

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,

Petitioner,

v.

138 EAST LCD ADVANCEMENTS LIMITED,

Patent Owner.

Case No. IPR2024-00956

U.S. Patent No. 8,355,574

**EXPERT DECLARATION OF KENNETH PARULSKI IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW**

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I. INTRODUCTION AND SUMMARY OF OPINIONS

1. I, Kenneth Parulski, have been retained as an independent expert by Google LLC (“Petitioner” or “Google”) in connection with an *inter partes* review of U.S. Patent No. 8,355,574 (the “’574 patent”) (Ex. 1001). I have prepared this declaration in connection with Petitioner’s Petition for *Inter Partes* Review. I believe the statements contained in this declaration to be true and correct to the best of my knowledge.

2. I have been asked by Petitioner to provide my opinion on the technology claimed in claims 1-12 of the ’574 patent (the “Challenged Claims”) and whether the Challenged Claims would have been obvious to a person of ordinary skill in the art (“POSITA”) at the time of the earliest claimed priority date of the ’574 patent, which I have been asked to assume is March 8, 2004. This declaration sets forth the opinions I have formed, the conclusions I have reached, and the bases for these opinions and conclusions. Based on my experience, and knowledge of the art at the time of the earliest claimed priority date, it is my opinion that claims 1-12 of the ’574 patent would have been obvious based on the asserted grounds discussed below. A POSITA would have found it obvious to combine the prior art references I cite and would have been motivated to do so before the priority date. I was not asked to provide any opinions that are not expressed herein.

II. BACKGROUND AND QUALIFICATIONS

3. I believe that I am well qualified to serve as a technical expert in this matter based upon my educational background, career history, publications, and other relevant qualifications, which I summarize below. I understand that my curriculum vitae, which includes a more detailed summary of my background, experience, patents, and publications, is attached as Exhibit 1004.

4. I am currently the Chief Scientist and Managing Member at aKAP Innovation, LLC.

5. I received a Master of Science degree in Electrical Engineering and a Bachelor of Science degree in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology in 1980. I completed my master's thesis research while working at Motorola Corporate Research Labs from 1978 through 1980, where I developed a system for wirelessly transmitting a series of digital images from a moving vehicle over an FM radio communications link to a base station.

6. I joined the Kodak Research Labs division of Eastman Kodak Company in 1980, where I began developing and implementing image processing algorithms. This work included developing and testing algorithms which increased the sharpness in certain areas of an image and decreased the sharpness in other areas of an image.

7. Beginning in 1984, I led a project to develop the world's first color megapixel digital camera system prototype. This included implementing color image processing algorithms, which compensated for the color filter array pattern and the color responses of the red, green, and blue pixels of the Kodak M1 megapixel CCD image sensor. Prints made using this system were exhibited at the Photokina trade show in Cologne, Germany in 1986, in Kodak's first public demonstration of its digital photography technology. Photokina was the world's largest trade show for the imaging industry.

8. Beginning in 1987, I led a team which developed a digital image processing VLSI chipset for digital still and video cameras, which processed the output signal from various Kodak color CCD image sensors. This VLSI chipset performed extensive real-time digital image processing, including color correction processing to improve the color balance and color saturation of the images, as well as digital image processing to increase the sharpness of the images. These digital image processing integrated circuits were sold by Kodak for nearly a decade.

9. From approximately 1986 through 1992, I served as Kodak's technical representative to the Advanced Television Research Program (ATRP) at MIT, which developed the "source adaptive" video compression technologies now used in most HDTV transmission systems. During this period, I met regularly with leading video technologists from major television networks (*e.g.*, ABC, PBS) and

video equipment suppliers (*e.g.*, Ampex, General Instruments) who co-sponsored ATRP, along with the MIT professors and graduate students conducting the ATRP research. This provided me with an in-depth understanding of video production, post-production (*e.g.*, editing), and distribution processes and technologies. As part of this project, I became a named inventor on a television decoding patent which was licensed by MIT to many HDTV manufacturers.

