retrieval required is made from a user, They are a classification and the retrieval device of a picture possessing a search means to cooperate and to perform content retrieval of a picture from said sorting tree.

[0040]A history of classification viewpoints which a user chose is saved at the time of the above-mentioned navigation. A static sorting tree which surveys the picture DB made into an object from this classification history is done. Establish a function means which peruses this static sorting tree, and a class classification and similar retrieval are made to cooperate, and it becomes possible to narrow down a picture, changing search to a classification according to a user's request.

[0041]In the form of the chapter and paragraph of a book, the 15th invention develops, in order that the presenting means of said sorting tree may use an electronic book and may express a classification result on this electronic book, and the node of a sorting tree for expression of said node. In order to express a chapter and a paragraph briefly, express combining classification viewpoints, synthetic drawing, and a representative sample, display most the outline of all the pictures included in the leaf on the leaf of an end, and said search means, When the outline of arbitrary pictures is chosen from said electronic book, they are a classification and retrieval device of the picture searching a picture by using the outline of the picture as a search key.

[0042]The node of the sorting tree built as a result of using and classifying the form of a book familiar every day as a means to provide a user with a classification result is expressed in the form of the chapter and paragraph of a book. In order to express each chapter and paragraph intelligibly to the visitor of an electronic book, display representation drawing as node expression, classification viewpoints are written by means of language, or synthetic drawing is displayed. When expressing the end leaf of a sorting tree, all the pictures included in the leaf are displayed. in order to move to each chapter or a paragraph to those lower layer paragraphs, the link is stretched, and a lower layer paragraph is easily displayed by clicking the link -- a PEJIHE jump can be carried out. If arbitrary pictures are chosen from the done electronic book, image retrieval which used the picture as the search key can be performed. If a favorite picture is chosen out of search results, the page by which the picture was published with the electronic book will be opened. The hierarchical midst of carrying out classification execution depended on navigation, and also when the above-mentioned node expression visualizes the sorting tree structure of a picture list to a user, it becomes possible to express the node of a sorting tree well.

[0043]The 16th invention is the recording medium which recorded the program which performs the hierarchical classification method of the picture recording the program which performs procedure in the hierarchical classification method of the above-mentioned picture by computer on the recording medium which this computer can read.

[0044]If this recording medium is used, it will become possible to distribute the hierarchical classification method of the picture of this invention as a recording medium, or to save it, and it will become possible to realize the method of this invention using a computer.

[0045]

[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described in detail using figures.

[0046]Drawing 1 shows the functional block composition of a system or equipment which realizes the image classification method by this invention. The method of this invention is realized in each following example of an embodiment, using these function means suitably. The image classification method by this invention is divided into (1) characteristic-quantity extraction phase, (2) sorting-tree construction phase, and (3) inspection phase.

[0047]In a characteristic quantity extraction phase, while the characteristic quantity for search is extracted from each picture of the inputted image set and being stored in the characteristic quantity DB for search, each image data is stored in the picture DB. On the other hand, the characteristic quantity for a classification described in the following examples of an embodiment from a picture by the feature amount extracting means for a classification is extracted, and it is stored in the characteristic quantity DB for a classification. An image dictionary and a sensibility word dictionary may be used in the case of extraction of this characteristic quantity for a classification.

[0048]In a classification timber construction phase, by a sorting tree construction support function, it is carried out by repeating directions of the classification viewpoints from a construction person, and the classification of the picture by it, a hierarchical classification is made, a sorting tree is built from the classification history, and it is stored in the sorting tree DB. A sorting tree construction support function is realized by navigation means, sorting tree preparing means, a clustering means, etc.

[0049]In an inspection phase, a classification result (sorting tree) is shown in this form by the browsing function by a presenting means. If a user emits retrieval required by this presentation, an image retrieval means will search based on a sorting tree, and will present search results by a presenting means.

[0050][Example 1 of an embodiment] The block diagram 2 (a), (b), and (c) of # image dictionary is a figure explaining an image dictionary.

[0051]Drawing 2 (a) shows the example of the dictionary about empty. For example, a "blue sky" can be defined as the representative color of an image object with a big area which the representative color of the big field of the upper part of a picture is blue, or exists in the upper part of a picture being **. A "cloudy sky" and a "night sky" can be defined similarly. The image dictionary corresponding to the concept of "empty" can consist of combining with the thesaurus

about empty.

[0052]Drawing 2 (b) shows the example of the dictionary about "people's face." "People's face" is a round image object and can be defined as a beige thing.

[0053]Drawing 2 (c) shows the example of the dictionary about a "roof." Two straight lines exist and a "roof" can be defined as those physical relationship being crest shapes. An image dictionary like drawing 3 can consist of combination of the language showing these concepts, and its characteristic quantity, and combination of a thesaurus.

[0054][Example 2 of an embodiment] Extraction drawing 4 of # area color is a figure showing the example of representative area color extraction of a picture. A metaphor is divided into seven patterns and 24 fields as shown in a figure. This serves as classification viewpoints about a field. Furthermore distribution about the color of each field is histogram-ized, and the maximum frequent appearance color which exceeded the specific threshold value on it is determined as a representative area color of the field. When there is no color exceeding a threshold value, suppose that he has no representative area color about the field. The calculating process of this representative area color is flow-chart-ized to drawing 5. A bright color will be emphasized and the threshold value will approach by human being's subjectivity, if you may differ for each color of every and the direction of a bright color has a threshold value smaller than a dark color.

[0055]The information on a field and its representative color is accumulated in the characteristic quantity DB for a classification. The picture in DB will be classified according to a field and its representative area color. A region division may also be a still finer field or a field which uses a diagonal line and is divided.

[0056][Example 3 of an embodiment] Extraction drawing 6 [of # straight-line-segments viewpoint] (a) - (f) is an example of the classification viewpoints using a straight line. The characteristic quantity about the relation between the length of the straight line of each classification viewpoints, an angle, a number, and two or more straight lines is extracted for every picture or imaging range, and it stores in the characteristic quantity DB for a classification. The flow chart of calculation of this straight-line-segments viewpoint is shown in drawing 7.

[0057][Example 4 of an embodiment] # recommendation classification candidate's presentation drawing 8 shows the process flow of the recommendation classification candidate presentation in an area color. After a representative area color is determined for every field to the arbitrary image sets registered into the database, the number of sheets X of the picture which does not have a representative area color for every field is totaled.

[0058]A user is shown the result rearranged in order of the field with little this number of sheets X as a recommendation classification candidate. A straight line and an object can also be processed in a similar way using straight line patterns or an object distribution pattern.

[0059]By navigating a user's classification by such a recommended candidate, a sorting tree building operation is made easy.

[0060][Example 5 of an embodiment] The flow chart is shown in the example of the navigation by presentation of classification viewpoints, and drawing 10 at the navigation by presentation of # classification viewpoints, and use drawing 9 of a history.

[0061]The retrieval object is narrowed down in navigation, adding a search condition (although it is generally narrowing down, there are correction of a retrieval object, etc. depending on the case).

[0062]Classification viewpoints are shown in order to support the next narrowing down like the conventional text navigation. However, the classification viewpoints serve as not a text (language) but an image dictionary, an area color, a straight line within a picture, an object within a picture, etc.

[0063]In drawing 9, to an image set in the middle of navigation, an area color, a straight line, A user was shown from a system a search viewpoint of an object and an image dictionary, a user chose an image dictionary, a system (or equipment) presented "people's face", "empty", and a "roof" further, and a user chose "people's face" and has got a set of a portrait.

[0064]A user is shown a search viewpoint of an area color, a straight line, an object, and an image dictionary from a system to the image set still like the last step as a following step. Thus, one narrowing down of a picture is performed by choosing two kinds of viewpoints, rough classification viewpoints (main class viewpoint), such as an image dictionary, an area color, a straight line within a picture, and an object within a picture, and classification viewpoints (minor class viewpoint) which detailed them. It is as recommendation classification-viewpoints presentation in an area color which is one of the main class viewpoints having been shown in drawing 9. About a minor class viewpoint and a classification outline which an area color is shown as a main class viewpoint at the time of selection, the flow chart is shown in drawing 11.

[0065]In drawing 11, the number of sheets X_i ($0 \leq i \leq N$) which belongs to each representative color (N color) to the field A inputted by the user is computed, it rearranges into order with much the number of sheets, a sample is acquired out of an image data entry in order with much number of sheets, and it shows with number of sheets.

[0066]In the example of drawing 9, as the 2nd narrowing down, the user chose the area color of No. 22, the system presented the classification outlines (statistical information concerning a class that much etc.) of the area color of No. 22 further, and the user chose white and has got the set of the portrait of white dress.

[0067]Since it turns out as a history of this navigation that white" has "person's face" and a "22 No. field effective in the classification of the picture DB present in use, that history is accumulated in a system (or equipment) as static sorting tree information. The picture DB is surveyable by perusing the overview of the accumulated static sorting tree using a keyword, synthetic drawing, and a sample picture.

[0068]It cooperates an image classification and similar retrieval like drawing 12. In a process in which a picture is narrowed down according to a classification, a key image is inputted and similar retrieval is performed to acquire a picture to which a more concrete photographic subject is reflected out of a classification set at the time. For example, "a photograph with which both persons and apples of white dress are reflected" can be obtained in inputting an "apple" as a key image in a portrait set of white dress of the classification set D of drawing 9. A change to a classification from search is also enabled conversely.

[0069]The [example 6 of an embodiment] # compound classification (fusion of a clustering classification and a representation classification)

A hierarchical classification method of a picture of the above-mentioned example of an embodiment of deciding some examples of a typical classification item beforehand, and classifying each picture into the nearest classification item when classifying a picture according to navigation hierarchical. It has a clustering classifying method which classifies characteristic quantity of pictures, such as the amount of color features of each field, and the amount of shape facilities, into a set similar using the clustering technique, and a picture is classified, combining them freely.

[0070]When classifying a miscellaneous picture, it is desirable for a classification to be possible using as many viewpoints as possible. Then, a "representation classification method" which determines some examples of the typical classification beforehand like the hierarchical classification method of an above-mentioned picture, and assigns each picture to the nearest item. A user chooses and classifies two kinds of "clustering classification methods" classified according to clustering characteristic quantity, such as the amount of color features of each field, and the amount of shape facilities, according to a situation. It becomes easy to form the set which is easy to carry out hierarchization of a classification by using such a "compound classification method", and is meaningful. It is shown as color clustering etc. into the classification viewpoints which consider it as one clustering of classification viewpoints, for example, are specifically shown to an image set in drawing 9. Since clustering by the amount of color features will be performed and it will generally be classified into two or more image sets if this color clustering is chosen and directed, one of them is chosen and it shifts to the step of the following classification.

[0071][Example 7 of an embodiment] Degeneration / subdivision drawing 13 of # representative color is a figure explaining degeneration of a representative color.

[0072]The area color of a certain field is determined as either without a representative color or a representative color which was set up beforehand using the technique of the example 2 of an embodiment. For example, as shown the picture of 1000 sheets in a figure, when you classify into the representative color of 13 colors, suppose that there were only two pictures used as a light green color. It is better to constitute the simplest possible sorting tree, since it becomes incomprehensible, whether if the number of leaves of a sorting tree generally increases, the picture for which it asks where of the constituted sorting tree is included, and. Therefore, a certain threshold value is established, and when only the picture below a threshold value exists in one leaf, it unifies with a color similar to it. For example, like drawing 13, only two sheets are unified with the near green of hue, when a light green color does not exist. When the unified green set is picture number of sheets still smaller than a threshold value, it combines with a further blue classification. A simple sorting tree is formed by using such a technique.

[0073]When more than the fixed number of sheets which, on the other hand, has the number of sheets of the picture classified into a certain color, additional offer of the classification viewpoints which can divide the color in detail more is made as following classification

viewpoints. Drawing 14 shows the example of the detailed classification by color in the case of a representative color "blue." It enables it to classify the representative color "blue" used as a standard according to several steps of deep colors "blue" to "blue". [thin]

[0074][Example 8 of an embodiment] Extraction drawing 15 of the # Nth main colors is a figure explaining extraction of the Nth main colors.

[0075]Although the representative color classification of a whole field can be performed using the technique of the above-mentioned example 2 of an embodiment, depending on a picture, as for a typical color, not one color but two or more dominant colors not necessarily exist in a whole field. Then, it is considered as the 1st main colors, the 2nd main colors, and — like drawing 15 at order from the thing of the whole picture field which has a high color histogram value, and the classification using these main colors is realized. This is extensible not only to the whole picture field but arbitrary imaging ranges.

[0076][Example 9 of an embodiment] A representation-shaped example is shown in # representation form classification drawing 16, and the flow chart of a representation form classification is shown in drawing 17.

[0077]In order to realize the classification based on form, fundamental pictures, such as the round head and square like drawing 16, and a rectangle, are prepared beforehand. Such representation form can be changed to arbitrary pictures by the user according to the kind of picture used as a sorting object. As shown in drawing 17 from the sorting object picture inputted as such representation form, after performing feature extraction and distance calculation of the amount of shape facilities, it classifies into the representation form whose distance was the shortest.

[0078][Example 10 of an embodiment] The flow chart of a sensibility word classification is shown in # sensibility word classification drawing 18.

[0079]The system (or equipment) has the sensibility word dictionary which matched the color received from a sensibility word and its sensibility word. A user can choose the sensibility word registered arbitrarily. If a sorting object picture is inputted, the sensibility word characteristic quantity based on a color will be extracted, and distance calculation with all the sensibility words registered into the sensibility word dictionary is performed. distance was the nearest in it — sensibility **** is carried out and an inputted image is classified into a meaning.

[0080][Example 11 of an embodiment] # electronic book system (or equipment)

The example of an electronic book system (or equipment) is shown in drawing 19.

[0081]The node of the sorting tree built by repeating a classification is expressed in the form of the chapter and paragraph of a book, and a table-of-contents page is provided at the beginning of an electronic book so that it may be easy to grasp the whole classification result. In order to express the contents of each chapter and paragraph intelligibly briefly to the visitor of an electronic book, the explained representation drawing is displayed or classification viewpoints are written by means of language. Only the end leaf of a sorting tree creates the page which displays all the pictures included in the leaf.

[0082]Like a actual book, the electronic book done with a described method can be turned over

fluently, and can be perused. In each chapter or a paragraph, one shot can be jumped to the page which displays a lower layer paragraph easily as shown in (1) of drawing 19 by providing the link function for moving to those lower layer paragraphs.

[0083]When arbitrary pictures are chosen from the done electronic book, search which used the picture as the search key as shown in (2) of drawing 19 is performed. If a favorite picture is chosen out of search results as shown in (3) of drawing 19, the page by which the picture was published with the electronic book will be opened. The above classifications → the seamless traffic with each technique of a search and search → classification may be tried how many times until the target picture is found.

[0084]The [example 12 of an embodiment] A function of a part or all of functional block composition shown by recording-medium drawing 1 of a computer program which performs # hierarchical classification is realizable using a computer, Or it cannot be overemphasized that procedure shown by drawing 5, drawing 7, drawing 8, drawing 10, drawing 11, drawing 12, drawing 17, drawing 18, drawing 19, etc. can be performed by computer, A program for a computer to realize a function of each part, Or a program for performing the procedure by computer, It records on a storage which can be read, for example, FD, (floppy disk), MO, ROM, a memory card, CD, DVD, a removable disc, etc., and the computer is provided and can be distributed.

[0085]

[Effect of the Invention]According to this invention 1, a picture can be classified hierarchical and a sorting tree can build easily.

[0086]According to this invention 2, the hierarchical classification based on the photographic subject or concept of the picture is realizable. A sorting tree can be created in order of the classification near human being's classification feeling.

[0087]According to this invention 3, the hierarchical classification by the representative color near the impression of the color which people receive from a picture is attained.

[0088]According to this invention 4, the classification of a picture with two or more dominant colors is attained.

[0089]According to this invention 5, the hierarchical representative area classification-by-color result according to the scale of the aggregate is obtained.

[0090]According to this invention 6, the hierarchical image classification based on people's sensibility becomes possible.

[0091]According to this invention 7, the hierarchical classification reflecting the linear composition of the picture is attained.

[0092]According to this invention 8, the hierarchical classification reflecting the composition by object distribution of a picture is attained.

[0093]According to this invention 9, the hierarchical classification by similar form is attained.

[0094]According to this invention 10, narrowing down of the picture in the process in which a picture is classified hierarchical becomes easy.

[0095]According to this invention 11, it can become possible to show a higher rank promising classification viewpoints among much classification viewpoints, and a user's burden can be made

to ease.

[0096]According to this invention 12, the sorting tree of a picture can create easily.

[0097]According to this invention 13, creation of the sorting tree which the picture for which it asks tends to find is attained.

[0098]According to this invention 14, the sorting tree of a picture can create easily, the overview of the picture registered into the database can be surveyed, and while grasping a general view of the picture DB can be searched. Thereby, discovery of the picture which had leaked from search results is also attained.

[0099]According to this invention 15, a picture is discoverable, while a user can look through the sorting tree of a picture easily and revolves a page with a clatter with an electronic book.

Narrowing down of a seamless picture using both the functions of a classification and search can be performed.

[0100]According to this invention 16, the hierarchical classification method of a picture can be saved as a computer program, can be provided, or can be distributed, and hierarchical classification of a picture can be performed using a computer.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a functional block diagram of the system (or equipment) for realizing the hierarchical classification method of the picture by this invention.

[Drawing 2]It is a figure in which (a) shows the example of image dictionary construction, (b) shows the example of image dictionary construction, and (c) shows the example of image dictionary construction.

[Drawing 3]It is a figure showing the example of composition of an image dictionary.

[Drawing 4]It is a figure showing the example of representative area color extraction of a picture.

[Drawing 5]It is a calculation flow chart of a representative area color.

[Drawing 6](a), (b), (c), (d), (e), and (f) are the figures showing a straight-line-segments candidate's example.

[Drawing 7]It is a figure showing the calculation flow chart of a straight-line-segments viewpoint.

[Drawing 8]It is a flow chart of the recommendation classification-viewpoints presentation in an area color.

[Drawing 9]It is a figure showing the example of a navigation classification of the picture DB using classification viewpoints.

[Drawing 10]It is a flow chart of the navigation by presentation of classification viewpoints.

[Drawing 11]It is a flow chart of the classification outline presentation in a field.

[Drawing 12]It is a flow chart of an image classification and image retrieval cooperation processing.

[Drawing 13] It is a figure showing the example of degeneration of a representative color.

[Drawing 14] It is a figure showing the detailed classification-by-color similar case (in the case of "blue") of a representative color.

[Drawing 15] It is a figure explaining extraction of the Nth main colors.

[Drawing 16] (a), (b), (c), (d), (e), (f), (g), and (h) are the figures showing a representation-shaped example.

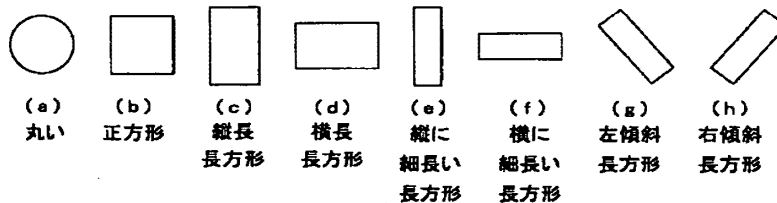
[Drawing 17] It is a flow chart of a representation form classification.

[Drawing 18] It is a flow chart of a sensibility word classification.