10. From approximately 1990 until my retirement from Kodak in 2012, I was involved in the research and development of Kodak's consumer digital cameras. Beginning in 1992, I served as architect of Kodak's first generation of consumer-oriented digital still cameras, which included the Kodak DC40 camera as well as the Apple QuickTake 100 camera, the first digital camera marketed by Apple. In my role as digital camera architect at Kodak and through my participation in various projects, I acquired experience in all aspects of digital camera design, including the selection of hardware and software components such as lenses, image sensors, digital image processors, and image processing algorithms.

11. Beginning in 1992, I worked with other digital photography experts at Kodak, as well as other companies such as Fujifilm, Canon, and Sony, to develop and standardize the image file formats used in digital cameras and digital photography systems. These image file formats include the Exif image format,

which has been widely used by digital cameras and smartphones to store digital images for more than 25 years. Each Exif image file contains the image data which represents the photograph along with numerous types of image metadata, which provide information from the digital camera which captured the photograph. Examples of image metadata include the camera make and model, capture date and time, camera settings, scene type, subject location, and GPS location.

12. From 2001 to 2009, I served as Kodak Research Fellow and Director, IP & Standards in the Consumer Digital Group. In that position, I was the technical leader of Kodak's digital camera patent licensing program, where I analyzed and provided advice on a very large number of patents involving digital cameras and digital photography systems.

13. From 2010 to 2012, I held the position of Kodak Research Fellow and Chief Scientist in the Digital Cameras and Devices Division. In that role, I invented and prototyped new digital photography systems, including imaging systems using wireless imaging devices and cloud storage and image processing technologies. This included imaging systems that processed, combined, and displayed images captured using a camera phone along with custom content (*e.g.*, graphics and templates) provided from a custom content database by a web server, based on the geographic location of the camera phone.

14. I was employed by Kodak for a total of more than thirty years, during which time I followed the literature closely, attended numerous industry conferences where I discussed the state of the art with engineers working in the field, and supervised the work of numerous engineers performing research and development in the field of digital photography.

15. In 2012, following my retirement from Kodak, I founded aKAP Innovation, LLC. As Chief Scientist and Managing Member, I provide innovation and digital photography related consulting services and participate in the development of ISO (“International Organization for Standardization”) standards for digital photography. I am also Co-founder of Tourblend Innovations, LLC, which has developed a mobile platform that utilizes location based content to provide guided tours of natural, cultural, and historic attractions using a GPS enabled smartphone application.

16. I am a named inventor on more than 225 issued United States patents. Most of these inventions relate to digital cameras, wireless imaging devices, and digital photography systems and have been licensed by Kodak to more than 40 companies for use in digital cameras, smartphones, and photo sharing services.

17. I am the author or co-author of numerous publications, including chapters in leading treatises in the field of digital imaging technology. Among these, I authored the “Digital Photography” chapter in the *Digital Consumer*

Electronics Handbook published by McGraw-Hill in 1997; the “Color Image Processing for Digital Cameras” chapter in the *Digital Color Imaging Handbook* published by CRC Press in 2003; and the “Digital Camera Image Storage Formats” chapter in *Single-Sensor Imaging: Methods and Applications for Digital Cameras*, published by CRC Press in 2008. I have also presented at numerous industry conferences around the world on the subject of digital cameras and digital image processing, including plenary talks at the 2003 PICS Digital Photography Conference and the 2021 Electronic Imaging Symposium.

18. I have received a number of awards in recognition of my achievements in the field of digital imaging technology. For example, in 2001, I received the Eastman Award, Kodak’s top technical honor, for the development of digital cameras. In 2002, I received the Technical Achievement Award from the Photo-Imaging Manufacturing and Distributors Association for “pioneering work in the development of digital imaging technology.” I was the first person to be honored by this photographic association for their contributions to digital photography. In 2008, I received the Achievement Award from the International Imaging Industries Association (I3A) for “significant contributions to the advancement and growth of the imaging industry.”

19. I have served as Chair of the IT10 standards committee for digital photography since 1994. This group provides the officially recognized United

States input for many international standards used by digital cameras, including smartphone cameras. In addition, from March 2007 through February 2013, I was chair of ISO technical committee 42 (ISO/TC42), which is responsible for all international photography standards. In 2013, I was elected chair of the US technical advisory group to ISO/TC42, and was re-elected in 2016, 2019, and 2022. From June 3-7, 2013, I served as head of the US delegation to the 23rd plenary meeting of ISO/TC42, held at the National Museum in Copenhagen, Denmark. From June 2-5, 2015, I served as head of the US delegation to the 24th plenary meeting of ISO/TC42, held in Sapporo, Japan. From June 5-9, 2017, I served as head of the US delegation to the 25th plenary meeting of ISO/TC42, held in Santa Clara, California. From May 13-16, 2019, I served as head of the US delegation to the 26th plenary meeting of ISO/TC42, held in Lisbon, Portugal. From June 4-15, 2021, I served as head of the US delegation to the 27th plenary meeting of ISO/TC42, which was held virtually. From June 19-22, 2023, I served as head of the US delegation to the 28th plenary meeting of ISO/TC42, held in Okayama, Japan.

20. I currently serve as the project leader for ISO standards on digital camera resolution measurements (ISO 12233) and digital camera ISO speed and sensitivity measurements (ISO 12232), as well as the co-project leader for ISO standards on image formats for digital photography (ISO 12234 series), which

includes the standardized Exif and XMP image metadata used in digital image files. This metadata, which is included along with image data in an image file, includes information which identifies, for example, the type of scene captured and the location of the main subject in the scene.

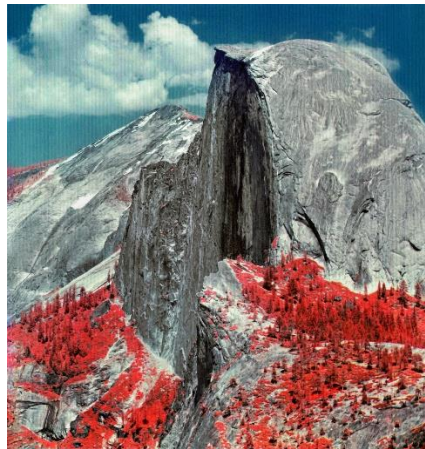
21. I am a Fellow of the Society of Motion Picture and Television Engineers (SMPTE), the global society of media professionals, technologists and engineers. In 2001, Kodak received a Technical Emmy Award for contributions I made to the development of the SMPTE 24P HDTV production standard, which has been used by Hollywood studios for over twenty years to produce movies and television programs.

III. TECHNOLOGY BACKGROUND

A. Early Digital Image Processing and Image Sensors

22. Digital image processing was an active research topic by the late 1960s. To perform digital image processing, each image was sampled and quantized into an array of picture elements, or “pixels”, which were processed by digital computers. This digital image processing research included developing various types of picture coding, to reduce the amount of data needed to transmit each image. For example, a digital linear filter can be applied at the transmitter and an inverse filter can be applied at the receiver. *See* W.F. Schreiber, “Picture coding”, Proceedings of the IEEE, Vol 55, No. 3, March 1967 pp. 320-330.

23. Beginning in 1968, Virginia Norwood conceived and developed the Landsat 1's multispectral scanner (MSS), the first wireless digital camera. The MSS captured and transmitted image data from green, red, and two infrared bands with 6 bits per channel, using a mechanical rocking mirror and an array of 24 detectors. Norwood insisted that the MSS produce and transmit digital data, since she knew that using digital technology made it possible to use computers to analyze the images. Two months before the MSS was launched into space on July 23, 1972, it was tested by taking digital photographs of Yosemite, as shown in the photo below. See <https://www.technologyreview.com/2021/06/29/1025732/the-woman-who-brought-us-the-world/>



Multispectral scanner false-color image of Half Dome in 1972.