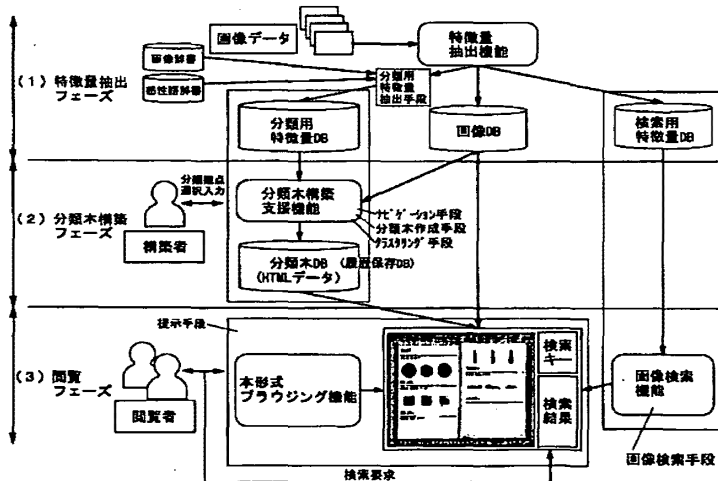
[Drawing 19] It is a figure explaining the example of an electronic book system (or equipment).

DRAWINGS

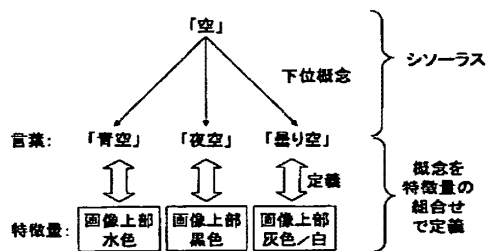
[Drawing 16]



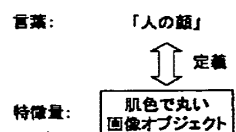
[Drawing 1]



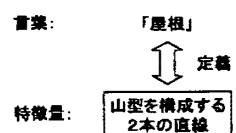
[Drawing 2]



(a) 画像辞書の例

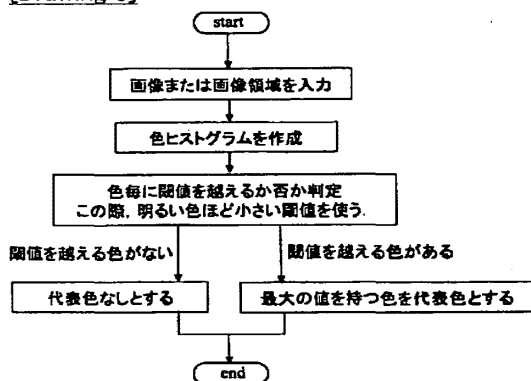


(b) 画像辞書の例

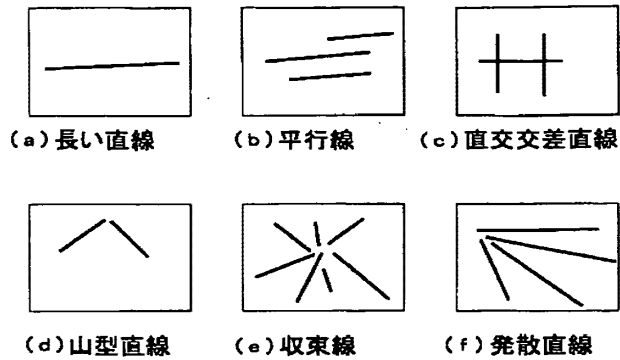


(c) 画像辞書の例

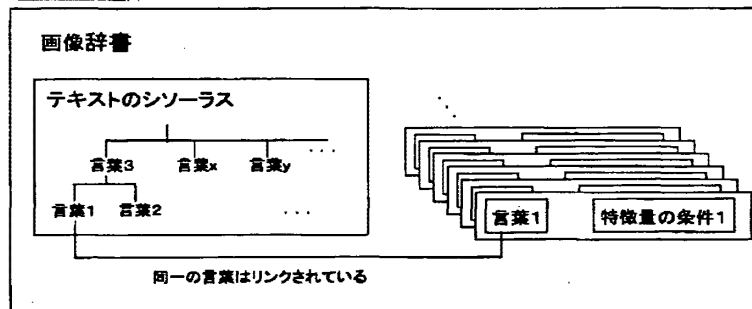
[Drawing 5]



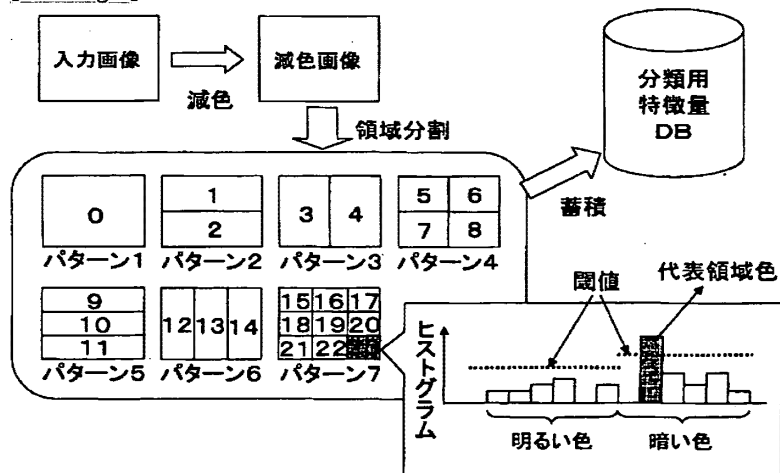
[Drawing 6]



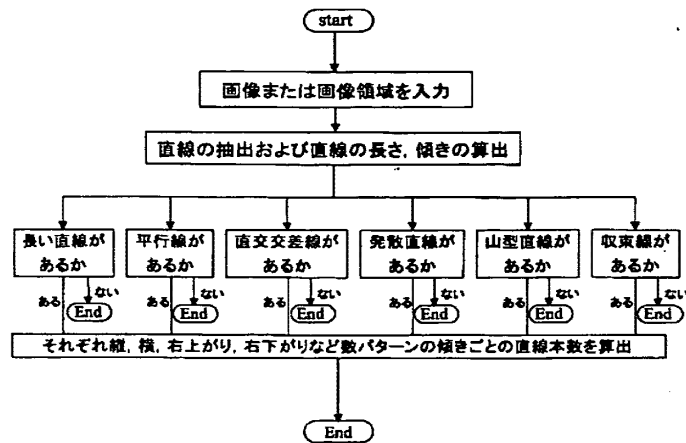
[Drawing 3]



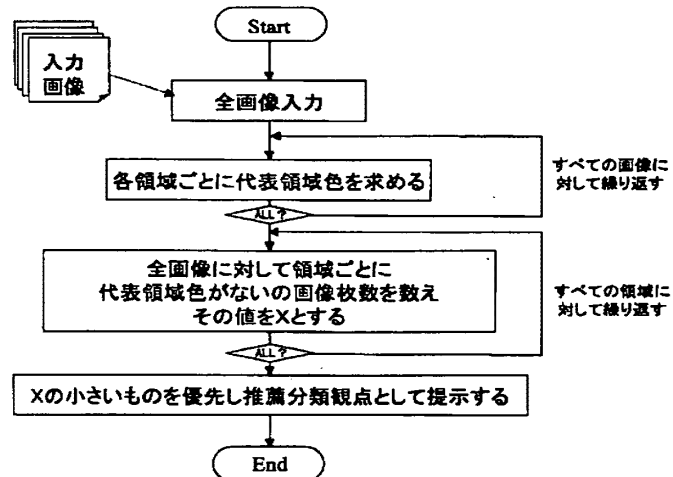
[Drawing 4]



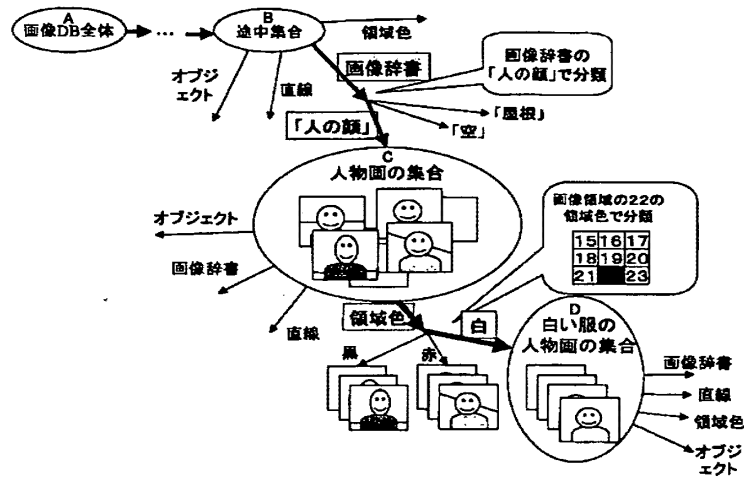
[Drawing 7]



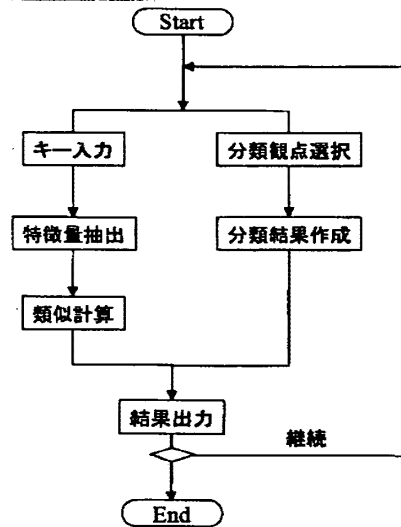
[Drawing 8]



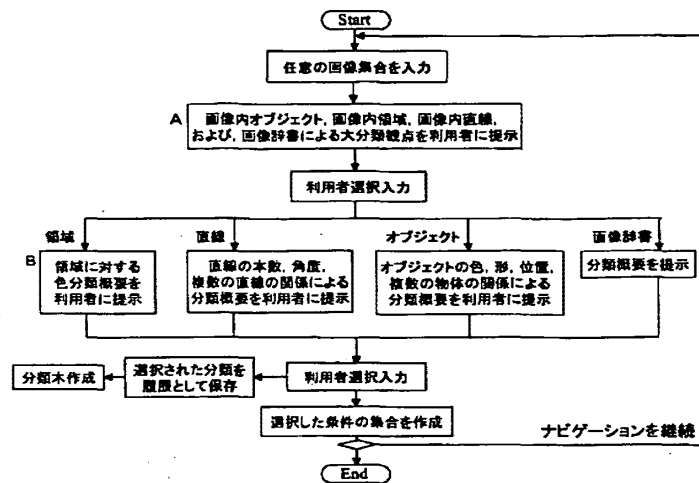
[Drawing 9]



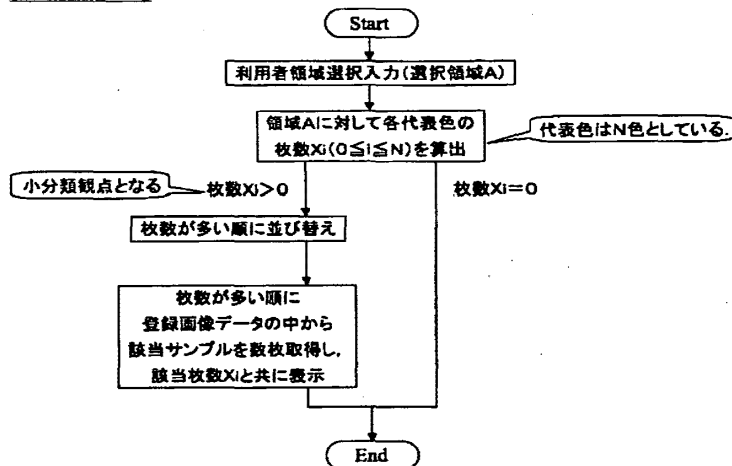
[Drawing 12]



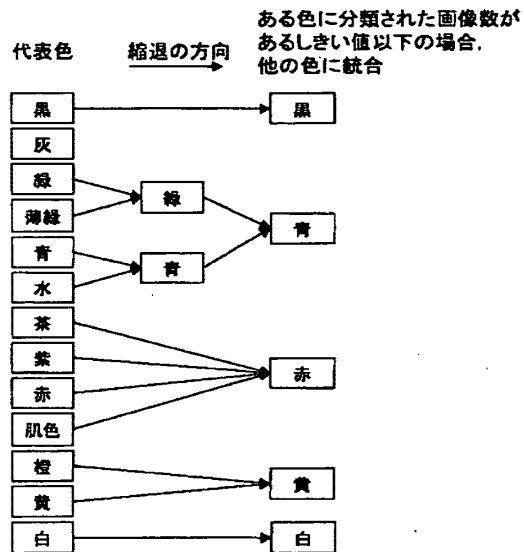
[Drawing 10]



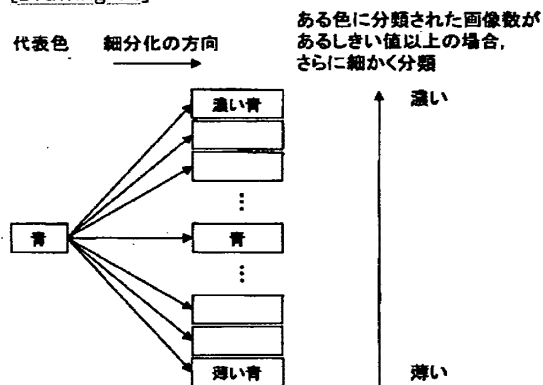
[Drawing 11]



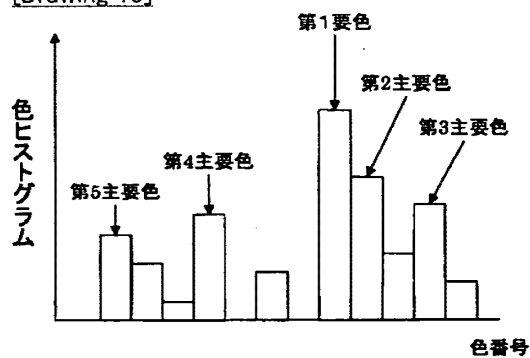
[Drawing 13]



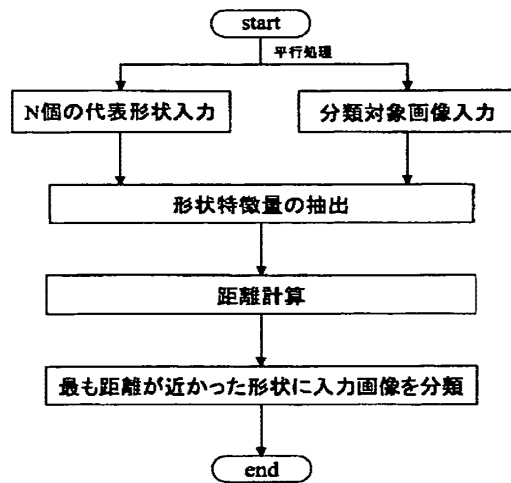
[Drawing 14]



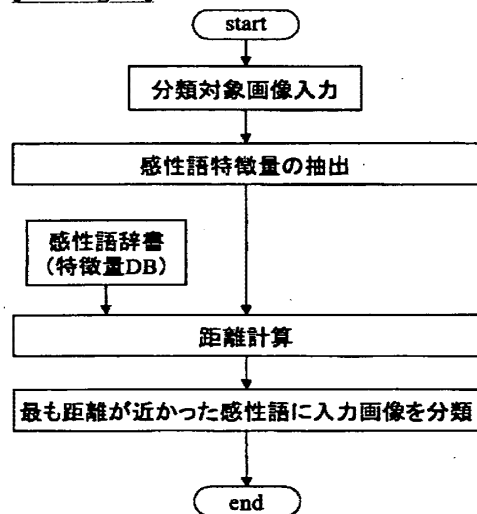
[Drawing 15]



[Drawing 17]



[Drawing 18]



[Drawing 19]

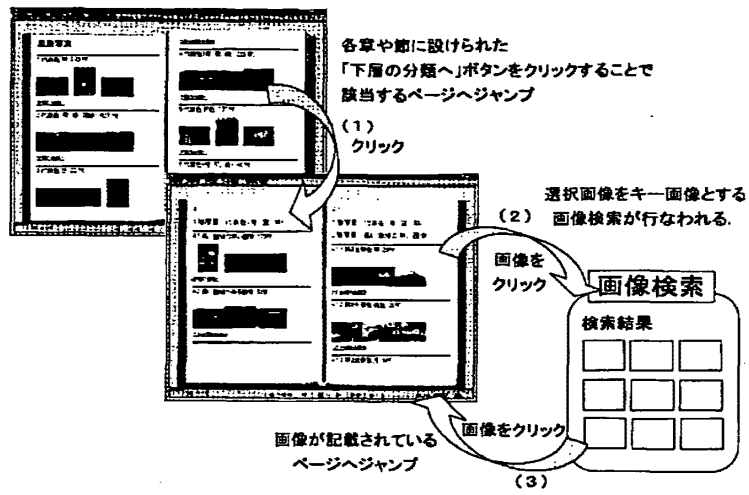


IMAGE PROCESSING APPARATUS, IMAGE PROCESSING SYSTEM, IMAGE PROCESSING METHOD, STORAGE MEDIUM AND PROGRAM

Publication number: JP2003087815 (A)

Publication date: 2003-03-20

Inventor(s): NOCHIDA ATSUSHI +

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Classification:

- international: **G06T1/00; G06T5/00; H04N1/40; H04N5/20; H04N5/243; H04N9/64; H04N9/68; H04N9/73;** (IPC1-7): G06T1/00; G06T5/00; H04N1/40; H04N5/20; H04N5/243; H04N9/64; H04N9/68; H04N9/73

- European:

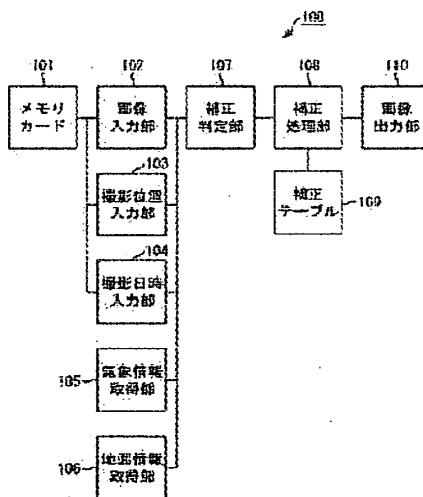
Application number: JP20010270563 20010906

Priority number(s): JP20010270563 20010906

Abstract of JP 2003087815 (A)

PROBLEM TO BE SOLVED: To provide an image processing apparatus capable of providing excellent after-processing image at all times through the configuration of applying proper image correction processing to an object image depending on the object image.

SOLUTION: In the case of processing an object image (photographed image) with prescribed information attached thereto, information acquisition means 103 to 106 acquire information associated with a state at acquisition of the object image (estimate information of a photographing state or the like) on the basis of the prescribed information (information attached to the object image at photographing) and processing means 107 to 109 apply image processing (image correction processing) to the object image on the basis of the acquisition information and the prescribed information. Since the image processing apparatus can apply proper image processing to the object image, the image processing apparatus can always provide an excellent after-processing image.