24. In 1969, Bell Labs invented the charge-coupled device (CCD) shift register, providing a very low noise structure for storing and reading the signal charge in an image sensor. See W. S. Boyle and G. E. Smith, *Charge Coupled Semiconductor Devices*, Bell Sys. Tech. J. 49 (4), 587–593 (April 1970). In 1973,

Fairchild introduced the CCD201ADC image sensor, the first commercially available interline CCD. This solid-state image sensor included an array of light sensitive photodiodes, arranged in a grid having 100 x 100 pixels, as depicted in the diagram below. See *Preliminary data sheet CCD201 Solid state self-scanning image sensor 100 x 100-element charge coupled device*, Fairchild Integrated Circuits, Jan. 1974, at 1.

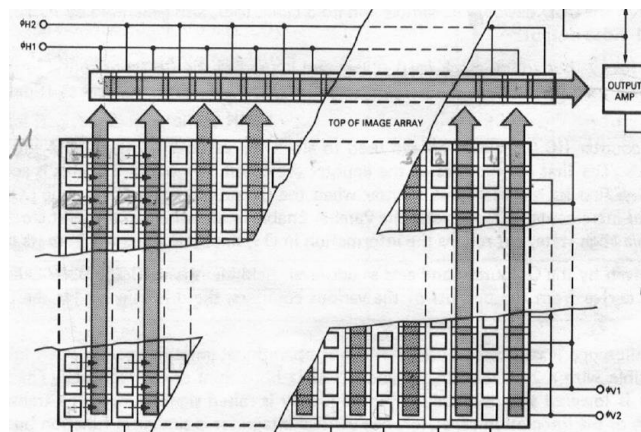


Diagram of Fairchild CCD201ADC image sensor

25. To capture color images using a single image sensor, Peter Dillon and his colleagues at Kodak Research Labs developed integral color filter arrays (CFAs). This was accomplished using a grid of color filters, having the same number of rows and columns as the array of light sensitive pixels on the sensor. Each pixel is covered with a filter that transmits only a specific color. See P. Dillon et al., *Fabrication and performance of color filter arrays for solid-state imagers*, IEEE Trans Electron Devices, vol. ED-25, pp. 97-101 (1978). One such pattern, invented by Bryce Bayer of Kodak in 1974 and described in U.S. Patent No.

3,971,065, titled “Color imaging array,” has been used in almost all digital cameras since the late 1990s. The pattern includes 50% green pixels arranged in a checkerboard, between alternate rows of red and blue pixels, as shown below in an excerpt from Bryce’s Kodak Research Laboratory notebook dated May 24, 1974.



Excerpt from Bryce’s Bayer’s Kodak notebook depicting color pattern

B. Portable Electronic Cameras

26. The first known portable prototype digital camera was designed by Steve Sasson of Kodak between 1974 and 1976. This work led to U.S. Patent No. 4,131,919, titled “Electronic still camera,” and issued to Lloyd and Sasson. Sasson’s prototype digital camera was publicly revealed for the first time in the digital camera history portion of an invited paper which I personally presented in May 2000 in Geneva, Switzerland. See Parulski and Rabbani, “*The Continuing Evolution of Digital Cameras and Digital Photography Systems*,” IEEE International Symposium on Circuits and Systems, Geneva, Switzerland, 2000. This prototype digital camera used the lens and optical viewfinder from a Kodak XL55 Super 8mm film movie camera and the Fairchild CCD201ADC image sensor described earlier. The sensor’s analog output signal was digitized using a 4-

bit A/D converter. The prototype camera, shown in the photo below, captured and stored 10,000 pixel (0.01 Megapixel) black and white still images using a standard Phillips digital cassette tape. The tape recorded 2275 bits/sec, moving at 5-1/4 inches/sec. It took 23 seconds to capture and store each image, and each tape could store up to 30 images.



Steve Sasson holding Kodak portable prototype digital camera

27. On Aug 24, 1981, Sony chairman Akio Morita demonstrated the Sony MAVICA electronic still camera, pictured below, and described the Sony MAVICA system. I personally attended the IEEE Conference on Consumer Electronics in June 1982, where Sony presented their first technical papers describing their MAVICA camera, printer, and transmission system. The MAVICA camera stored up to 50 images on an approximately 2" MAVIPAK floppy disk. See Kihara, et al, "*The electronic still camera – a new concept in photography*," IEEE Trans Consumer Electronics, Vol. CE-28, No. 3, Aug 1982. The MAVICA system also included a video picture printer and a video picture transmitter for sending and receiving images over a telephone line. A slightly

modified version of the “MAVIPAK” was later standardized as the “still video floppy” (SVF).



Sony Mavica electronic still camera, lenses, and still video floppy discs

28. Canon was the first company to sell electronic still cameras in the US, when they introduced the Canon RC-701 electronic camera in 1986. The Canon RC-701 system components included the camera, a player/recorder, a printer, and a unit for transmitting images captured by the camera over a telephone line, as shown in the photo below. See Kriss, et al. “*Critical technologies for electronic still imaging systems*,” SPIE vol. 1082, pp. 157-184 at p. 159 and <http://global.canon/en/c-museum/history/story06.html>.



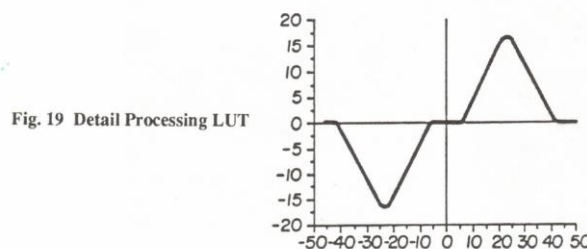
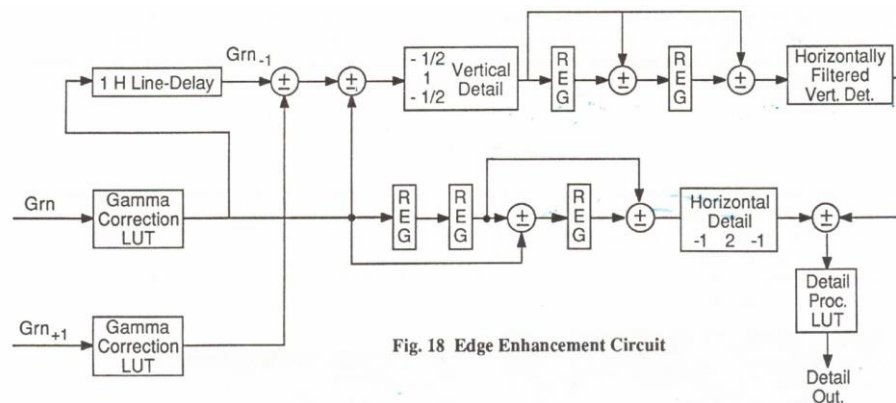
Canon electronic still camera, printer, transmitter, and player

C. Image Processing in Digital Cameras

29. By the early 1990s, it was widely known that digital cameras could process digital images using custom hardware circuitry or using programmable processors which execute software algorithms that were uploaded from digital storage media. For example, the first publication describing an experimental digital camera was made by NHK in 1983. See “*Fully Digitalized Electronic Still Camera*”, Ohnishi, et. al., J. Inst. TV Engrs of Japan, Vol. 37, No. 10 (1983) pp. 863-868. In this camera, images were captured by a color image sensor and stored using a detachable static RAM memory. To view the images, the static RAM memory was detached from the camera and inserted into the playback device. An Intel 8086 microprocessor, located in a playback device, was used to perform digital image processing, including color separation, white balance, and gamma correction.