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(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2003-87815

(P2003-87815A)

(43) 公開日 平成15年3月20日 (2003.3.20)

(51) Int.Cl.	識別記号	F I	キーワード(参考)
H 0 4 N 9/68		H 0 4 N 9/68	A 5 B 0 4 7
G 0 6 T 1/00	4 6 0	C 0 6 T 1/00	4 6 0 A 5 B 0 5 7
	1 0 0		1 0 0 5 C 0 2 1
H 0 4 N 1/40		H 0 4 N 5/20	5 C 0 2 2
5/20		5/243	5 C 0 6 6

審査請求 未請求 請求項の数11 O L (全 8 頁) 最終頁に続く

(21) 出願番号 特願2001-270563(P2001-270563)

(22) 出願日 平成13年9月6日(2001.9.6)

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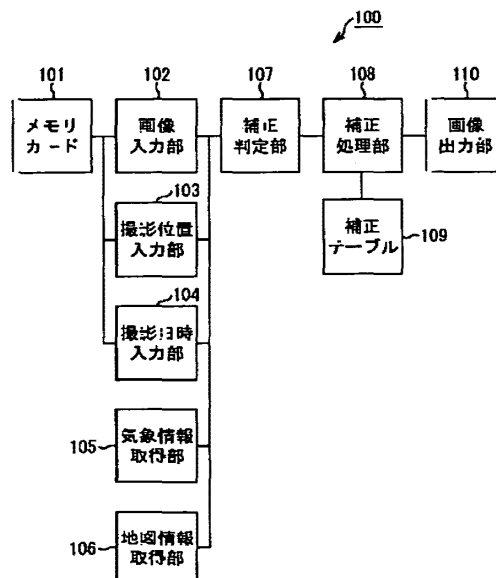
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(54) 【発明の名称】 画像処理装置、画像処理システム、画像処理方法、記憶媒体、及びプログラム

(57) 【要約】

【課題】 対象画像に応じて適切な画像補正処理を施す構成により、常に良好な処理後画像を提供できる画像処理装置を提供する。

【解決手段】 所定情報が付与された対象画像（撮影画像）を処理するにあたって、情報取得手段103～106は、所定情報（撮影時に対象画像に付与された情報）に基づき対象画像取得時の状況に関する情報（撮影状況の推定情報等）を取得し、処理手段107～109は、当該取得情報及び所定情報に基づき、対象画像に対して画像処理（画像補正処理）を施す。これにより、対象画像にとって適切な画像処理を施すことができるため、常に良好な処理後画像を提供することができる。



【特許請求の範囲】

【請求項1】 所定情報が付与された対象画像を処理する画像処理装置であって、

上記所定情報に基づき対象画像取得時の状況に関する情報を取得する情報取得手段と、

上記所定情報及び上記情報取得手段の取得情報に基づき対象画像を処理する処理手段とを備えることを特徴とする画像処理装置。

【請求項2】 上記対象画像は、被写体を撮影して得られた撮影画像を含み、

上記所定情報は、上記撮影時に得られる情報を含み、
上記情報取得手段は、上記撮影時の状況を推定した結果の情報を取得することを特徴とする請求項1記載の画像処理装置。

【請求項3】 上記処理手段は、上記所定情報及び上記情報取得手段の取得情報に基づき選択した画像補正処理方法により、対象画像に対して画像補正処理を施すことを特徴とする請求項1記載の画像処理装置。

【請求項4】 上記情報取得手段は、撮影時の気象に係わる情報或いは撮影位置に係わる情報を取得することを特徴とする請求項2記載の画像処理装置。

【請求項5】 複数の機器が互いに通信可能に接続されてなる画像処理システムであって、

上記複数の機器のうち少なくとも1つの機器は、請求項1～4の何れかに記載の画像処理装置の機能を有することを特徴とする画像処理システム。

【請求項6】 所定情報が付与された対象画像を処理するための画像処理方法であって、

上記所定情報に基づき対象画像取得時の状況に関する情報を取得する情報取得ステップと、

上記所定情報及び上記情報取得ステップによる取得情報に基づき対象画像を処理する処理ステップとを含むことを特徴とする画像処理方法。

【請求項7】 撮影画像を処理するための画像処理方法であって、

撮影時に上記撮影画像に付与された情報を取得する付与信息取得ステップと、撮影時の状況を推定するための補助情報を取得する補助情報取得ステップと、

上記付与信息取得ステップにより得られた付与信息、及び上記補助情報取得ステップにより得られた補助情報に基づいて撮影状況を推定した結果により、上記撮影画像に対する補正方法を選択する補正判定ステップと、

上記補正判定ステップにより選択された補正方法に基づいて、上記撮影画像を補正する画像補正ステップとを含むことを特徴とする画像処理方法。

【請求項8】 請求項1～4の何れかに記載の画像処理装置の機能、又は請求項5記載の画像処理システムの機能をコンピュータに実現させるためのプログラムを記録したコンピュータ読出可能な記憶媒体。

【請求項9】 請求項6又は7記載の画像処理方法の処

理ステップをコンピュータに実行させるためのプログラムを記録したコンピュータ読出可能な記憶媒体。

【請求項10】 請求項1～4の何れかに記載の画像処理装置の機能、又は請求項5記載の画像処理システムの機能をコンピュータに実現させるためのプログラム。

【請求項11】 請求項6又は7記載の画像処理方法の処理ステップをコンピュータに実行させるためのプログラム。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、例えば、対象画像に対して階調補正乃至色補正等の画像処理を施す装置或いはシステムに用いられる、画像処理装置、画像処理システム、画像処理方法、それを実施するためのプログラムを記憶したコンピュータ読出可能な記憶媒体、及び当該プログラムに関するものである。

【0002】

【従来の技術】従来より、デジタルカメラ等により得られた撮影画像（対象画像）に対して、コントラスト、ハイライト、シャドウポイント（シャドウバランス）、及びホワイトバランス等の補正処理を施す方法として、例えば、対象画像におけるハイライト部の色の偏りの比率を判別し、当該判別結果に基づいて、ホワイトバランスの度合いを調整し、これと同時に、コントラスト、ハイライト、及びシャドウバランスを最適に補正することで、対象画像に存在する物体（撮影対象の被写体等）の色を忠実に再現する方法がある。

【0003】

【発明が解決しようとする課題】しかしながら、上述したような従来の画像補正処理では、例えば、補正対象画像が撮影画像である場合、撮影対象の被写体にかかわらず、同じ度合いで画像補正が施されていたので、撮影画像中に含まれる被写体によっては、必ずしも好ましい補正結果が得られない場合があった。また、例えば、対象画像が、夕焼けや、スキー場、或いは真夏の晴天の海等のように、色の分布に偏りのある背景画像を含む画像である場合には、当該画像に対して適正な補正処理が行えない場合があった。

【0004】そこで、本発明は、上記の欠点を除去するために成されたもので、対象画像に応じて適切な画像補正処理を施す構成により、常に良好な処理後画像を提供できる、画像処理装置、画像処理システム、画像処理方法、それを実施するためのプログラムを記憶したコンピュータ読出可能な記憶媒体、及び当該プログラムを提供することを目的とする。

【0005】

【課題を解決するための手段】斯かる目的下において、第1の発明は、所定情報が付与された対象画像を処理する画像処理装置であって、上記所定情報に基づき対象画像取得時の状況に関する情報を取得する情報取得手段

と、上記所定情報及び上記情報取得手段の取得情報に基づき対象画像を処理する処理手段とを備えることを特徴とする。

【0006】第2の発明は、上記第1の発明において、対象画像は、被写体を撮影して得られた撮影画像を含み、上記所定情報は、上記撮影時に得られる情報を含み、上記情報取得手段は、上記撮影時の状況を推定した結果の情報を取得することを特徴とする。

【0007】第3の発明は、上記第1の発明において、上記処理手段は、上記所定情報及び上記情報取得手段の取得情報に基づき選択した画像補正処理方法により、対象画像に対して画像補正処理を施すことを特徴とする。

【0008】第4の発明は、上記第2の発明において、上記情報取得手段は、撮影時の気象に係わる情報或いは撮影位置に係わる情報を取得することを特徴とする。

【0009】第5の発明は、複数の機器が互いに通信可能に接続されてなる画像処理システムであって、上記複数の機器のうち少なくとも1つの機器は、請求項1〜4の何れかに記載の画像処理装置の機能を有することを特徴とする。

【0010】第6の発明は、所定情報が付与された対象画像を処理するための画像処理方法であって、上記所定情報に基づき対象画像取得時の状況に関する情報を取得する情報取得ステップと、上記所定情報及び上記情報取得ステップによる取得情報に基づき対象画像を処理する処理ステップとを含むことを特徴とする。

【0011】第7の発明は、撮影画像を処理するための画像処理方法であって、撮影時に上記撮影画像に付与された情報を取得する付与信息取得ステップと、撮影時の状況を推定するための補助情報を取得する補助情報取得ステップと、上記付与信息取得ステップにより得られた付与信息、及び上記補助情報取得ステップにより得られた補助情報に基づいて撮影状況を推定した結果により、上記撮影画像に対する補正方法を選択する補正判定ステップと、上記補正判定ステップにより選択された補正方法に基づいて、上記撮影画像を補正する画像補正ステップとを含むことを特徴とする。

【0012】第8の発明は、請求項1〜4の何れかに記載の画像処理装置の機能、又は請求項5記載の画像処理システムの機能をコンピュータに実現させるためのプログラムをコンピュータ読出可能な記憶媒体に記録したことを特徴とする。

【0013】第9の発明は、請求項6又は7記載の画像処理方法の処理ステップをコンピュータに実行させるためのプログラムを記録したコンピュータ読出可能な記憶媒体に記録したことを特徴とする。

【0014】第10の発明は、請求項1〜4の何れかに記載の画像処理装置の機能、又は請求項5記載の画像処理システムの機能をコンピュータに実現させるためのプログラムであることを特徴とする。

【0015】第11の発明は、請求項6又は7記載の画像処理方法の処理ステップをコンピュータに実行させるためのプログラムであることを特徴とする。

【0016】

【発明の実施の形態】以下、本発明の実施の形態について図面を用いて説明する。

【0017】本発明は、例えば、図1に示すような画像処理装置100に適用される。本実施の形態の画像処理装置100は、デジタルカメラ等により得られた撮影画像に対して画像補正処理を施す機能を有し、特に、撮影画像の取得時（撮影時）に当該撮影画像に付与された情報（付与信息）、及び撮影時の状況を推定するための補助情報に基いて画像補正方法を選択することで、撮影画像に応じた適切な画像補正処理を実行するように構成されている。以下、本実施の形態の画像処理装置100の構成及び動作について具体的に説明する。

【0018】＜画像処理装置100の構成＞画像処理装置100は、上記図1に示すように、デジタルカメラ等により得られた撮影画像データ及び撮影時に当該撮影画像データに付与されたデータ（付与データ）を保持するメモ리카ード101と、メモ리카ード101から処理対象となる撮影画像データ（対象画像データ）を入力する画像データ入力部102と、メモ리카ード101から対象画像データの付与データに含まれる撮影位置情報等を入力する撮影位置入力部103と、メモ리카ード101から対象画像データの付与データに含まれる撮影日時情報等を入力する撮影日時入力部104と、対象画像データの取得時（撮影時）の気象情報を取得する気象情報取得部105と、対象画像データの取得場所（撮影場所）の地形情報（地図情報）を取得する地図情報取得部106と、各構成部102〜106により得られた情報から撮影状況を推定した結果に基づき該当する画像補正処理方法を適切な判定する補正判定部107と、補正判定部107の判定結果に基づいて対象画像データに対して画像補正処理を施す補正処理部108と、補正処理部108での画像補正処理に使用されるパラメータを保持する補正テーブル109と、補正処理部108で得られた処理後画像データを出力する画像出力部110とを備えている。

【0019】上述のような画像処理装置100において、メモ리카ード101には、デジタルカメラ等の画像撮影装置により撮影して得られた撮影画像データが記録されている。

【0020】図2は、ここでの画像撮影装置200の構成の一例を示したものである。画像撮影装置200は、上記図2に示すように、撮像部207、カメラ制御部201、位置センサー202、環境センサー203、リアルタイムクロック204、画像処理部205、及び画像出力部206を備えている。

【0021】撮像部207は、レンズ、シャッター、フ

ラッシュ、撮像素子(CCD)、及びこれらの制御部(不図示)を含み、被写体の撮影画像を取得する。カメラ制御部201は、撮影時のピント、フラッシュ、絞り、及びシャッタースピードを制御する。位置センサー202は、撮影時の緯度、経度、高度、及び被写体の方向等の撮影位置情報を取得する。環境センサー203は、撮影時の気温及び湿度等の撮影環境情報を取得する。この環境情報として、さらに気圧等の情報を含めるようにしてもよい。リアルタイムクロック204は、撮影時の日付及び時刻等の撮影日時情報を取得する。画像処理部205は、撮像部207で得られた撮影画像データに対して、ホワイトバランス調整、色変換、及び圧縮等の画像処理を施す。画像出力部206は、画像処理部205の処理後画像データと共に、各構成部201~204で得られた当該画像データの取得時(撮影時)のカメラ制御情報、撮影位置情報、撮影環境情報、及び撮影日時情報を付与データとして、画像処理装置100に対して出力する。したがって、画像処理装置100のメモリカード101には、画像撮影装置200の画像出力部206からの出力データが記録される。

【0022】尚、位置センサー202で得られる撮影位置情報については、例えば、ユーザからの入力情報としてもよいが、GPS等の所謂位置取得機能を組み込むことがより好ましい。また、撮影位置情報に含まれる被写体の方向については、例えば、画像撮影装置200本体内に磁気コンパスを組み込む構成により取得可能である。

【0023】<画像処理装置100の動作>図3は、上記図1に示した画像処理装置100の動作をフローチャートにより示したものである。

【0024】ステップS301:画像入力部102は、メモリカード101から処理対象の画像データ(対象画像データ)を入力する。ステップS302:撮影位置入力部103は、メモリカード101から対象画像データの付与データに含まれる撮影位置情報を入力し、撮影日時入力部104は、メモリカード101から対象画像データの付与データに含まれる撮影日時情報を入力する。また、撮影日時入力部104は、メモリカード101から対象画像データの付与データに含まれるカメラ制御情報及び撮影環境情報を入力する。

【0025】ステップS303:気象情報取得部105は、ステップS302で撮影位置入力部103及び撮影日時入力部104により入力された対象画像データの取得時(撮影時)の撮影日時情報及び撮影位置情報(緯度及び経度等の情報)に基づき、当該撮影時の気象情報を取得する。ここでの気象情報は、気温、湿度、気圧、及び天候(晴れ、曇り、雨、雪)等の情報である。具体的には例えば、気象情報取得部105は、インターネット等の任意の通信手段を介して、外部の気象情報サーバ等にアクセスすることで、当該気象情報を取得する。或い

は、気象情報取得部105は、過去の各地の気象情報をCD-ROM等の記憶媒体を介して取得する。

【0026】ステップS304:地図情報取得部106は、ステップS302で撮影位置入力部103により入力された対象画像データの取得時(撮影時)の撮影位置情報(緯度及び経度等の情報)に基づき、当該撮影場所の地形情報(地図情報)を取得する。具体的には例えば、地図情報取得部106は、撮影時の撮影位置情報(緯度及び経度等の情報)に基づき取得した地図を参照することで、当該撮影場所の地形(海、山、市街地等)の種別を判定する。地図の取得方法としては、例えば、インターネット等の任意の通信手段により、外部の地図情報サーバ等にアクセスする方法等が挙げられる。

【0027】ステップS305:補正判定部107は、ステップS201で画像入力部102により入力された対象画像データの取得時の状況(撮影状況)を、ステップS302で撮影位置入力部103及び撮影日時入力部104により入力された撮影位置情報、撮影日時情報、カメラ制御情報、及び撮影環境情報(付与情報)と共に、撮影後に付与情報に基づいて何らかの方法で取得された補助情報(ステップS303で気象情報取得部105により入力された気象情報、及びステップS304で地図情報取得部106により入力された地図情報)に基づき推定する。

【0028】具体的には例えば、図4に示すように、先ず、補正判定部107は、付与情報に含まれる撮影環境情報により示される気温と、補助情報に含まれる気象情報により示される気温とを比較し(ステップS401)、この比較の結果、気温差が3℃以上であれば「屋内モード」と判定し(ステップS406)、本処理を終了する。一方、ステップS401の比較の結果、気温差が3℃未満の場合、補正判定部107は、付与情報に含まれる撮影環境情報により示される湿度と、補助情報に含まれる気象情報により示される湿度とを比較する(ステップS402)。

【0029】ステップS402の比較の結果、湿度差が10%RH以上である場合、補正判定部107は、「屋内モード」と判定し(ステップS406)、本処理を終了する。一方、ステップS402の比較の結果、湿度差が10%RH未満である場合、補正判定部107は、付与情報に含まれる撮影日時情報により示される日時、及び付与情報に含まれるカメラ制御情報により示されるフラッシュの制御状況に基づき、撮影時間が日中であり、且つフラッシュがONの撮影である、或いは撮影時間が夜間であり、且つフラッシュがOFFの撮影であるか否かを判別し(ステップS403)、何れかの撮影であれば「室内モード」と判定し(ステップS406)、本処理を終了する。

【0030】ステップS403の判別の結果、上記の何れの撮影でもない場合、補正判定部107は、付与情報

に含まれる撮影日時情報により示される日時、及び付与情報に含まれる撮影位置情報により示される撮影方向に基づき、明方の東側又は夕方の西側の撮影であるか否かを判別し（ステップS404）、そうであれば「朝方夕方モード」と判定し（ステップS407）、本処理終了する。

【0031】一方、ステップS404の判別の結果、明方の東側又は夕方の西側の撮影でない場合、補正判定部107は、付与情報に含まれる撮影日時情報により示される日時、及び補助情報に含まれる地図情報により示される撮影場所情報に基づき、冬の日中且つ積雪地域の撮影の場合には「雪モード」と判定し（ステップS410）、夏の日中且つ海の撮影の場合には「海モード」と判定し（ステップS408）、これらの何れでもない撮影の場合には「一般モード」と判定し（ステップS409）、本処理終了する。

【0032】尚、上記図4に示した推定処理は一具体例であり、これに限られることはない。例えば、付与情報に含まれる各種情報の組み合わせにより、さらに精度の高い撮影状況の推定を行うことも可能である。また、例えば、付与情報に含まれる情報のうちの一部が欠けた状態ある場合でも、撮影状況を推定することは可能である。具体的には例えば、撮影時にGPSの電波を受信できないため位置情報が欠けた場合、「室内モード」と判定する。

【0033】ステップS306：補正判定部107は、ステップS301で画像入力部102により入力された対象画像データのヒストグラムを解析する。具体的には例えば、補正判定部107は、対象画像のRGBヒストグラムに基づき、ハイライト及びシャドウのポイントや、RGBのバランスを検出し、当該検出結果に基づき、露出補正処理の必要性を判断する。また、補正判定部107は、上記検出結果（RGBバランス）に基づき、色かぶり補正処理の必要性を判断する。

【0034】ステップS307：補正処理部108は、ステップS305で補正判定部107により推定された撮影状況、及び対象画像のヒストグラムに基づいた必要な補正処理に関する情報に基づいて、補正テーブル109を生成する。ここでの補正テーブル109は、対象画像のRGBのそれぞれの入力値に対する補正出力値を有する3つの1次元ルックアップテーブルを含んでいる。

【0035】具体的には例えば、補正処理部108は、次のような、撮影状況及び必要性のある補正処理によるパターン（1）～（5）のそれぞれに応じて、補正テーブル109を生成する。

（1）推定撮影状況が「室内モード」であり、対象画像のヒストグラムから対象画像に緑かぶりが発生していることにより緑かぶり補正処理が必要であると判断された場合、蛍光灯照明下での緑かぶりの補正に適した補正テーブル109を生成する。

（2）推定撮影状況が「朝方夕方モード」であり、対象画像のヒストグラムから対象画像において赤の比率が高いため赤かぶり補正処理が必要であると判断された場合、朝焼け夕焼け写真に適した補正テーブル109を生成する。

（3）推定撮影状況が「海モード」であり、対象画像のヒストグラムから対象画像において青の比率が高いため青かぶり補正処理が必要であると判断された場合、海と空の青さを強調した補正テーブル109を生成する。

（4）推定撮影状況が「雪モード」であり、対象画像のヒストグラムから対象画像において露出オーバーであるため露出補正処理が必要であると判断された場合、雪景色に適した補正テーブル109を生成する。

（5）推定撮影状況が「一般モード」である場合、一般的な露出補正及びホワイトバランス調整等のための補正テーブル109を生成する。

【0036】ステップS308：補正処理部108は、ステップS307で生成した補正テーブル109を用いて、ステップS301で画像入力部102により入力された対象画像データに対して画像補正処理を施す。具体的には例えば、補正処理部108は、補正テーブル109を参照し、対象画像のRGB画素値を変更する。

【0037】ステップS309：画像出力部110は、ステップS308で補正処理部108により得られた処理後画像データを出力する。

【0038】上述のように本実施の形態では、対象画像に付与された付与情報（撮影日時、撮影位置、及びカメラ制御等の情報）、及び当該付与情報に基づき得られる補助情報（撮影時の気象、及び撮影場所の地図等の情報）から、対象画像の撮影状況を推定し、この推定結果に基づいた画像補正処理を対象画像に施すように構成したので、対象画像が、雪景色や夕焼け等の様々な撮影状況で撮影して得られた画像であっても、撮影対象に適した画像補正を施すことができる。

【0039】尚、本発明の目的は、本実施の形態のホスト及び端末の機能を実現するソフトウェアのプログラムコードを記憶した記憶媒体を、システム或いは装置に供給し、そのシステム或いは装置のコンピュータ（又はCPUやMPU）が記憶媒体に格納されたプログラムコードを読みだして実行することによっても、達成されることは言うまでもない。この場合、記憶媒体から読み出されたプログラムコード自体が本実施の形態の機能を実現することとなり、そのプログラムコードを記憶した記憶媒体及び当該プログラムコードは本発明を構成することとなる。プログラムコードを供給するための記憶媒体としては、ROM、フレキシブルディスク、ハードディスク、光ディスク、光磁気ディスク、CD-ROM、CD-R、磁気テープ、不揮発性のメモ리카ード等を用いることができる。また、コンピュータが読みだしたプログラムコードを実行することにより、本実施の形態の機能

が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼動しているOS等が実際の処理の一部又は全部を行い、その処理によって本実施の形態の機能が実現される場合も含まれることは言うまでもない。さらに、記憶媒体から読み出されたプログラムコードが、コンピュータに挿入された拡張機能ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに書き込まれた後、そのプログラムコードの指示に基づき、その機能拡張ボードや機能拡張ユニットに備わるCPUなどが実際の処理の一部又は全部を行い、その処理によって本実施の形態の機能が実現される場合も含まれることは言うまでもない。

【0040】図5は、上記コンピュータの機能600を示したものである。コンピュータ機能600は、上記図5に示すように、CPU601と、ROM602と、RAM603と、キーボード(KB)609のキーボードコントローラ(KBC)605と、表示部としてのCRTディスプレイ(CRT)610のCRTコントローラ(CRTC)606と、ハードディスク(HD)611及びフレキシブルディスク(FD)612のディスクコントローラ(DKC)607と、ネットワーク620との接続のためのネットワークインターフェースコントローラ(NIC)608とが、システムバス604を介して互いに通信可能に接続された構成としている。

【0041】CPU601は、ROM602或いはHD611に記憶されたソフトウェア、或いはFD612より供給されるソフトウェアを実行することで、システムバス604に接続された各構成部を総括的に制御する。すなわち、CPU601は、所定の処理シーケンスに従った処理プログラムを、ROM602、或いはHD611、或いはFD612から読み出して実行することで、本実施の形態での動作を実現するための制御を行う。

【0042】RAM603は、CPU601の主メモリ或いはワークエリア等として機能する。KBC605は、KB609や図示していないポインティングデバイス等からの指示入力を制御する。CRTC606は、CRT610の表示を制御する。DKC607は、ブートプログラム、種々のアプリケーション、編集ファイル、ユーザファイル、ネットワーク管理プログラム、及び本

実施の形態における所定の処理プログラム等を記憶するHD611及びFD612とのアクセスを制御する。NIC608は、ネットワーク620上の装置或いはシステムと双方向にデータをやりとりする。

【0043】

【発明の効果】以上説明したように本発明では、所定情報が付与された対象画像(撮影画像等)を処理するにあたって、所定情報(撮影時に対象画像に付与された情報等)に基づき対象画像取得時の状況に関する情報(撮影状況の推定情報等)を取得し、当該取得情報及び所定情報に基づき、対象画像に対して画像処理(画像補正処理等)を施すように構成した。これにより、対象画像にとって適切な画像処理を施すことができるため、常に良好な処理後画像を提供することができる。

【図面の簡単な説明】

【図1】本発明を適用した画像処理装置の構成を示すブロック図である。

【図2】上記画像処理装置で処理対象となる画像の入力装置の構成を示すブロック図である。

【図3】上記画像処理装置の動作を説明するためのフローチャートである。

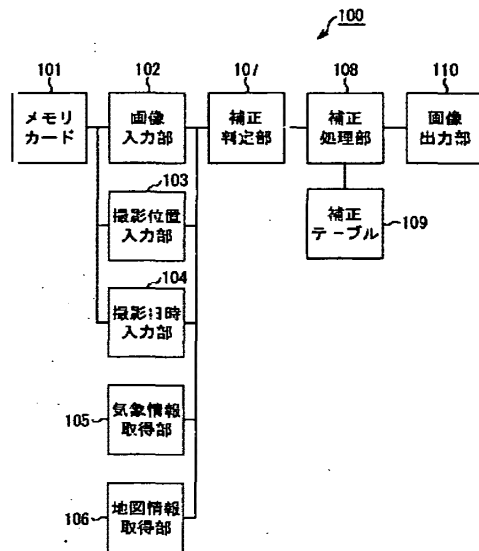
【図4】上記画像処理装置の動作において、撮影状況推定処理を説明するためのフローチャートである。

【図5】上記画像処理装置の機能をコンピュータに実現させるためのプログラムをコンピュータ読出可能な記憶媒体から読み出して実行する当該コンピュータの構成を示すブロック図である。

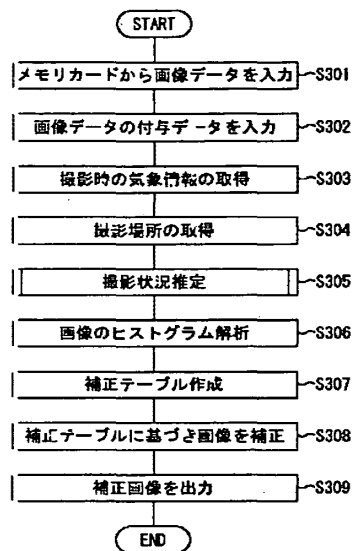
【符号の説明】

- 100 画像処理装置
- 101 メモリカード
- 102 画像入力部
- 103 撮影位置入力部
- 104 撮影日時入力部
- 105 気象情報取得部
- 106 地図情報取得部
- 107 補正判定部
- 108 補正処理部
- 109 補正テーブル
- 110 画像出力部

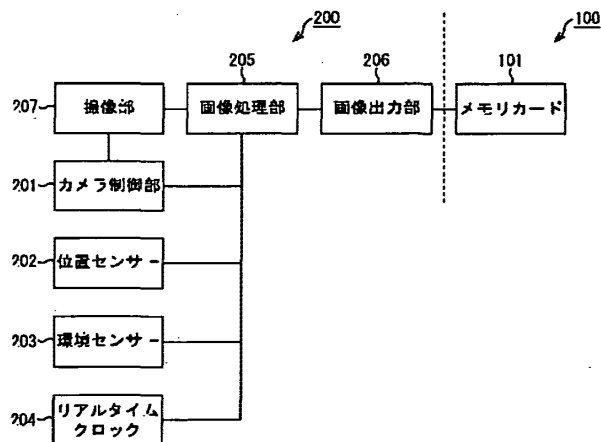
【図1】



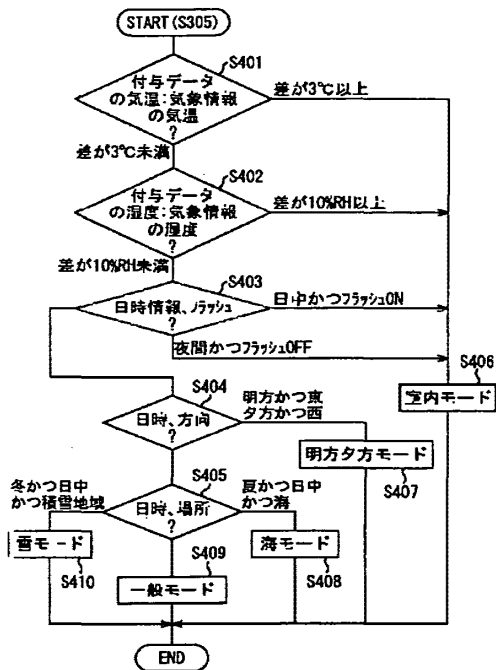
【図3】



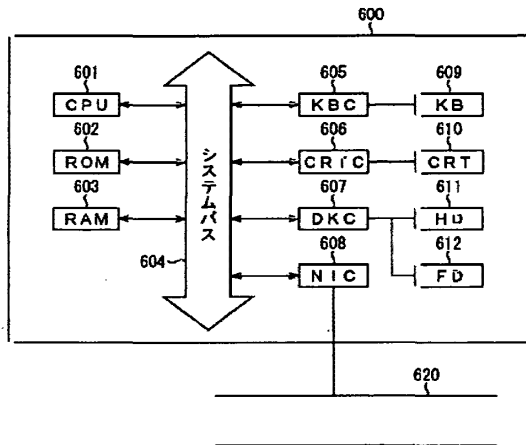
【図2】



【図4】



【图5】



フロントページの続き

(51) Int. Cl. 7

H O 4 N 5/243
 9/64
 9/73

識別記号

FI

HO 4 N 9/64
9/73
1/40

(参考)

J 5C077
A
101Z

Fターム(参考) 5B047 AA30 AB04 BA03 BB04 BC23
CB30 DC20
5B057 CA01 CA08 CA12 CB08 CB12
CB16 CE11 CE16 CH07 DB02
DB06 DB09 DC22 DC23
5C021 PA58 PA78 PA80 XA03
5C022 AA13 AC69
5C066 AA11 CA08 EA05 EC01 GA01
KA11 KE07 KP05
5C077 LL02 MP01 PQ12 PQ25 SS01
TT09

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]An image processing system which processes an object image in which prescribed information was given, comprising:

An information acquisition means which acquires information about a situation at the time of object image acquisition based on the above-mentioned prescribed information.

A processing means to process an object image based on the above-mentioned prescribed information and acquisition information of the above-mentioned information acquisition means.

[Claim 2]The image processing system according to claim 1, wherein the above-mentioned information acquisition means acquires information on a result that a situation at the time of the above-mentioned photography was presumed, including information from which the above-mentioned prescribed information is acquired at the time of the above-mentioned photography including a taken image produced by the above-mentioned object image photoing a photographic subject.

[Claim 3]The image processing system according to claim 1 characterized by performing picture correction processing to an object image with an image correction processing method which chose the above-mentioned processing means based on the above-mentioned prescribed information and acquisition information of the above-mentioned information acquisition means.

[Claim 4]The image processing system according to claim 2, wherein the above-mentioned information acquisition means acquires information concerning the weather at the time of photography, or information concerning a camera station.

[Claim 5]An image processing system which two or more apparatus is the image processing systems which it comes to connect mutually so that communication is possible, and is characterized by at least one apparatus having a function of the image processing system according to any one of claims 1 to 4 among two or more above-mentioned apparatus.

[Claim 6]An image processing method characterized by comprising the following for processing an object image in which prescribed information was given.

An information acquisition step which acquires information about a situation at the time of object

image acquisition based on the above-mentioned prescribed information.

A processing step which processes an object image based on the above-mentioned prescribed information and acquisition information by the above-mentioned information acquisition step.

[Claim 7]An image processing method characterized by comprising the following for processing a taken image.

A grant information acquisition step which acquires information given to the above-mentioned taken image at the time of photography.

A supplementary information acquisition step which acquires supplementary information for presuming a situation at the time of photography.

An amendment determination step which chooses a Method of amendment for the above-mentioned taken image by a result of having presumed a photographing condition based on grant information acquired by the above-mentioned grant information acquisition step, and supplementary information acquired by the above-mentioned supplementary information acquisition step.

A picture correction step which amends the above-mentioned taken image based on a Method of amendment with the above-mentioned selected amendment determination step.

[Claim 8]A storage which recorded a program for making a computer realize a function of the image processing system according to any one of claims 1 to 4, or a function of the image processing system according to claim 5 and in which computer read-out is possible.

[Claim 9]A storage which recorded a program for making a computer perform a processing step of the image processing method according to claim 6 or 7 and in which computer reading is possible.

[Claim 10]A program for making a computer realize a function of the image processing system according to any one of claims 1 to 4, or a function of the image processing system according to claim 5.

[Claim 11]A program for making a computer perform a processing step of the image processing method according to claim 6 or 7.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]. This invention is used for the equipment or the system, which performs Image Processing Division, such as gray level correction thru/or color correction, to an object image, for example. It is related with the storage which memorized the program for carrying an image processing system, an image processing system, an image processing method, and it out and in which computer read-out is possible, and the program concerned.

[0002]

[Description of the Prior Art]As opposed to the taken image (object image) conventionally obtained with the digital camera etc., As a method of performing compensation processes, such as contrast, a highlight, a shadow point (shadow balance), and a white balance, By for example, the thing for which the ratio of the bias of the color of the highlight part in an object image is distinguished, the degree of a white balance is adjusted based on the discriminated result concerned, it can come, simultaneously contrast, a highlight, and shadow balance are amended the optimal. There is the method of reproducing faithfully the color of the objects (photographic subject for photography, etc.) which exist in an object image.

[0003]

[Problem to be solved by the invention]However, in the conventional picture correction processing which was mentioned above. For example, since picture amendment was performed by the degree same irrespective of the photographic subject for photography when an object-of-amendment picture was a taken image, there was a case where desirable correction results were not necessarily obtained depending on the photographic subject included in a taken image. For example, when an object image was a picture which contains the background image which has a bias in distribution of a color like evening glow, and a skiing area or the sea of the fine weather of midsummer, there was a case where a proper compensation process could not be performed to the picture concerned.

[0004]By then, composition which accomplished this invention in order to remove the above-mentioned fault, and performs suitable picture correction processing according to an object image. It aims at providing the storage which memorized the program for carrying out the image processing system, the image processing system, the image processing method, and it which can provide an always good after-processing picture and in which computer read-out is possible, and the program concerned.

[0005]

[Means for solving problem]This invention is characterized by that the bottom of this purpose comprises:

The information acquisition means which the 1st invention is an image processing system which processes the object image in which prescribed information was given, and acquires the information about the situation at the time of object image acquisition based on the above-mentioned prescribed information.

A processing means to process an object image based on the above-mentioned prescribed information and the acquisition information of the above-mentioned information acquisition means.

[0006]The above-mentioned information acquisition means acquires the information on a result that the situation at the time of the above-mentioned photography was presumed, including the information which is acquired at the time of the above-mentioned photography as for the above-mentioned prescribed information including the taken image produced by an object image photoing a photographic subject in the 1st above-mentioned invention in the 2nd invention.

[0007]The 3rd invention performs picture correction processing to an object image in the 1st above-mentioned invention with the image correction processing method which chose the above-mentioned processing means based on the above-mentioned prescribed information and the acquisition information of the above-mentioned information acquisition means.

[0008]The 4th invention acquires the information concerning the weather at the time of photography in the above-mentioned information acquisition means, or the information concerning a camera station in the 2nd above-mentioned invention.

[0009]The 5th invention is an image processing system to which it comes to connect two or more apparatus of each other so that communication is possible, and, as for at least one apparatus, it has a function of the image processing system according to any one of claims 1 to 4 among two or more above-mentioned apparatus.

[0010]This invention is [the 6th invention] characterized by that the image processing method for processing the object image in which prescribed information was given comprises the following.

The information acquisition step which acquires the information about the situation at the time of object image acquisition based on the above-mentioned prescribed information.

The processing step which processes an object image based on the above-mentioned prescribed information and the acquisition information by the above-mentioned information acquisition step.

[0011]The 7th invention is characterized by that an image processing method for this invention to process a taken image comprises:

The grant information acquisition step which acquires the information given to the above-mentioned taken image at the time of photography.

The supplementary information acquisition step which acquires the supplementary information for presuming the situation at the time of photography.

The amendment determination step which chooses the Method of amendment for the above-mentioned taken image by the result of having presumed the photographing condition based on the grant information acquired by the above-mentioned grant information acquisition step, and the supplementary information acquired by the above-mentioned supplementary information acquisition step.

The picture correction step which amends the above-mentioned taken image based on a Method of amendment with the above-mentioned selected amendment determination step.

[0012]The 8th invention recorded the program for making a computer realize the function of the image processing system according to any one of claims 1 to 4, or the function of the image processing system according to claim 5 on the storage in which computer read-out is possible.

[0013]The 9th invention was recorded on the storage which recorded the program for making a computer perform the processing step of the image processing method according to claim 6 or 7 and in which computer read-out is possible.

[0014]10th invention is characterized by being a program for making a computer realize the

function of the image processing system according to any one of claims 1 to 4, or the function of the image processing system according to claim 5.

[0015] 11th invention is characterized by being a program for making a computer perform the processing step of the image processing method according to claim 6 or 7.

[0016]

[Mode for carrying out the invention] Hereafter, an embodiment of the invention is described using Drawings.

[0017] This invention is applied to the image processing system 100 as shown in drawing 1, for example. The image processing system 100 of this embodiment has the function to perform picture correction processing to the taken image obtained with the digital camera etc., It comprises choosing an image correction method based on the supplementary information for presuming the information (grant information) especially given to the taken image concerned at the time of acquisition of a taken image (at the time of photography), and the situation at the time of photography so that suitable picture correction processing according to a taken image may be performed. Hereafter, the composition and operation of the image processing system 100 of this embodiment are explained concretely.

[0018] The <composition of image processing system 100> image processing system 100 is provided with the following.

The memory card 101 holding the data (grant data) given to the photographed image data concerned at the time of the photographed image data obtained with the digital camera etc., and photography as shown in above-mentioned drawing 1.

The image data input part 102 which inputs the photographed image data (object image data) which serves as a processing object from the memory card 101.

The camera station input part 103 which inputs the camera station information etc. which are included in the grant data of object image data from the memory card 101.

The photographing date input part 104 which inputs the photographing date information etc. which are included in the grant data of object image data from the memory card 101, The weather intelligence acquisition part 105 which acquires the weather intelligence at the time of acquisition of object image data (at the time of photography), The map information acquisition part 106 which acquires the terrain intelligence (map information) of the acquisition place (photographing location) of object image data, An image correction processing method applicable based on the result of having presumed the photographing condition, from the information acquired by each formation parts 102-106 The suitable amendment judgment part 107 to judge, The correction processing section 108 which performs picture correction processing to object image data based on the decided result of the amendment judgment part 107, The compensation table 109 holding the parameter used for the picture correction processing in the correction processing section 108, and the image output part 110 which outputs the after-processing image data obtained by the correction processing section 108.

[0019] In the above image processing systems 100, the photographed image data produced by

taking a photograph with image photographing apparatus, such as a digital camera, is recorded on the memory card 101.

[0020]Drawing 2 shows an example of the composition of the image photographing apparatus 200 here. The image photographing apparatus 200 is provided with the image pick-up part 207, the camera control part 201, the position sensor 202, the environment sensor 203, the real-time clock 204, the image processing portion 205, and the image output part 206 as shown in above-mentioned drawing 2.