30. By the mid-1980s, custom digital image processing integrated circuits were being developed for use in digital still and video cameras. See “*A Basic Approach to a Digital Color Camera System*”, O’Keefe, et al., IEEE Trans. on Consumer Electronics, Vol. CE-30, No. 3, Aug. 1984, pp 409-415. These hardwired integrated circuits performed specific digital image processing functions, such as sharpening and color correction, to rapidly produce processed

color images from a single-chip color image sensor. For example, the circuitry depicted below provides edge enhancement, using the high-frequency edge “details” to enhance the sharpness of the images. The vertical and horizontal details are extracted using simple high-pass filters, summed, and non-linearly processed by a “detail processing” lookup table (LUT) to provide an edge enhancement signal. See “A High-Performance Digital Color Video Camera”, Parulski et al., SPIE Vol. 1448 Camera and Input Scanner Systems, 1991 (“Parulski 1991”; Ex. 1013), pp 45-58.



Digital edge enhancement circuitry for modifying image sharpness

31. In 1991, Kodak introduced the Kodak Professional Digital Camera System, later known as the DCS-100, which consisted of a camera back fitted to a Nikon F3 camera and a separate digital storage unit (DSU) connected to the

camera back using a digital interconnect cable, which are pictured below. This was the world's first commercially available D-SLR camera. The DCS-100 camera used a color image sensor, manufactured by Kodak, having approximately 1.3 Megapixels. The DSU included a magnetic hard drive which stored the captured images, and an LCD display which displayed the captured images. The DSU also enabled the user to enter image metadata, such as image titles, captions, and keywords, which were stored in the image file along with the image data, and to download the captured images to a computer. See Kodak Professional Digital Camera Reference Manual, copyright 1991-1992, pp. 4.2-4.10.



Kodak DCS-100 camera back and digital storage unit (DSU)

32. To process the captured images, the Kodak DCS-100 DSU was connected to a computer, such as an Apple MacIntosh computer. The computer used Adobe Photoshop software, along with the Kodak Driver for Adobe

Photoshop software, to download the raw images captured by the Kodak DCS-100 camera and to perform digital image processing. This image processing included color balancing, which permitted the user to select between daylight, tungsten, and fluorescent settings. It also permitted the user to “provide color balancing data by clicking on a white area of a thumbnail or a preview of an image.” See Kodak Professional Digital Camera Reference Manual, copyright 1991-1992, pp. 6-31 – 6.34.

33. The Adobe Photoshop software permitted the user to perform many additional digital image processing operations on the images captured by the Kodak DCS-100 camera. For example, a user could selectively sharpen one portion of the image and selectively blur the rest of the image, as described in the excerpt of the Photoshop 5.0 manual below. See Adobe Photoshop version 5.0 User Guide, 1998 (“Photoshop 5.0”; Ex. 1014), p. 191.

- The focus tools consist of the blur tool and the sharpen tool. The blur tool softens hard edges or areas in an image to reduce detail. The sharpen tool focuses soft edges to increase clarity or focus. For other ways to adjust image sharpness, see “Step 6: Sharpen the image” on page 128, or “Choosing a filter effect” on page 306.



Blurring an image, and sharpening an image

34. The Apple QuickTake 100, pictured below, was introduced in February 1994. I was the architect of the Apple QuickTake 100 and 150 cameras, which were designed by Kodak and marketed by Apple. The QuickTake 100 used a 1 MB internal Flash EPROM memory to store a maximum of 8 “high resolution” images having 640 x 480 pixels, or 32 “standard resolution” images having 320 x 240 pixels. See “*Apple QuickTake 100*” brochure, Apple Computer, Inc. 1994. The digital images were compressed prior to storage in the camera using a software compression algorithm stored in the camera’s firmware memory. The stored images were then transferred to an Apple MacIntosh computer, which performed digital image processing.