[0021]The image pick-up part 207 acquires the taken image of a photographic subject including a lens, a shutter, a flash plate, image sensors (CCD), and these control sections (un-illustrating). The camera control part 201 controls the focus at the time of photography, a flash plate, a diaphragm, and shutter speed. The position sensor 202 acquires camera station information, including the latitude at the time of photography, longitude, an altitude, the direction of a photographic subject, etc. The environment sensor 203 acquires photographing environmental information, such as atmospheric temperature at the time of photography, and humidity. It may be made to include information, including atmospheric pressure etc., further as this environment information. The real-time clock 204 acquires photographing date information, including the date at the time of photography, time, etc. The image processing portion 205 performs Image Processing Division, such as white balance adjustment, convert colors, and compression, to the photographed image data obtained in the image pick-up part 207. The image output part 206 is outputted to the image processing system 100 with the after-processing image data of the image processing portion 205 by using as grant data the camera-control information, the camera station information, the photographing environmental information, and the photographing date information at the time of acquisition of the image data concerned obtained by each formation parts 201-204 (at the time of photography). Therefore, the output data from the image output part 206 of the image photographing apparatus 200 is recorded on the memory card 101 of the image processing system 100.

[0022>About the camera station information acquired with the position sensor 202, it is more preferred to, incorporate what is called reference-by-location profitable functions, such as GPS, for example, although it is good also as input from a user. About the direction of the photographic subject included in camera station information, it is acquirable by composition which builds magnetic compass into the 200 image photographing apparatus inside of the body, for example.

[0023]<Operation of image processing system 100> drawing 3 shows operation of the image processing system 100 shown in above-mentioned drawing 1 with a flow chart.

[0024]Step S301: The image input part 102 inputs the image data (object image data) of a processing object from the memory card 101. Step S302: The camera station input part 103 inputs the camera station information included in the grant data of object image data from the memory card 101, and the photographing date input part 104 inputs the photographing date information included in the grant data of object image data from the memory card 101. The photographing date input part 104 inputs the camera-control information and photographing

environmental information which are included in the grant data of object image data from the memory card 101.

[0025]Step S303: The weather intelligence acquisition part 105 acquires the weather intelligence at the time of the photography concerned based on the photographing date information and camera station information (information, including latitude, longitude, etc.) at the time of acquisition of the object image data inputted by the camera station input part 103 and the photographing date input part 104 (at the time of photography) at Step S302. Weather intelligence here is information, including atmospheric temperature, humidity, atmospheric pressure, the weather (being fine cloudy weather, rain, snow), etc. Via concrete for example, arbitrary means of communication, such as the Internet, the weather intelligence acquisition part 105 is accessing an external weather intelligence server etc., and acquires the weather intelligence concerned. Or the weather intelligence acquisition part 105 acquires the weather intelligence of past every place via storages, such as CD-ROM.

[0026]Step S304: The map information acquisition part 106 acquires the terrain intelligence (map information) of the photographing location concerned based on the camera station information (information, including latitude, longitude, etc.) at the time of acquisition of the object image data inputted by the camera station input part 103 (at the time of photography) at Step S302. The map information acquisition part 106 is referring to the map acquired based on the camera station information at the time of photography (information, including latitude, longitude, etc.), and, specifically, judges the classification of the geographical features (the sea, a mountain, an urban area, etc.) of the photographing location concerned. As an acquisition method of a map, the method of accessing an external map information server etc., etc. are mentioned by arbitrary means of communication, such as the Internet, for example.

[0027]Step S305 : the amendment judgment part 107 the situation at the time of acquisition of the object image data inputted by the image input part 102 at Step S201 (photographing condition), With the camera station information, the photographing date information, the camera-control information, and photographing environmental information (grant information) which were inputted by the camera station input part 103 and the photographing date input part 104 at Step S302. It presumes based on the supplementary information (weather intelligence inputted by the weather intelligence acquisition part 105 at Step S303, and map information inputted by the map information acquisition part 106 at Step S304) acquired by a certain method based on grant information after photography.

[0028]As specifically shown in drawing 4, first the amendment judgment part 107, The atmospheric temperature shown by the photographing environmental information included in grant information is compared with the atmospheric temperature shown by the weather intelligence contained in supplementary information (Step S401), as a result of this comparison, if air temperature difference is not less than 3 **, it will judge with "indoor mode" (Step S406), and this processing will be ended. On the other hand, when air temperature difference is less than 3 ** as a result of comparison of Step S401, the amendment judgment part 107 measures the humidity shown by the photographing environmental information included in grant information,

and the humidity shown by the weather intelligence contained in supplementary information (Step S402).

[0029]When humidity difference is more than 10%RH as a result of comparison of Step S402, the amendment judgment part 107 judges with "indoor mode" (Step S406), and carries out this end of processing. When humidity difference is less than 10%RH as a result of comparison of Step S402, on the other hand, the amendment judgment part 107, Based on the control state of the flash plate shown using the time shown using the photographing date information included in grant information, and the camera-control information included in grant information, Or exposure time is daytime and a flash plate is photography of ON, it distinguishes (Step S403), and if it is photography [which], it will judge with "indoor mode" (Step S406), and this end of processing of whether exposure time is night and a flash plate is photography of OFF will be carried out.

[0030]When it is not the above-mentioned photography [which] as a result of distinction of Step S403, either, the amendment judgment part 107, Based on the bearing of the exposure axis shown using the time shown using the photographing date information included in grant information, and the camera station information included in grant information, It distinguishes (Step S404), and if that is right, it will judge with "toward morning evening mode" (Step S407), and this end of processing of whether it is photography of the east side at dawn or the west side in the evening will be carried out.

[0031]When it is not photography of the east side at dawn or the west side in the evening as a result of distinction of Step S404, on the other hand, the amendment judgment part 107, Based on the photographing place information shown by the time shown using the photographing date information included in grant information, and the map information included in supplementary information, In photography of the daytime of winter, and a snow cover area, it judges with "snow mode" (Step S410), in photography of the daytime of summer, and the sea, judges with "sea mode" (Step S408), and, in the photography which is not these any, either, judges with "general mode" (Step S409), and this end of processing is carried out.

[0032]The estimation processing shown in above-mentioned drawing 4 is one example, and is not restricted to this. For example, it is also possible to presume a still higher-precision photographing condition with the combination of the variety of information included in grant information. It is possible to presume a photographing condition also by the state **** case which lacked the part of the information included in grant information, for example. Since the electric wave of GPS is specifically unreceivable at the time of photography, when position information is missing, it judges with "indoor mode."

[0033]Step S306: The amendment judgment part 107 analyzes the histogram of the object image data inputted by the image input part 102 at Step S301. The amendment judgment part 107 detects the point of a highlight and a shadow, and the balance of RGB based on the RGB histogram of an object image, and, specifically, judges the necessity for exposure correction processing based on the detection result concerned. The amendment judgment part 107 judges the necessity for a color fogging compensation process based on the above-mentioned detection result (RGB balance).

[0034]Step S307: The correction processing section 108 generates the compensation table 109 based on the information about the photographing condition presumed by the amendment judgment part 107 and the required compensation process based on the histogram of the object image at Step S305. The compensation table 109 here contains three one-dimensional look-up tables which have a corrected output value over each input value of RGB of an object image.

[0035]Specifically, the correction processing section 108 generates the compensation table 109 according to each of pattern (1) – (5) by a compensation process with following photographing conditions and necessity.

- (1) A presumed photographing condition is in "indoor mode", and when [which needs a green fogging compensation process] the green fogging has occurred in the object image from the histogram of an object image, and judged, generate the compensation table 109 suitable for amendment of the green fogging under fluorescent lamp Lighting Sub-Division.
- (2) A presumed photographing condition is in "toward morning evening mode", and since the red ratio is [histogram / of an object image] high in an object image, when it is judged that a red fogging compensation process is required, generate the compensation table 109 suitable for a morning glow evening glow photograph.
- (3) A presumed photographing condition is in "sea mode", and from the histogram of an object image, since the blue ratio is high in an object image, when [which needs a blue fogging compensation process] judged, generate the compensation table 109 which emphasized the blue of the sea and empty.
- (4) A presumed photographing condition is in "snow mode", and from the histogram of an object image, since it is overexposure in an object image, when [which needs exposure correction processing] judged, generate the compensation table 109 suitable for having been suitable for the snow-covered landscape.
- (5) When a presumed photographing condition is "general mode", generate the compensation table 109 for general exposure correction, white balance adjustment, etc.

[0036]Step S308: The correction processing section 108 performs picture correction processing to the object image data inputted by the image input part 102 at Step S301 using the compensation table 109 generated at Step S307. Specifically, the correction processing section 108 changes the RGB picture element value of an object image with reference to the compensation table 109.

[0037]Step S309: The image output part 110 outputs the after-processing image data obtained by the correction processing section 108 at Step S308.

[0038]the grant information (a photographing date.) given to the object image by this embodiment as mentioned above the supplementary information (the weather at the time of photography.) which may be based on information, including a camera station, camera control, etc., and the grant information concerned And since it constituted from information on the map of a photographing location, etc. so that the photographing condition of an object image might be presumed and picture correction processing based on this estimation result might be performed to an object image, Even if an object image is a picture acquired by taking a photograph by

various photographing conditions, such as a snow-covered landscape and evening glow, picture amendment suitable for the candidate for photography can be performed.

[0039]The purpose of this invention the storage which memorized the program code of the software which realizes the host of this embodiment, and the function of a terminal, It cannot be overemphasized that it is attained, also when a system or equipment is supplied and the computer (or CPU and MPU) of the system or equipment reads and executes the program code stored in the storage. In this case, the program code itself read from the storage will realize the function of this embodiment, and the storage which memorized that program code, and the program code concerned will constitute this invention. As a storage for supplying a program code, ROM, a flexible disk, a hard disk, an optical disc, a magneto-optical disc, CD-ROM, CD-R, magnetic tape, a nonvolatile memory card, etc. can be used. By executing the program code which the computer read, It cannot be overemphasized that it is contained also when the function of this embodiment is not only realized, but it performs a part or all of processing that OS etc. which are working on a computer are actual, based on directions of the program code and the function of this embodiment is realized by the processing. After the program code read from the storage was written in the memory with which the function expansion unit connected to the expanded-function board inserted in the computer or the computer is equipped, It cannot be overemphasized that it is contained also when a part or all of processing that CPU etc. with which the expansion board and function expansion unit are equipped are actual is performed based on directions of the program code and the function of this embodiment is realized by the processing.

[0040]Drawing 5 shows the function 600 of the above-mentioned computer. As shown in above-mentioned drawing 5, the computer function 600 CPU601, ROM602, RAM603, and the keyboard controller (KBC) 605 of the keyboard (KB) 609, CRT controller (CRTC) 606 of CRT display (CRT) 610 as a display, The disk controller (DKC) 607 of the hard disk (HD) 611 and the flexible disk (FD) 612, The network interface controller (NIC) 608 for connection with the network 620 has composition mutually connected via the system bath 604 so that communication was possible.

[0041]CPU601 is performing software memorized by ROM602 or HD611 or software supplied from FD612, and controls each formation part connected to the system bath 604 in the gross. That is, CPU601 is reading the processing program according to a predetermined processing sequence from ROM602, HD611, or FD612, and executing it, and performs control for realizing operation by this embodiment.

[0042]RAM603 functions as main memory or a work area of CPU601, etc. KBC605 controls the indicating input from KB609, the pointing device which is not illustrated, etc. CRTC606 controls the display of CRT610. DKC607 controls access with HD611 and FD612 which memorize a boot program, various applications, a compilation file, a user file, a network management program, the predetermined processing program in this embodiment, etc. NIC608 exchanges data in the equipment on the network 620 or a system, and both directions.

[0043]

[Effect of the Invention]In processing the object images (taken image etc.) in which prescribed

information was given in this invention, as explained above, Based on prescribed information (information given to the object image at the time of photography), the information about the situation at the time of object image acquisition, including estimation information of a photographing condition, etc., was acquired, and based on the acquisition information concerned and prescribed information, it constituted so that Image Processing Division (picture correction processing etc.) might be performed to an object image. Since suitable Image Processing Division for an object image can be performed by this, an always good after-processing picture can be provided.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a block diagram showing the composition of the image processing system which applied this invention.

[Drawing 2] It is a block diagram showing the composition of the input device of the picture which serves as a processing object with a described image processing unit.

[Drawing 3] It is a flow chart for explaining operation of a described image processing unit.

[Drawing 4] In operation of a described image processing unit, it is a flow chart for explaining photographing condition estimation processing.

[Drawing 5] It is a block diagram showing the composition of the computer concerned which reads the program for making a computer realize the function of a described image processing unit from the storage in which computer read-out is possible, and executes it.

[Explanations of letters or numerals]

100 Image processing system

101 Memory card

102 Image input part

103 Camera station input part

104 Photographing date input part

105 Weather intelligence acquisition part

106 Map information acquisition part

107 Amendment judgment part

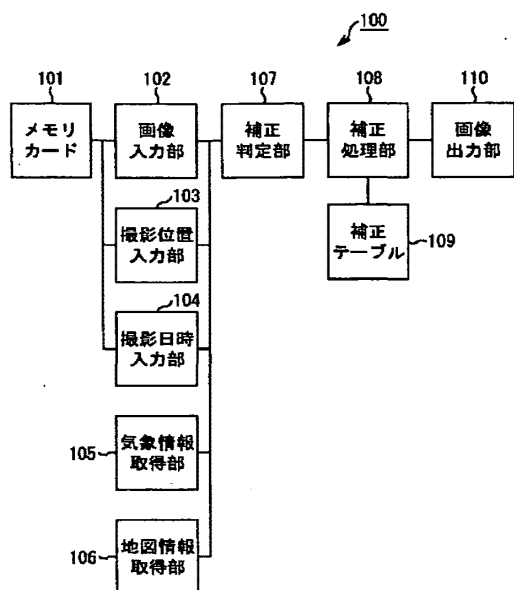
108 Correction processing section

109 Compensation table

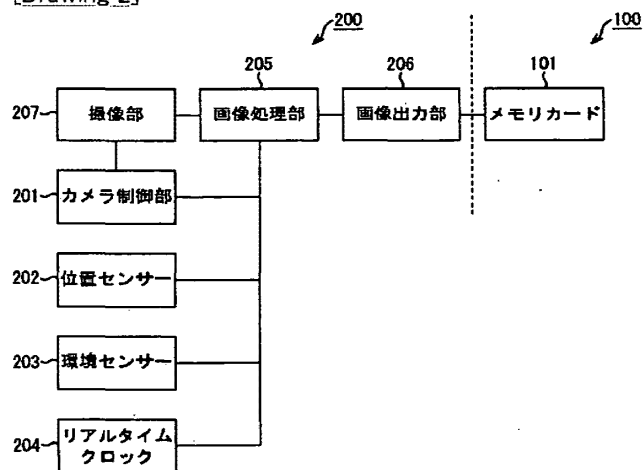
110 Image output part

DRAWINGS

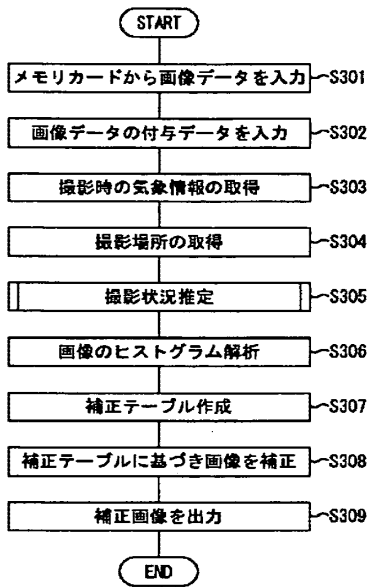
[Drawing 1]



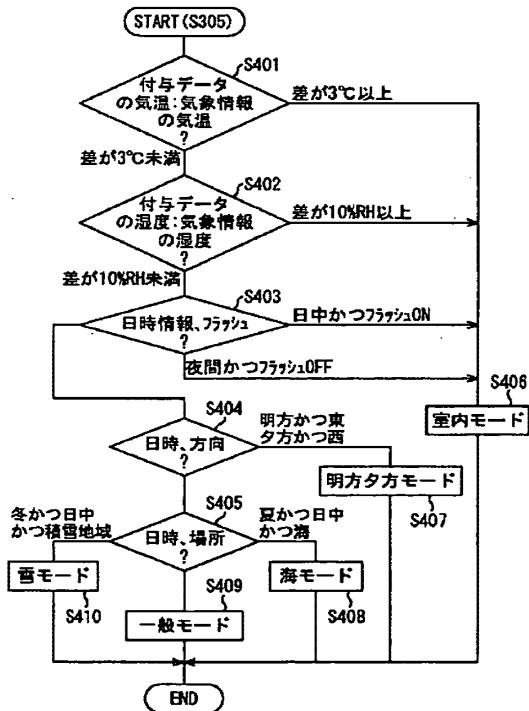
[Drawing 2]



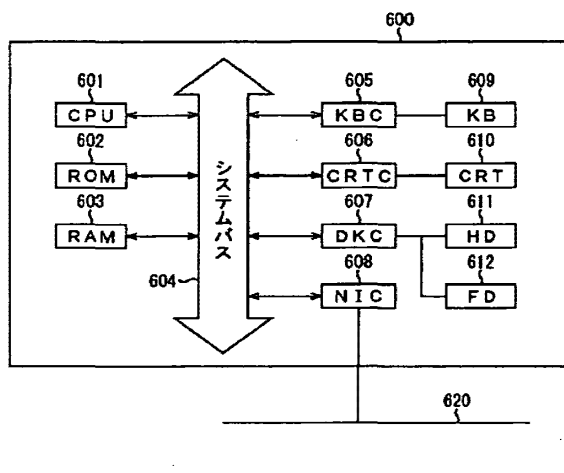
[Drawing 3]



[Drawing 4]



[Drawing 5]





TH
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	)	Docket No. MIPFP147C
Toshie IMAI	)	Examiner: P. Tran
Application No. 12/590,586	)	Group Art Unit: 2624
Filed: November 10, 2009	)	Date: February 25, 2011
For: DETERMINATION OF MAIN OBJECT ON	)	Confirmation No. 2020
IMAGE AND IMPROVEMENT OF IMAGE	)	
QUALITY ACCORDING TO MAIN OBJECT	)	

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 25, 2011.

Signed:

Diane Schwanbeck
Diane Schwanbeck

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

The references listed in the attached PTO Form 1449, copies of which are attached, may be material to examination of the above-identified patent application. Applicant submits these references in compliance with her duty of disclosure pursuant to 37 CFR §§ 1.56 and 1.97. The Examiner is requested to consider these references and to acknowledge such consideration by signing the appropriate location on the attached PTO Form 1449.

References L-N are in the Japanese language. The relevance of References L-N can be ascertained by reviewing the attached machine-generated English translations of these references.

Applicant states that this Information Disclosure Statement (IDS) is being filed before the first Office Action on the merits. Accordingly, no fees are due in connection with the filing of this IDS. In the event fees are due to effect consideration of the listed references, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-0805 (Order No. MIPFP147C).

Respectfully submitted,
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshie Imai	MIPEP147C	2020
25920 7590 04/27/2011 MARTINE PENILLA & GENCARELLA, LLP 710 LAKEWAY DRIVE SUITE 200 SUNNYVALE, CA 94085			EXAMINER TRAN, PHUOC	
			ART UNIT 2624	PAPER NUMBER
			MAIL DATE 04/27/2011	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/590,586	IMAI, TOSHIE	
	Examiner	Art Unit	
	Phuoc Tran	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 01 February 2010.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 15-26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 15-26 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on 10 November 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some * c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☒ Certified copies of the priority documents have been received in Application No. 11/075,380.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892) 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____. 5) ☐ Notice of Informal Patent Application 6) ☐ Other: _____.
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1. The disclosure is objected to because of the following informalities: In the first paragraph of specification, updating the current status of parent application 11/075,380 is required.

Appropriate correction is required.

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 15-26 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 15-18 are directed to abstract ideas because the claims neither transform an article nor are positively tied to a particular machine that accomplishes the claimed method steps. For example, the steps "determining ...", "acquiring properties ...", "acquiring correction conditions...", "adjusting ..." in the claims neither transform an article nor are positively tied to a particular machine.

Claims 19-22 define an apparatus. However, the body of the claims lacks definite structures indicative of a physical apparatus. The broadest reasonable interpretation of "a determining module", "a property acquirer", "a correction condition acquirer", "an image quality adjuster" in the claims covers pure software elements. Therefore, the claims as a whole appear to be nothing more than a system of software elements, and software per se does not fall within a statutory category.

Claims 23-26 are directed to a computer program product comprising a computer readable medium. However, the broadest reasonable interpretation of the "computer readable medium" covers a transitory propagating signal which is non-statutory subject matter.

"A transitory, propagating signal ... is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (In re Petrus A.C.M. Nuijten; Fed Cir, 2006-1371, 9/20/2007). The examiner suggests amending **the claim(s) to recite a "non-transitory computer-readable medium" or equivalent in order to exclude non-statutory subject matter such as a transitory propagating signal** . Any amendment to the claims should be commensurate with its corresponding disclosure.

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 15-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Bolle et al (6,301,440).

As to claim 15 Bolle et al disclose a computer implemented method of image processing, the method comprising:

determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face (col. 4, lines 16-25);

acquiring properties of the determined main object (col. 4, lines 16-44);

acquiring correction conditions corresponding to the acquired properties (col. 4, lines 16-63); and

adjusting image quality of the main object using the acquired correction conditions (col. 5, lines 28-45).

As to claim 16, Bolle et al disclose wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face (col. 6, lines 35-42, col. 7, lines 34-51).

Claims 17-26 recite limitations which are similar to those of claims 15-16. Therefore, they are rejected for the same reasons as claims 15-16.

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned

with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

7. Claims 15-26 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 18, 32 of U.S. Patent No. 7,668,365 in view of Bolle et al (6,301,440).

Claims 15 differs from claim 32 of the U.S. Patent No. 7,668,365 in that it requires that the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face.

Bolle et al disclose such limitations (see col. 4, lines 16-25). It would have been obvious to incorporate Bolle et al's teachings into the claim for the purpose of determining if the object image is a human face so that the picture quality is adjusted accordingly.

As to claim 16, Bolle et al disclose wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face (col. 6, lines 35-42, col. 7, lines 34-51).

Claims 19 differs from claim 18 of the U.S. Patent No. 7,668,365 in that it requires that the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face.

Bolle et al disclose such limitations (see col. 4, lines 16-25). It would have been obvious to incorporate Bolle et al's teachings into the claim for the purpose of determining if the object image is a human face so that the picture quality is adjusted accordingly.

As to claim 20, Bolle et al disclose wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face (col. 6, lines 35-42, col. 7, lines 34-51).

Claims 17-18, 21-26 recite limitations which are similar to those of claims 15-16, 19-20. Therefore, they are rejected for the same reasons as claims 15-16, 19-20.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuoc Tran whose telephone number is (571) 272-7399. The examiner can normally be reached on MON-FRI.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on (571) 272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 12/590,586
Art Unit: 2624

Page 7

/Phuoc Tran/
Primary Examiner, Art Unit 2624

Notice of References Cited	Application/Control No. 12/590,586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE	
	Examiner Phuoc Tran	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,301,440	10-2001	Bolle et al.	396/128
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 12590586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE
	Examiner Phuoc Tran	Art Unit 2624

SEARCHED			
Class	Subclass	Date	Examiner
382	118, 165, 167, 274, 286, 291	4/13/11	PT

SEARCH NOTES		
Search Notes	Date	Examiner

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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Receipt date: 12/06/2010

12590586 - GAU: 2624

Substitute for Form 1449/PTO		Application Number	12/590,586
Information Disclosure Statement By Applicant (Use as many sheets as necessary)		Filing Date:	November 10, 2009
		First Named Inventor:	Toshie IMAI
		Art Unit:	2624
		Examiner Name:	P. Tran
		Attorney Docket Number:	MIPFP147C
Sheet	1	of	

U.S. Patent Documents

Examiner Initial	Cite No.	Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear
	A				
	B				
	C				
	D				
	E				
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	J				
	K				

Foreign Patent Documents

Examiner Initial	Cite No.	Foreign Patent Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	YES	NO
	L	JP 2000-278524	10/2000	Takano et al.		x	
	M	JP 2003-248825	9/2003	Hibi et al.		x	
	N						
	O						
	P						
	Q						

Non Patent Literature Documents

Examiner Initial	Cite No.	Include name of author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	R	Abstract of Japanese Patent Publication No. 2003-248825, Pub. Date: 05 September 2003, Patent Abstracts of Japan
	S	
	T	
	U	
	V	
	W	

Examiner Signature	/Phuoc Tran/	Date Considered	03/14/2011
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Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /PT/

Information Disclosure Statement By Applicant <i>(Use as many sheets as necessary)</i>				Application Number		Not Assigned	
				Filing Date:		November 10, 2009	
				First Named Inventor:		Toshie IMAI	
				Art Unit:		Not Assigned	
				Examiner Name:		Not Assigned	
				Attorney Docket Number:		MIPFP147C	
Sheet	1	of	2				

U.S. Patent Documents

Examiner Initial	Cite No.	Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear
	A	6,021,221	2/2000	Takaha	
	B	2002/0150291	10/2002	Naf et al.	
	C	6,564,851	5/2003	Liao	
	D	2003/0108250	6/2003	Luo et al.	
	E	6,947,078	9/2005	Kuwata et al.	
	F	6,975,437	12/2005	Takemoto	
	G	6,989,914	1/2006	Iwaki	
	H	7,016,075	3/2006	Tsukada	
	I	7,016,077	3/2006	Semba et al.	
	J	7,269,292	9/2007	Steinberg	
	K				

Foreign Patent Documents

Examiner Initial	Cite No.	Foreign Patent Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	Translation	
						YES	NO
	L	JP 2000-270222	9/2000	Detachi			
	M	JP 2000-278524	10/2000	Takano et al.			
	N	JP 2001-092956	4/2001	Tsukada			
	O	JP 2001-169135	6/2001	Nakami et al.			
	P	JP 2001-218047	8/2001	Iwai			
	Q	JP 2001-358961	1/2002	Takemoto			

Non Patent Literature Documents

Examiner Initial	Cite No.	Include name of author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	R	Abstract of Japanese Patent Publication No. 2000-270222, Pub. Date: 29 September 2000, Patent Abstracts of Japan
	S	Abstract of Japanese Patent Publication No. 2000-278524, Pub. Date: 06 October 2000, Patent Abstracts of Japan
	T	Abstract of Japanese Patent Publication No. 2001-092956, Pub. Date: 27 September 2002, Patent Abstracts of Japan
	U	Abstract of Japanese Patent Publication No. 2001-169135, Pub. Date: 22 June 2001, Patent Abstracts of Japan
	V	Abstract of Japanese Patent Publication No. 2001-218047, Pub. Date: 10 August 2001, Patent Abstracts of Japan
	W	Abstract of Japanese Patent Publication No. 2001-016818, Pub. Date: 18 January 2002, Patent Abstracts of Japan

Examiner Signature	/Phuoc Tran/	Date Considered	03/14/2011
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Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /PT/

Receipt date: 11/10/2009

12590586 - GAU: 2624

Substitute for Form 1449/PTO Information Disclosure Statement By Applicant <i>(Use as many sheets as necessary)</i>				Application Number		Not Assigned	
				Filing Date:		November 10, 2009	
				First Named Inventor:		Toshie IMAI	
				Art Unit:		Not Assigned	
				Examiner Name:		Not Assigned	
				Attorney Docket Number:		MIPFP147C	
Sheet	2	of	2				

U.S. Patent Documents

Examiner Initial	Cite No.	Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear
	A-2				
	B-2				
	C-2				
	D-2				
	E-2				
	F-2				
	G-2				
	H-2				
	I-2				
	J-2				
	K-2				

Foreign Patent Documents

Examiner Initial	Cite No.	Foreign Patent Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	Translation	
						YES	NO
	L-2	JP 2002-016818	1/2000	Takemoto			
	M-2	JP 2002-279416	9/2002	Naef et al.			
	N-2	JP 2003-198850	7/2003	Luo et al.			
	O-2						
	P-2						
	Q-2						

Non Patent Literature Documents

Examiner Initial	Cite No.	Include name of author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	R-2	Abstract of Japanese Patent Publication No. 2002-016818, Pub. Date: 18 January 2002, Patent Abstracts of Japan
	S-2	Abstract of Japanese Patent Publication No. 2002-279416, Pub. Date: 27 September 2002, Patent Abstracts of Japan
	T-2	Abstract of Japanese Patent Publication No. 2003-2198850, Pub. Date: 11 July 2003, Patent Abstracts of Japan
	U-2	
	V-2	
	W-2	

Examiner Signature	/Phuoc Tran/	Date Considered	03/14/2011
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Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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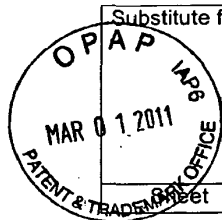
BIB DATA SHEET

CONFIRMATION NO. 2020

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/590,586	11/10/2009	382	2624	MIPFP147C		
APPLICANTS Toshie Imai, Nagano-ken, JAPAN; ** CONTINUING DATA ***** This application is a CON of 11/075,380 03/07/2005 PAT 7,668,365 ** FOREIGN APPLICATIONS ***** JAPAN 2004-63630 03/08/2004 JAPAN 2004-63637 03/08/2004 JAPAN 2004-182016 06/21/2004 JAPAN 2005-38009 02/15/2005 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 11/24/2009						
Foreign Priority claimed ☒ Yes ☐ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and /PHUOC TRAN/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY JAPAN	SHEETS DRAWINGS 18	TOTAL CLAIMS 14	INDEPENDENT CLAIMS 3
ADDRESS MARTINE PENILLA & GENCARELLA, LLP 710 LAKEWAY DRIVE SUITE 200 SUNNYVALE, CA 94085 UNITED STATES						
TITLE Determination of main object on image and improvement of image quality according to main object						
FILING FEE RECEIVED 1750	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Receipt date: 03/01/2011

12590586 - GAU: 2624



Substitute for Form 1449/PTO

Information Disclosure Statement By Applicant

(Use as many sheets as necessary)

Application Number	12/590,586
Filing Date:	November 10, 2009
First Named Inventor:	Toshie IMAI
Art Unit:	2624
Examiner Name:	P. Tran
Attorney Docket Number:	MIPFP147C

Sheet 1 of 1

U.S. Patent Documents

Examiner Initial	Cite No.	Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear
	A				
	B				
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Foreign Patent Documents

Examiner Initial	Cite No.	Foreign Patent Document No.	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	Translation
	L	JP 11-167634	6/1999	Okochi et al		YES NO
	M	JP 2001-160057	6/2001	Sato et al.		x
	N	JP 2003-087815	3/2003	Nochida		x
	O					
	P					
	Q					

Non Patent Literature Documents

Examiner Initial	Cite No.	Include name of author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
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Examiner Signature	/Phuoc Tran/	Date Considered	03/14/2011
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Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /PT/

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>In re</i> application of:	)	
	)	Docket No. MIPFP147C
Toshie IMAI	)	
	)	Examiner: P. Tran
Application No. 12/590,586	)	
	)	Group Art Unit: 2624
Filed: November 10, 2009	)	
	)	Date: August 29, 2011
For: DETERMINATION OF MAIN OBJECT	)	
ON IMAGE AND IMPROVEMENT OF	)	Confirmation No. 2020
IMAGE QUALITY ACCORDING TO	)	
MAIN OBJECT	)	
	)	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant submits this paper in response to the Office Action dated April 27, 2011. A response to this Office Action was due on July 27, 2011. Accordingly, Applicant requests a one-month extension of the period for response (Applicant notes that the one-month extended deadline of August 27, 2011 fell on a Saturday). Please amend this application as follows:

The **Amendments to the Specification** are shown on page 2 of this paper.

The **Amendments to the Claims** made herein are reflected in the **Listing of Claims**, which begins on page 3 of this paper.

Applicant's **Remarks** begin on page 6 of this paper.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>In re</i> application of:	)	
	)	Docket No. MIPFP147C
Toshie IMAI	)	
	)	Examiner: P. Tran
Application No. 12/590,586	)	
	)	Group Art Unit: 2624
Filed: November 10, 2009	)	
	)	Date: August 29, 2011
For: DETERMINATION OF MAIN OBJECT	)	
ON IMAGE AND IMPROVEMENT OF	)	Confirmation No. 2020
IMAGE QUALITY ACCORDING TO	)	
MAIN OBJECT	)	
	)	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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The **Amendments to the Specification** are shown on page 2 of this paper.

The **Amendments to the Claims** made herein are reflected in the **Listing of Claims**, which begins on page 3 of this paper.

Applicant's **Remarks** begin on page 6 of this paper.

Application No. 12/590,586
Amendment dated August 29, 2011
Response to Office Action mailed April 27, 2011

Amendments to the Specification:

Please replace Paragraph [0001] (the paragraph under the heading “Cross-Reference to Related Applications”), with the following rewritten paragraph:

This application is a continuation of U.S. Patent Application No. 11/075,380, filed on March 7, 2005, now Patent No. US 7,668,365 B2, the disclosure of which is hereby incorporated by reference in its entirety for all purposes.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-14 (Canceled).

Claim 15 (Currently Amended): A ~~computer-implemented~~ method of image processing, the method comprising:

determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face;

acquiring properties of the determined main object;

acquiring correction conditions corresponding to the acquired properties; and

adjusting image quality of the main object using the acquired correction conditions,

wherein each operation of the method of image processing is executed by a computer.

Claim 16 (Currently Amended): The ~~computer-implemented~~ method in accordance with claim 15, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 17 (Currently Amended): A ~~computer-implemented~~ method of image processing, the method comprising:

determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face; and

adjusting image quality of the main object using correction conditions corresponding to properties of the determined main object,

wherein each operation of the method of image processing is executed by a computer.

Claim 18 (Currently Amended): The ~~computer implemented~~ method in accordance with claim 17, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 19 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face;

a property acquirer configured to acquire properties of the determined main object;

a correction condition acquirer configured to acquire correction conditions corresponding to the acquired properties; and

an image quality adjuster configured to adjust image quality of the main object using the acquired correction conditions.

Claim 20 (Previously Presented): The image processing apparatus in accordance with claim 19, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 21 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face; and

an image quality adjuster configured to adjust image quality of the main object using correction conditions corresponding to properties of the determined main object.

Claim 22 (Previously Presented): The image processing apparatus in accordance with claim 21, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 23 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein, the computer readable code comprising:

computer readable code for determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face;

computer readable code for acquiring properties of the determined main object;

computer readable code for acquiring correction conditions corresponding to the acquired properties; and

computer readable code for adjusting image quality of the main object using the acquired correction conditions.

Claim 24 (Previously Presented): The computer program product in accordance with claim 23, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 25 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein, the computer readable code comprising:

computer readable code for determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face; and

computer readable code for adjusting image quality of the main object using correction conditions corresponding to properties of the determined main object.

Claim 26 (Previously Presented): The computer program product in accordance with claim 25, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

REMARKS

Claims 15-26 are pending in this application.

Applicant has amended claims 15-19, 21, 23, and 25. In addition, Applicant has made a minor change to the specification. These changes do not introduce any new matter.

Objection to the Disclosure

In response to the objection to the disclosure, Applicant has amended the specification to update the status of the parent application. Accordingly, Applicant requests that the objection to the disclosure be withdrawn.

Rejection Under 35 U.S.C. § 101

Applicant respectfully requests reconsideration of the rejection of claims 15-26 under 35 U.S.C. § 101 as being directed toward nonstatutory subject matter. Applicant has amended each of independent method claims 15 and 17 to specify that each operation of the method is executed by a computer. Applicant has amended each of independent apparatus claims 19 and 21 to specify that the apparatus includes one or more processors and memory. Applicant has amended each of independent claims 23 and 25 to specify that the claimed computer readable medium is a “non-transitory” computer readable medium. In light of these changes, each of present claims 15-26 defines statutory subject matter under 35 U.S.C. § 101. Accordingly, Applicant requests that the rejection of claims 15-26 under 35 U.S.C. § 101 be withdrawn.

Rejection Under 35 U.S.C. § 102

Applicant respectfully requests reconsideration of the rejection of claims 15-26 under 35 U.S.C. § 102(b) as being anticipated by *Bolle et al.* (“*Bolle*”) (US 6,301,440 B1). As will be explained in more detail below, the *Bolle* reference does not disclose each and every feature of the claimed subject matter.

The *Bolle* reference discloses a technique for automatically setting shooting conditions at the time of shooting with a digital camera. In particular, *Bolle* determines whether the object is either a portrait or a group shot, whether the object is a backlit image or not, and whether the object is a night scene or not. Based on the determination, *Bolle* sets the image acquisition controls of a camera. In accordance with the disclosed technique, *Bolle* sets the image acquisition controls for camera performance (focal position adjustment, shutter speed adjustment), and no controls are set with regard to image quality.

Considering first independent claim 15, Applicant respectfully submits that the *Bolle* reference does not disclose at least the claimed features of 1) determining whether or not a main object includes at least a human face, and 2) adjusting the image quality of the main object using the acquired correction conditions. As noted above, *Bolle* provides no disclosure regarding a technique for allowing an image processing apparatus to adjust the image quality of a shot image. Instead, what *Bolle* actually discloses is a technique regarding camera controls performed *before* and *when shooting*.

In support of the anticipation rejection, the Examiner cites column 4, lines 16-63 of *Bolle* as disclosing certain features of the claimed method (see the Office Action at pages 3-4). The cited portion of the *Bolle* reference, however, describes determinations that are premised on the condition when the user commits to taking the photograph (see *Bolle* at column 3, line 14). As such, the *Bolle* reference does not support the Examiner's anticipation rejection of claim 15.

Turning now to the other independent claims, each of independent claims 17, 19, 21, 23, and 25 includes features that correspond to the features discussed above with regard to claim 15. Thus, the arguments set forth above with regard to claim 15 also apply to claims 17, 19, 21, 23, and 25.

Accordingly, independent claims 15, 17, 19, 21, 23, and 25, as amended herein, are patentable under 35 U.S.C. § 102(b) over *Bolle*. Claims 16, 18, 20, 22, 24, and 26, which depend from 15, 17, 19, 21, 23, and 25, respectively, are likewise patentable under 35 U.S.C. § 102(b) over *Bolle* for at least the same reasons set forth above with regard to the applicable independent claim.

Obviousness-Type Double Patenting Rejection

In response to the obviousness-type double patenting rejection of claims 15-26 based on the combination of claims 18 and 32 of US 7,668,365 B1 in view of *Bolle*, Applicant is submitting a terminal disclaimer. Accordingly, Applicant requests that the obviousness-type double patenting rejection be withdrawn.

Conclusion

In view of the foregoing, Applicant respectfully requests reconsideration and reexamination of claims 15-26, as amended herein, and submits that these claims are in condition for allowance. Accordingly, a notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at **(408) 749-6902**. If any additional fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. MIPFP147C).

Respectfully submitted,
MARTINE PENILLA & GENCARELLA, L.L.P.

/Peter B. Martine/

Peter B. Martine
Reg. No. 32,043

710 Lakeway Drive, Suite 200
Sunnyvale, California 94085
Customer Number 25920

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Power of Attorney by Assignee of Entire Interest and Revocation of Prior Powers

Honorable Commissioner for Patents
Alexandria VA 22313-1450

Sir:

Power of Attorney by Assignee of Entire Interest and Revocation of Prior Powers:

Pursuant to 37 C.F.R. § 1.36, Seiko Epson Corporation, the assignee of record of the entire interest in the patent applications listed in the attached Exhibit A (a Statement Under 37 C.F.R. § 3.73(b) is being submitted herewith), revokes all previous powers of attorney in the patent applications listed in Exhibit A and hereby appoints the following attorneys and/or agents assigned to the Customer Number set forth below to prosecute the patent applications listed in Exhibit A and to transact all business in the U.S. Patent and Trademark Office connected therewith:

Customer Number 25920.