Apple QuickTake 100 camera

35. In 1994, I co-authored a paper at the Imaging Science and Technology (IS&T) Conference that detailed the architecture and components of the QuickTake 100 camera. The camera was part of a digital photography system, shown in Figure 1 below, with a computer which performed digital image processing, a display which displayed the processed images, a CD writer which stored and transferred digital images, and a hardcopy printer. The digital camera, shown in Figure 2 below, used a Kodak CCD image sensor with the Bayer color filter to capture “raw” digital images, which were compressed using ADPCM (adaptive differential pulse code modulation) image compression implemented using a DSP (digital signal processor) in the camera. The compressed images were stored in Flash EPROM memory, and later downloaded to the computer. An image processing software module in the computer performed the digital image processing functions shown in Figure 5. These functions included ADPCM decompression and CFA interpolation, which creates red, green, and blue (RGB)

values for all of the pixels in the image array. Edge sharpening was implemented using adaptive FIR (finite impulse response) filters to extract a high frequency “detail” signal, which was added to the color-matrixed and tone corrected RGB signals in a “edge enhancement” block. See Parulski, et al., “*Digital, Still-Optimized Architecture for Electronic Photography*,” IS&T’s 47th Annual Conference, 1994 (“Parulski 1994”; Ex. 1015), pp. 665-667.

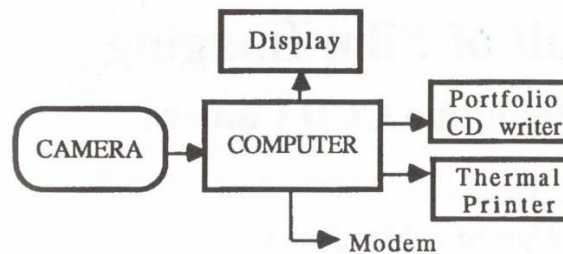


Figure 1. Digital Electronic Photography System

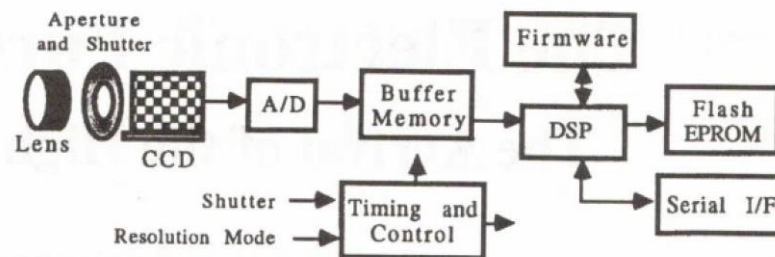


Figure 3. Digital Camera Architecture

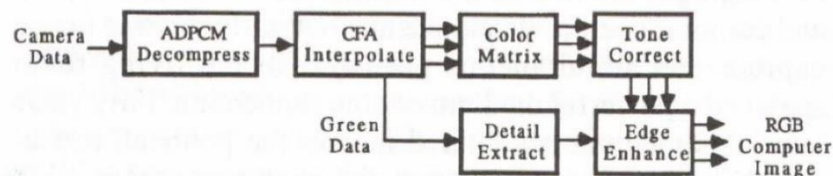


Figure 5. Imaging Processing Module Functions

36. The Casio QV-10 digital camera, pictured below, was released in 1995 in Japan. It included an LCD panel for composing and reviewing digital still images, which allowed captured images to be immediately viewed by the photographer and those being photographed. This feature made the camera very popular, and within two years most newly introduced digital cameras included similar LCD flat panel displays. The Casio QV-10 used a 32-bit RISC microcontroller to perform JPEG compression, by executing the compression algorithm instructions which were stored in a ROM memory. See Parulski, “*Chapter 21 Digital Photography*” in Jurgen, “*Digital Consumer Electronics Handbook*,” 1997, McGraw-Hill, p. 21.5.