Please send all correspondence to:

MARTINE PENILLA & GENCARELLA, LLP
710 Lakeway Dr., Suite 200
Sunnyvale, CA 94085
Tel: (408) 749-6900
Fax: (408) 749-6901
Customer Number 25920.

The undersigned (whose title is supplied below) is empowered to sign this certificate on behalf of the above-identified assignee.

The undersigned hereby declares that all statements made herein of the undersigned's own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of any patents issuing thereon.

Seiko Epson Corporation

Signature:


Masataka Kamiyanagi

Title: Managing Executive Officer

Date: February 18, 2011

Seiko Epson Corporation

Power of Attorney

Exhibit A

	Attorney Docket	Application Serial Number	Filing Date
1	MIPFP001C	11985438	2007/11/14
2	MIPFP002C	12080994	2008/4/7
3	MIPFP003	10072266	2002/2/5
4	MIPFP004C	12004942	2007/12/20
5	MIPFP005C	12319433	2009/1/6
6	MIPFP012	10098733	2002/3/14
7	MIPFP014C	12383008	2009/3/18
8	MIPFP027C	11820998	2007/6/20
9	MIPFP028C	12001585	2007/12/11
10	MIPFP036C	12231516	2008/9/2
11	MIPFP040C	12380151	2009/2/23
12	MIPFP043	10621264	2003/7/15
13	MIPFP047	10634741	2003/8/4
14	MIPFP047D1	11983655	2007/11/9
15	MIPFP047D2	11983640	2007/11/9
16	MIPFP047D3	11983665	2007/11/9
17	MIPFP056C	12462227	2010/10/7
18	MIPFP057.CIP.C	12386939	2009/4/23
19	MIPFP063C	12456491	2009/6/16
20	MIPFP064A	12004981	2007/12/20
21	MIPFP064B	12004872	2007/12/20
22	MIPFP065C	12454582	2009/5/19
23	MIPFP066C	12454323	2009/5/14
24	MIPFP075	10751202	2004/1/2
25	MIPFP078C	12381797	2009/3/16
26	MIPFP081C	12313832	2008/11/24
27	MIPFP082	10794927	2004/3/5
28	MIPFP083	10811078	2004/3/26
29	MIPFP084	10810062	2004/3/26
30	MIPFP087	10821651	2004/4/9
31	MIPFP090	10498253	2004/6/10
32	MIPFP092C	12319946	2009/1/13
33	MIPFP093C	12456405	2009/6/15
34	MIPFP096	10871507	2004/6/18
35	MIPFP104	10912514	2004/8/4
36	MIPFP104C	12378389	2009/2/13
37	MIPFP106C	12386742	2009/4/21
38	MIPFP113C	12806142	2010/8/6
39	MIPFP114	10937101	2004/9/8
40	MIPFP116C	12802212	2010/6/1
41	MIPFP118C	12798357	2010/4/2
42	MIPFP119C	12658684	2010/2/12
43	MIPFP122C	12802036	2010/5/28
44	MIPFP127	10980606	2004/11/2
45	MIPFP131	11004618	2004/12/3
46	MIPFP132C	12156221	2008/5/29
47	MIPFP133C	12592758	2009/12/1
48	MIPFP140	11063373	2005/2/22
49	MIPFP141C	12802213	2010/6/1
50	MIPFP147C	12590586	2009/11/10
51	MIPFP149C	12799194	2010/4/19
52	MIPFP152D	12590981	2009/11/16
53	MIPFP158C	12290166	2008/10/27
54	MIPFP162	10546126	2005/8/19

Exhibit A

55	MIPFP165	10543824	2005/7/28
56	MIPFP178	10551199	2005/9/27
57	MIPFP183	11354733	2006/2/14
58	MIPFP185	10578696	2006/5/9
59	MIPFP186	11350374	2006/2/7
60	MIPFP188C	12800608	2010/5/18
61	MIPFP191D	12925234	2010/10/15
62	MIPFP192	11513722	2006/8/30
63	MIPFP196	11585014	2006/10/23
64	MIPFP198	11600988	2006/11/17
65	MIPFP199	11601509	2007/1/8
66	MIPFP200	11601162	2006/11/17
67	MIPFP201	11601492	2006/11/17
68	MIPFP203	11643748	2006/12/20
69	MIPFP204	11645145	2006/12/21
70	MIPFP208	11707395	2007/2/15
71	MIPFP209	11709634	2007/2/21
72	MIPFP212	11725064	2007/3/15
73	MIPFP213	11809609	2007/6/1
74	MIPFP214	11821033	2007/6/20
75	MIPFP215	11823424	2007/6/26
76	MIPFP216	11823444	2007/6/26
77	MIPFP217	11825094	2007/7/2
78	MIPFP218	11880946	2007/7/24
79	MIPFP219	11881186	2007/7/25
80	MIPFP220	11891071	2007/8/8
81	MIPFP221	11891977	2007/8/13
82	MIPFP222C	12661230	2010/3/11
83	MIPFP223	11899672	2007/9/6
84	MIPFP224C	12927486	2010/11/15
85	MIPFP225	11906953	2007/10/3
86	MIPFP226	11974021	2007/10/10
87	MIPFP227	11999425	2007/12/4
88	MIPFP228	12002991	2007/12/18

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>In re</i> the application of	)	
	)	Examiner: P. Tran
Toshie IMAI	)	
	)	Group Art Unit: 2624
Application No. 12/590,586	)	
	)	Docket No. MIPFP147C
Filing Date: November 10, 2009	)	
	)	Date: August 29, 2011
For: DETERMINATION OF MAIN OBJECT ON	)	
IMAGE AND IMPROVEMENT OF IMAGE	)	Confirmation No. 2020
<u>QUALITY ACCORDING TO MAIN OBJECT</u>	)	

TRANSMITTAL OF POWER OF ATTORNEY

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

Applicant hereby transmits a Power of Attorney document for the subject application. The subject application (Application No. 12/590,586) appears in Exhibit A, which is attached to the Power of Attorney document, under Entry No. 50.

Respectfully submitted,
MARTINE PENILLA & GENCARELLA, LLP

/Peter B. Martine/

Peter B. Martine
Reg. No. 32,043

710 Lakeway Drive, Suite 200
Sunnyvale, CA 94085
Telephone: (408) 749-6902
Customer No. 25920

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Toshie IMAI

Application No./Patent No.: 12/590,586

Filed/Issue Date: November 10, 2009

Titled:

Seiko Epson Corporation

, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 016755, Frame 0294, or for which a copy therefore is attached.

OR

- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Peter B. Martine/

August 29, 2011

Signature

Date

Peter B. Martine

Attorney/Reg. No. 32,043

Printed or Typed Name

Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		12590586		
Filing Date:		10-Nov-2009		
Title of Invention:		Determination of main object on image and improvement of image quality according to main object		
First Named Inventor/Applicant Name:		Toshie Imai		
Filer:		Peter B. Martine		
Attorney Docket Number:		MIPFP147C		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with \$0 paid	1251	1	130	130

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Statutory or terminal disclaimer	1814	1	140	140
Total in USD (\$)				270

Electronic Acknowledgement Receipt	
EFS ID:	10839291
Application Number:	12590586
International Application Number:	
Confirmation Number:	2020
Title of Invention:	Determination of main object on image and improvement of image quality according to main object
First Named Inventor/Applicant Name:	Toshie Imai
Customer Number:	25920
Filer:	Peter B. Martine
Filer Authorized By:	
Attorney Docket Number:	MIPFP147C
Receipt Date:	29-AUG-2011
Filing Date:	10-NOV-2009
Time Stamp:	22:39:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$270
RAM confirmation Number	6341
Deposit Account	500805
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Amendment/Req. Reconsideration-After Non-Final Reject	MIPFP147C_Amdt_e filed.pdf	47189 56bc77909a448964b6394435c701a4663d4 ddad6	no	8
Warnings:					
Information:					
2	Terminal Disclaimer Filed	MIPFP147C_Term_Disclaimer_ e filed.pdf	210444 7febe2e47963950a319a36cde4a5f050ce21 b10a	no	2
Warnings:					
Information:					
3	Power of Attorney	MIPFP147C_POA_e filed.pdf	223710 972a4a4d8bef4eafb59caaa3d7e672b9530 709c2	no	3
Warnings:					
Information:					
4	Miscellaneous Incoming Letter	MIPFP147C_Transmittal_of_PO A_e filed.pdf	19599 5a8b7ecef32e3a206ea27b7500258a89fc94 5e01	no	1
Warnings:					
Information:					
5	Assignee showing of ownership per 37 CFR 3.73(b).	MIPFP147C_373bStatement_ef iled.pdf	422295 991b34db757d634f0b4365789c10ddf4bd2 4d761	no	2
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	32108 a92ee33dcebe4bcb2f8e118b50b76c566d5 c8d56	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			955345		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) MIPFP147C
In re Application of: Toshie IMAI Application No.: 12/590,586 Filed: November 10, 2009 For: DETERMINATION OF MAIN OBJECT ON IMAGE AND IMPROVEMENT OF IMAGE QUALITY ACCORDING TO MAIN OBJECT The owner*, <u>Seiko Epson Corporation</u>, of <u>100</u> percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term prior patent No. <u>US 7,668,365 B2</u> as the term of said prior patent is defined in 35 U.S.C. 154 and 173, and as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later: - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. Check either box 1 or 2 below, if appropriate. 1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. 2. ☒ The undersigned is an attorney or agent of record. Reg. No. <u>32043</u> <u>/Peter B. Martine/</u> Signature <u>August 29, 2011</u> Date <u>Peter B. Martine</u> Typed or printed name <u>408-749-6902</u> Telephone Number ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. *Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP § 324.	

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/590,586		Filing Date 11/10/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☒ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	330			
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =			X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
			TOTAL			TOTAL	330			
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			(Column 3)		SMALL ENTITY OR OTHER THAN SMALL ENTITY		
AMENDMENT	08/29/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X \$ =		OR	X \$2= 0	
	Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X \$ =		OR	X \$220= 0	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0	
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										
Legal Instrument Examiner: /GLORIA TRAMMELL/										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/590,586	11/10/2009	Toshie Imai	MIPFP147C

CONFIRMATION NO. 2020

POA ACCEPTANCE LETTER

25920
MARTINE PENILLA & GENCARELLA, LLP
710 LAKEWAY DRIVE
SUITE 200
SUNNYVALE, CA 94085



Date Mailed: 09/06/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/29/2011.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/atesfai/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Application Number 	Application/Control No. 12/590,586	Applicant(s)/Patent under Reexamination IMAI, TOSHIE	
Document Code - DISQ		Internal Document – DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 29 AUG 2011	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

JAB

U.S. Patent and Trademark Office



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Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshie Imai	MIPEP147C	2020

25920	7590	12/27/2011
MARTINE PENILLA GROUP, LLP		
710 LAKEWAY DRIVE		
SUITE 200		
SUNNYVALE, CA 94085		

EXAMINER	
TRAN, PHUOC	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
12/27/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/590,586	IMAI, TOSHIE	
	Examiner	Art Unit	
	PHUOC TRAN	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 29 August 2011.

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 15-26 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 15-26 is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____.
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) ☐ Notice of Informal Patent Application
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date ____.	6) ☐ Other: ____.

1. Applicant's arguments filed 8/29/2011 have been fully considered but they are not persuasive.

Applicant argues that the Bolle reference does not disclose at least the claimed features of 1) determining whether or not a main object includes at least a human face, and 2) adjusting the image quality of the main object using the acquired correction conditions.

Bolle et al disclose, at column 4, lines 16-25, determining whether or not a main object includes at least a human face.

Bolle et al disclose, at column 5, lines 28-45, adjusting the image quality of the main object using the acquired correction conditions.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 15-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Bolle et al (6,301,440).

As to claim 15, Bolle et al disclose a computer implemented method of image processing, the method comprising:

determining a main object in an image, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face (col. 4, lines 16-25);

acquiring properties of the determined main object (col. 4, lines 16-44);

acquiring correction conditions corresponding to the acquired properties (col. 4, lines 16-63); and

adjusting image quality of the main object using the acquired correction conditions (col. 5, lines 28-45).

As to claim 16, Bolle et al disclose wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face (col. 6, lines 35-42, col. 7, lines 34-51).

Claims 17-26 recite limitations which are similar to those of claims 15-16. Therefore, they are rejected for the same reasons as claims 15-16.

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuoc Tran whose telephone number is (571) 272-7399. The examiner can normally be reached on MON-FRI.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on (571) 272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Phuoc Tran/
Primary Examiner, Art Unit 2624

<i>Search Notes</i> 	Application/Control No. 12590586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE
	Examiner Phuoc Tran	Art Unit 2624

SEARCHED			
Class	Subclass	Date	Examiner
382	118, 165, 167, 274, 286, 291	4/13/11	PT
Updated search		12/1/2011	PT

SEARCH NOTES		
Search Notes	Date	Examiner

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL **(Submitted Only via EFS-Web)**

Application Number	12590586	Filing Date	2009-11-10	Docket Number (if applicable)	MIPFP147C	Art Unit	2624
First Named Inventor	Toshie IMAI			Examiner Name	P. Tran		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No. 500805

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Peter B. Martine/	Date (YYYY-MM-DD)	2012-03-27
Name	Peter B. Martine	Registration Number	32043

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>In re</i> application of:	)	
	)	Docket No. MIPFP147C
Toshie IMAI	)	
	)	Examiner: P. Tran
Application No. 12/590,586	)	
	)	Group Art Unit: 2624
Filed: November 10, 2009	)	
	)	Date: March 27, 2012
For: DETERMINATION OF MAIN OBJECT	)	
ON IMAGE AND IMPROVEMENT OF	)	Confirmation No. 2020
IMAGE QUALITY ACCORDING TO	)	
MAIN OBJECT	)	
	)	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant submits this paper in response to the Final Office Action dated December 27, 2011, and in conjunction with the Request for Continued Examination (RCE) being concurrently filed. Please amend this application as follows:

The **Amendments to the Claims** made herein are reflected in the **Listing of Claims**, which begins on page 2 of this paper.

Applicant's **Remarks** begin on page 5 of this paper.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-14 (Canceled).

Claim 15 (Currently Amended): A method of image processing, the method comprising:
determining a main object in an image generated by an image generating apparatus,
wherein the main object includes at least a human face, and wherein the determining of the
main object is implemented by determining whether the image includes the human face;
acquiring properties of the determined main object;
acquiring correction conditions corresponding to the acquired properties; and
adjusting image quality of the main object using the acquired correction conditions,
wherein each operation of the method of image processing is executed by a computer.

Claim 16 (Previously Presented): The method in accordance with claim 15, wherein the
correction conditions are different when the main object is determined as a night time scene
and a human face and when the main object is determined as a human face.

Claim 17 (Currently Amended): A method of image processing, the method comprising:
determining a main object in an image generated by an image generating apparatus,
wherein the main object includes at least a human face, and wherein the determining of the
main object is implemented by determining whether the image includes the human face; and
adjusting image quality of the main object using correction conditions corresponding
to properties of the determined main object,
wherein each operation of the method of image processing is executed by a computer.

Claim 18 (Previously Presented): The method in accordance with claim 17, wherein the
correction conditions are different when the main object is determined as a night time scene
and a human face and when the main object is determined as a human face.

Claim 19 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face;

a property acquirer configured to acquire properties of the determined main object;

a correction condition acquirer configured to acquire correction conditions corresponding to the acquired properties; and

an image quality adjuster configured to adjust image quality of the main object using the acquired correction conditions.

Claim 20 (Previously Presented): The image processing apparatus in accordance with claim 19, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 21 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face; and

an image quality adjuster configured to adjust image quality of the main object using correction conditions corresponding to properties of the determined main object.

Claim 22 (Previously Presented): The image processing apparatus in accordance with claim 21, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 23 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein, the computer readable code comprising:

computer readable code for determining a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face;

computer readable code for acquiring properties of the determined main object;

computer readable code for acquiring correction conditions corresponding to the acquired properties; and

computer readable code for adjusting image quality of the main object using the acquired correction conditions.

Claim 24 (Previously Presented): The computer program product in accordance with claim 23, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 25 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein, the computer readable code comprising:

computer readable code for determining a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face; and

computer readable code for adjusting image quality of the main object using correction conditions corresponding to properties of the determined main object.

Claim 26 (Previously Presented): The computer program product in accordance with claim 25, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

REMARKS

Claims 15-26 are pending in this application.

Applicant has amended claims 15, 17, 19, 21, 23, and 25. The changes to these claims made herein do not introduce any new matter.

Rejection Under 35 U.S.C. § 102

Applicant respectfully requests reconsideration of the rejection of claims 15-26 under 35 U.S.C. § 102(b) as being anticipated by *Bolle et al.* (“*Bolle*”) (US 6,301,440 B1). As will be explained in more detail below, the *Bolle* reference does not disclose each and every feature of the presently claimed subject matter.

The *Bolle* reference discloses a technique for automatically setting shooting conditions at the time of shooting with a digital camera. In particular, *Bolle* determines whether the object is either a portrait or a group shot, whether the object is a backlit image or not, and whether the object is a night scene or not. Based on the determination, *Bolle* sets the image acquisition controls of a camera. In accordance with the disclosed technique, *Bolle* sets the image acquisition controls for camera performance (focal position adjustment, shutter speed adjustment), and no controls are set with regard to image quality.

In the Amendment filed on August 29, 2011, Applicant argued that the *Bolle* reference does not disclose at least the claimed features of 1) determining whether or not a main object includes at least a human face, and 2) adjusting the image quality of the main object using the acquired correction conditions. In response to Applicant’s arguments, the Examiner has maintained the position that the *Bolle* reference discloses both of features 1) and 2) set forth above. See the Final Office Action at page 2.

Considering first feature 1), Applicant acknowledges that *Bolle* teaches person detection and human face detection; however, the person detection shown by *Bolle* is carried

out at the time of image shooting, and is therefore different from person detection performed using a shot image after shooting. Indeed, the *Bolle* technique relates to a digital camera whereas the claimed subject matter relates to image processing, which is typically carried out in an image processing apparatus.

Turning to feature 2), *Bolle* discloses a procedure for determining image *shooting* parameters; however, *Bolle* does not disclose (or suggest) a procedure for determining image *processing* parameters.

In summary, *Bolle* discloses a technique for setting image *shooting* parameters *at the time of image shooting* by a shooting device, e.g., a digital camera. This technique does not constitute an image adjustment technique that is implemented on a shot image by an image processing apparatus. More specifically, before shooting the shot, *Bolle* carries out scene determination to decide the conditions for generating the image data that is to be generated by the shooting. At that point, *i.e.*, before the shot is taken, a shot image to be output does not exist. Applicant respectfully submits that it is not reasonable to characterize *Bolle* as disclosing the determination of a variety of parameters depending on image data that has yet to be acquired, and that it is not possible to realize image processing in *Bolle* based on a shot image as in the case of the claimed subject matter.

To distinguish further the claimed subject matter from *Bolle*, each of independent claims 15, 17, 19, 21, 23, and 25 has been amended to specify that the main object is an object “in an image generated by an image generating apparatus.” Thus, the presently claimed operation of determining a main object in an image (or the corresponding determining module or code for determining) involves determining the main object in a shot image. Further, with this change, the claimed operation of adjusting image quality (or the corresponding image quality adjuster or code for adjusting) involves adjusting the image

quality of a shot image. As discussed above, in contrast with the presently claimed subject matter, the *Bolle* reference relates to the setting of image shooting parameters at the time of image shooting by a shooting device, e.g., a digital camera.

Accordingly, independent claims 15, 17, 19, 21, 23, and 25, as amended herein, are patentable under 35 U.S.C. § 102(b) over *Bolle*. Claims 16, 18, 20, 22, 24, and 26, which depend from claims 15, 17, 19, 21, 23, and 25, respectively, are likewise patentable under 35 U.S.C. § 102(b) over *Bolle* for at least the same reasons set forth above with regard to the applicable independent claim.

Conclusion

In view of the foregoing, Applicant respectfully requests reconsideration and reexamination of claims 15-26, as amended herein, and submits that these claims are in condition for allowance. Accordingly, a notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 749-6902. If any additional fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. MIPEP147C).

Respectfully submitted,
MARTINE PENILLA GROUP, L.L.P.

/Peter B. Martine/

Peter B. Martine
Reg. No. 32,043

710 Lakeway Drive, Suite 200
Sunnyvale, California 94085
Customer Number 25920

Electronic Patent Application Fee Transmittal				
Application Number:		12590586		
Filing Date:		10-Nov-2009		
Title of Invention:		Determination of main object on image and improvement of image quality according to main object		
First Named Inventor/Applicant Name:		Toshie Imai		
Filer:		Peter B. Martine		
Attorney Docket Number:		MIPFP147C		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for continued examination	1801	1	930	930
Total in USD (\$)				930

Electronic Acknowledgement Receipt	
EFS ID:	12407955
Application Number:	12590586
International Application Number:	
Confirmation Number:	2020
Title of Invention:	Determination of main object on image and improvement of image quality according to main object
First Named Inventor/Applicant Name:	Toshie Imai
Customer Number:	25920
Filer:	Peter B. Martine
Filer Authorized By:	
Attorney Docket Number:	MIPFP147C
Receipt Date:	27-MAR-2012
Filing Date:	10-NOV-2009
Time Stamp:	21:40:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 930
RAM confirmation Number	7462
Deposit Account	500805
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Request for Continued Examination (RCE)	MIPFP147C_RCE_eFiled.pdf	697776 c21158ccedf424ea784ca97f4cd40436e5e76a12	no	3
Warnings:					
Information:					
2	Amendment Submitted/Entered with Filing of CPA/RCE	MIPFP147C_AmdtwithRCE_eFiled.pdf	46271 e5a6929c2d55994e41ddff6cb81efc15bc6de1a2	no	7
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30319 cfla807acce24af151e02f516a4ab1981b5e6eac	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			774366		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/590,586		Filing Date 11/10/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =		OR	X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	03/27/2012	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X \$ =		OR	X \$60=	0
	Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X \$ =		OR	X \$250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
	* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

Legal Instrument Examiner:
/MARTHA NEWMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshie Imai	MIPEP147C	2020
25920 7590 04/16/2012 MARTINE PENILLA GROUP, LLP 710 LAKEWAY DRIVE SUITE 200 SUNNYVALE, CA 94085			EXAMINER TRAN, PHUOC	
			ART UNIT 2624	PAPER NUMBER
			MAIL DATE 04/16/2012	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/590,586	IMAI, TOSHIE	
	Examiner	Art Unit	
	PHUOC TRAN	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 27 March 2012.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 15-26 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 15-26 is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____.
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) ☐ Notice of Informal Patent Application
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date ____.	6) ☐ Other: ____.

1. Applicant's arguments filed 03/27/2012 have been fully considered but they are not persuasive.

Applicant argues that the claimed invention distinguishes from Bolle reference in that the main object is an object generated by an image generating apparatus.

Bolle reference discloses, at column 2, line 64 through column 3, line 2, that image acquisition device 102 acquires an image which includes a main object. The scene analysis 103 then extracts certain information about the image acquired by the image acquisition device 102. Bolle reference discloses, at column 4, line 16 through column 36, line 2, that the main object such as a human face in the image is determined.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 15-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Bolle et al (6,301,440).

As to claim 15, Bolle et al disclose a computer implemented method of image processing, the method comprising:

determining a main object in an image generated by an image generating apparatus (e.g., an image is generated by image acquisition device 102, see col. 2, line 64 - col. 3, line 2, col. 3, lines 20-30), wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face (col. 4, lines 16-25, lines 28-36);

acquiring properties of the determined main object (col. 4, lines 16-44);
acquiring correction conditions corresponding to the acquired properties (col. 4, lines 16-63); and
adjusting image quality of the main object using the acquired correction conditions (col. 5, lines 28-45, col. 7, lines 36-41),
wherein each operation of the method of image processing is executed by a computer (Fig. 1, col. 3, lines 29-30).

As to claim 16, Bolle et al disclose wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face (col. 6, lines 35-42, col. 7, lines 34-51).

Claims 17-26 recite limitations which are similar to those of claims 15-16. Therefore, they are rejected for the same reasons as claims 15-16.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuoc Tran whose telephone number is (571) 272-7399. The examiner can normally be reached on MON-FRI.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on (571) 272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2624

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Phuoc Tran/
Primary Examiner, Art Unit 2624

<i>Search Notes</i> 	Application/Control No. 12590586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE
	Examiner Phuoc Tran	Art Unit 2624

SEARCHED			
Class	Subclass	Date	Examiner
382	118, 165, 167, 274, 286, 291	4/13/11	PT
Updated search		12/1/2011	PT
Udated search		04/09/2012	PT

SEARCH NOTES		
Search Notes	Date	Examiner

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>In re</i> application of:	)	
	)	Docket No. MIPFP147C
Toshie IMAI	)	
	)	Examiner: P. Tran
Application No. 12/590,586	)	
	)	Group Art Unit: 2624
Filed: November 10, 2009	)	
	)	Date: July 16, 2012
For: DETERMINATION OF MAIN OBJECT	)	
ON IMAGE AND IMPROVEMENT OF	)	Confirmation No. 2020
IMAGE QUALITY ACCORDING TO	)	
MAIN OBJECT	)	
	)	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Madam:

Applicant submits this paper in response to the Office Action dated April 16, 2012.

Please amend this application as follows:

The **Amendments to the Claims** made herein are reflected in the **Listing of Claims**, which begins on page 2 of this paper.

Applicant's **Remarks** begin on page 6 of this paper.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-14 (Canceled).

Claim 15 (Currently Amended): A method of image processing, the method comprising:
determining a main object in an image generated by an image generating apparatus,
wherein the main object includes at least a human face, and wherein the determining of the
main object is implemented by determining whether the image includes the human face;
acquiring properties of the determined main object;
acquiring correction conditions corresponding to the acquired properties; and
adjusting image quality of the main object using the acquired correction conditions,
wherein a parameter used in adjusting the image quality is a highlight, a shadow, brightness,
contrast, color balance, or memory color, and
wherein each operation of the method of image processing is executed by one of a
personal computer, a printer, or a display device.

Claim 16 (Previously Presented): The method in accordance with claim 15, wherein the
correction conditions are different when the main object is determined as a night time scene
and a human face and when the main object is determined as a human face.

Claim 17 (Currently Amended): A method of image processing, the method comprising:
determining a main object in an image generated by an image generating apparatus,
wherein the main object includes at least a human face, and wherein the determining of the
main object is implemented by determining whether the image includes the human face; and
adjusting image quality of the main object using correction conditions corresponding
to properties of the determined main object, wherein a parameter used in adjusting the image
quality is a highlight, a shadow, brightness, contrast, color balance, or memory color, and
wherein each operation of the method of image processing is executed by one of a
personal computer, a printer, or a display device.

Claim 18 (Previously Presented): The method in accordance with claim 17, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 19 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face;

a property acquirer configured to acquire properties of the determined main object;

a correction condition acquirer configured to acquire correction conditions corresponding to the acquired properties; and

an image quality adjuster configured to adjust image quality of the main object using the acquired correction conditions, wherein a parameter used by the image quality adjuster to adjust image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color, and

wherein the image processing apparatus is either a personal computer or a printer or a display device.

Claim 20 (Previously Presented): The image processing apparatus in accordance with claim 19, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 21 (Currently Amended): An image processing apparatus comprising:

one or more processors;

memory;

a determining module configured to determine a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining module determines whether the image includes the human face; and

an image quality adjuster configured to adjust image quality of the main object using correction conditions corresponding to properties of the determined main object, wherein a parameter used by the image quality adjuster to adjust image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color, and

wherein the image processing apparatus is either a personal computer or a printer or a display device.

Claim 22 (Previously Presented): The image processing apparatus in accordance with claim 21, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 23 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein for execution by either a personal computer or a printer or a display device, the computer readable code comprising:

computer readable code for determining a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face;

computer readable code for acquiring properties of the determined main object;

computer readable code for acquiring correction conditions corresponding to the acquired properties; and

computer readable code for adjusting image quality of the main object using the acquired correction conditions, wherein a parameter used in adjusting the image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color.

Claim 24 (Previously Presented): The computer program product in accordance with claim 23, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

Claim 25 (Currently Amended): A computer program product for image processing comprising:

a non-transitory computer readable medium storing computer readable code therein for execution by either a personal computer or a printer or a display device, the computer readable code comprising:

computer readable code for determining a main object in an image generated by an image generating apparatus, wherein the main object includes at least a human face, and wherein the determining of the main object is implemented by determining whether the image includes the human face; and

computer readable code for adjusting image quality of the main object using correction conditions corresponding to properties of the determined main object, wherein a parameter used in adjusting the image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color.

Claim 26 (Previously Presented): The computer program product in accordance with claim 25, wherein the correction conditions are different when the main object is determined as a night time scene and a human face and when the main object is determined as a human face.

REMARKS

Claims 15-26 are pending in this application.

Applicant has amended claims 15, 17, 19, 21, 23, and 25. The changes to these claims made herein do not introduce any new matter.

Rejection Under 35 U.S.C. § 102

Applicant respectfully requests reconsideration of the rejection of claims 15-26 under 35 U.S.C. § 102(b) as being anticipated by *Bolle et al.* (“*Bolle*”) (US 6,301,440 B1). As will be explained in more detail below, the *Bolle* reference does not disclose each and every feature of the presently claimed subject matter.

The *Bolle* reference discloses a technique for automatically setting shooting conditions at the time of shooting with a camera, e.g., a digital camera. In particular, *Bolle* determines whether the object is either a portrait or a group shot, whether the object is a backlit image or not, and whether the object is a night scene or not. Based on the determination, *Bolle* sets the image acquisition controls of the camera. In accordance with the disclosed technique, *Bolle* sets the image acquisition controls for camera performance, e.g., focal position adjustment, shutter speed adjustment, and no controls are set with regard to image quality.

In response to the Amendment filed on March 27, 2012, the Examiner states that 1) *Bolle* discloses that image acquisition device 102 acquires an image which includes a main object, 2) the scene analysis 103 extracts certain information about the image acquired by image acquisition device 102, and 3) *Bolle* discloses that the main object such as a human face in the image is determined. See the Office Action at page 2.

With regard to item 1), it is clear from description in the *Bolle* reference that image acquisition device 102 is part of a camera. Indeed, the Abstract of the *Bolle* reference states that a “system and method use computer image processing for setting the parameters for an

image acquisition device *of a camera*.” (Emphasis added.) Moreover, the stated object of the *Bolle* reference is to enable optimal settings for a camera. See column 2, lines 1-10.

Further, the person detection and face detection taught in the *Bolle* reference are used for scene determination that is then used as the conditions under which the shooting parameters are decided. Thus, the person detection and face detection taught in *Bolle* are not used for image processing as in the claimed subject matter. More specifically, *Bolle* describes a technique for setting shooting parameters, e.g., focus setting, exposure amount, and shutter speed, which is carried out at the time an image is shot by an imaging device based on the scene determined upon shooting. The technique shown by *Bolle* does not involve adjusting the image quality of a main object in an image based on the characteristics of the shot image. At the time *Bolle* sets the generation conditions for image data to be generated by shooting an image, an image has yet to be generated. Thus, because no shot image exists, it is not technically possible for *Bolle* to determine various parameters for image processing to be performed on a shot image based on the shot image itself.

As explained above, *Bolle* discloses a sequence for determining shooting parameters in a camera, e.g. a digital camera, at the time of image shooting. In contrast with the Examiner’s characterization, the technique for determining shooting parameters of *Bolle* does not correspond to the claimed image quality adjustment technique for adjusting the image quality of image data acquired by image shooting.

To distinguish further the claimed subject matter from that shown by *Bolle*, independent claim 15 has been amended to specify that the method of image processing is carried out by one of a personal computer, a printer, or a display device. In contrast with the presently claimed subject matter, the technique of *Bolle* is to be used with a camera, e.g., a digital camera, at the time of image shooting. Further, claim 15 has been amended to specify that one parameter used in adjusting the image quality is a highlight, a shadow, brightness,

contrast, color balance, or memory color. The claimed parameter used in adjusting the image quality is different from the shooting (image capture) parameters used in the system of *Bolle*. In this regard, Applicant notes that the “imaging parameters” shown in Figure 3 of the *Bolle* reference (see reference number 107) are all parameters that are used in connection with the shooting (image capture) process.

Thus, for at least the foregoing reasons, the *Bolle* reference does not disclose each and every feature of present claim 15.

Applicant has amended each of independent claims 17, 19, 21, 23, and 25 along the same lines that claim 15 has been amended. As such, the patentability arguments set forth above with regard to present claim 15 also apply to present claims 17, 19, 21, 23, and 25.

Accordingly, independent claims 15, 17, 19, 21, 23, and 25, as amended herein, are patentable under 35 U.S.C. § 102(b) over *Bolle*. Claims 16, 18, 20, 22, 24, and 26, which depend from claims 15, 17, 19, 21, 23, and 25, respectively, are likewise patentable under 35 U.S.C. § 102(b) over *Bolle* for at least the same reasons set forth above with regard to the applicable independent claim.

Conclusion

In view of the foregoing, Applicant respectfully requests reconsideration and reexamination of claims 15-26, as amended herein, and submits that these claims are in condition for allowance. Accordingly, a notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 749-6902. If any additional fees are due in

Application No. 12/590,586
Amendment dated July 16, 2012
Response to Office Action mailed April 16, 2012

connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. MIPFP147C).

Respectfully submitted,
MARTINE PENILLA GROUP, L.L.P.

/Peter B. Martine/

Peter B. Martine
Reg. No. 32,043

710 Lakeway Drive, Suite 200
Sunnyvale, California 94085
Customer Number 25920

Electronic Acknowledgement Receipt	
EFS ID:	13266240
Application Number:	12590586
International Application Number:	
Confirmation Number:	2020
Title of Invention:	Determination of main object on image and improvement of image quality according to main object
First Named Inventor/Applicant Name:	Toshie Imai
Customer Number:	25920
Filer:	Peter B. Martine
Filer Authorized By:	
Attorney Docket Number:	MIPFP147C
Receipt Date:	16-JUL-2012
Filing Date:	10-NOV-2009
Time Stamp:	23:09:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	MIPFP147C_AmdtafterRCE_efiled.pdf	52422 77c2108c90e0e5c0910778e66da0e0379a847fcc	no	9

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/590,586		Filing Date 11/10/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)		RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =		OR	X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	07/16/2012	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)		
Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X \$ =		OR	X \$60=	0	
Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X \$ =		OR	X \$250=	0	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)		
Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =		
Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =		
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.										
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".										
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/ANDREA FREEMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

25920 7590 09/13/2012
MARTINE PENILLA GROUP, LLP
710 LAKEWAY DRIVE
SUITE 200
SUNNYVALE, CA 94085

EXAMINER

TRAN, PHUOC

ART UNIT

PAPER NUMBER

2624

DATE MAILED: 09/13/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshie Imai	MIPFP147C	2020

TITLE OF INVENTION: DETERMINATION OF MAIN OBJECT ON IMAGE AND IMPROVEMENT OF IMAGE QUALITY ACCORDING TO MAIN OBJECT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	12/13/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25920 7590 09/13/2012
MARTINE PENILLA GROUP, LLP
710 LAKEWAY DRIVE
SUITE 200
SUNNYVALE, CA 94085

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/590,586	11/10/2009	Toshie Imai	MIPFP147C	2020
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TITLE OF INVENTION: DETERMINATION OF MAIN OBJECT ON IMAGE AND IMPROVEMENT OF IMAGE QUALITY ACCORDING TO MAIN OBJECT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	12/13/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, PHUOC	2624	382-167000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshie Imai	MIPFP147C	2020

25920	7590	09/13/2012
MARTINE PENILLA GROUP, LLP		
710 LAKEWAY DRIVE		
SUITE 200		
SUNNYVALE, CA 94085		

EXAMINER	
TRAN, PHUOC	

ART UNIT	PAPER NUMBER
2624	

DATE MAILED: 09/13/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 74 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 74 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/590,586	IMAI, TOSHIE	
	Examiner	Art Unit	
	PHUOC TRAN	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to communication(s) filed on 07/16/2012.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 15-26.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date ____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date ____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | <ol style="list-style-type: none"> 5. ☐ Notice of Informal Patent Application 6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date ____. 7. ☐ Examiner's Amendment/Comment 8. ☐ Examiner's Statement of Reasons for Allowance 9. ☐ Other ____. |
|---|---|

/Phuoc Tran/
Primary Examiner, Art Unit 2624

<i>Search Notes</i> 	Application/Control No. 12590586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE
	Examiner Phuoc Tran	Art Unit 2624

SEARCHED			
Class	Subclass	Date	Examiner
382	118, 165, 167, 274, 286, 291	4/13/11	PT
Updated search		12/1/2011	PT
Udated search		04/09/2012	PT
Updated search		08/30/2012	PT

SEARCH NOTES		
Search Notes	Date	Examiner

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
PGPUB text search		09/10/2012	PT

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Issue Classification 	Application/Control No. 12590586	Applicant(s)/Patent Under Reexamination IMAI, TOSHIE
	Examiner PHUOC TRAN	Art Unit 2624

ORIGINAL						INTERNATIONAL CLASSIFICATION												
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED							
382		167				G	0	6	K	9 / 00 (2006.01.01)								
CROSS REFERENCE(S)																		
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	
382	274	291																

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	3	17												
	2	4	18												
	3	5	19												
	4	6	20												
	5	7	21												
	6	8	22												
	7	9	23												
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	9	11	25												
	10	12	26												
	11														
	12														
	13														
	14														
1	15														
2	16														

NONE		Total Claims Allowed:	
		12	
(Assistant Examiner)	(Date)		
/PHUOC TRAN/ Primary Examiner.Art Unit 2624	09/10/2012	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	14

EAST Search History**EAST Search History (Interference)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(image and object and face and acquir\$3 and correct\$5 and propert\$3 and condition and quality).clm.	US-PGPUB	OR	ON	2012/09/10 13:59
L2	5	(image and object and face and acquir\$3 and correct\$5 and condition and quality).clm.	US-PGPUB	OR	ON	2012/09/10 14:00

9/ 10/ 2012 2:00:43 PM**C:\ Users\ ptran\ Documents\ EAST\ Workspaces\ 12590586a.wsp**

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25920 7590 09/13/2012
MARTINE PENILLA GROUP, LLP
710 LAKEWAY DRIVE
SUITE 200
SUNNYVALE, CA 94085



Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Diane Schwanbeck (Depositor's name)
[Signature] (Signature)
 December 3, 2012 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	11/10/2009	Toshio Imai	MIPFP147C	2020

TITLE OF INVENTION: DETERMINATION OF MAIN OBJECT ON IMAGE AND IMPROVEMENT OF IMAGE QUALITY ACCORDING TO MAIN OBJECT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	12/13/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, PHUOC	2624	382-167000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. Martine Penilla
Group, LLP

2. _____

3. _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Seiko Epson Corporation

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Tokyo, Japan

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
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☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☒ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-0805 (enclose an extra copy of this form).

(MIPFP147C)

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature

[Signature]

Typed or printed name

Peter B. Martine

Date

12/10/2012 12/10/2012 12/10/2012
01 12/10/2012 02 12/10/2012 03 12/10/2012
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32,043

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/590,586	01/15/2013	8355574	MIPFP147C	2020

25920 7590 12/22/2012
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ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 74 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Toshie Imai, Nagano-ken, JAPAN;

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