Casio QV-10 digital camera

37. In 1997, Kodak released the DC210 Digital Camera, pictured below, which was the first consumer digital camera with an image sensor having at least one million pixels (i.e., 1 Megapixel). The general design of the Kodak DC210 camera became the dominant design for consumer digital cameras. The features

that it offered, including a zoom lens, megapixel image sensor, LCD graphical user interface, video output, JPEG image compression, and removable flash memory card storage, soon became standard features of almost all consumer digital cameras. Flash memory cards using the Exif/JPEG image format became a very common way to store images in digital cameras, and then transfer the images to personal computers (PCs).



Kodak DC210 Digital Camera

D. Image compression, image files, and image metadata

38. By the late 1990s, essentially all digital cameras used image compression to reduce the amount of memory used to store each image on a removable flash memory card. The JPEG standard (ISO/IEC 10918-1:1994, “*Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines*”, available online at <http://www.iso.org>)

specifies a baseline compression algorithm for still images using the adaptive discrete cosine transform (ADCT). It was published as an approved international standard in 1994. The baseline JPEG compression uses the DCT (Discrete Cosine Transform) to transform 8 x 8 pixel blocks of the source image into the spatial frequency domain, as shown in Figure 1 below. The resulting 64 DCT coefficients are quantized and entropy coded, to reduce the amount of data which encodes the still image. The DCT-based decoder, shown below in Figure 2, reverses these processing steps, and is used, for example, in a computer to decompress JPEG images prior to display. See Wallace, “*The JPEG still picture compression standard*”, submitted in Dec. 1991 for publication in the IEEE Transactions on Consumer Electronics.

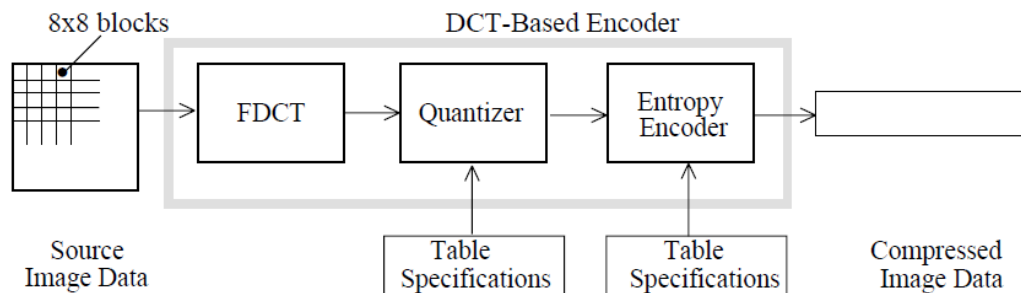


Figure 1. DCT-Based Encoder Processing Steps

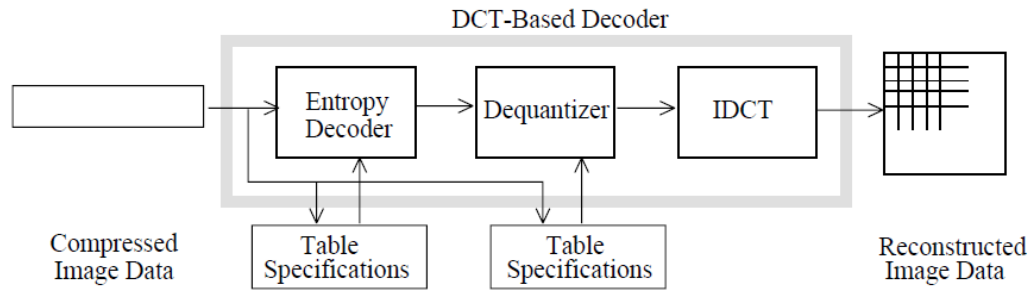


Figure 2. DCT-Based Decoder Processing Steps

39. Almost all digital cameras sold after 1996 used JPEG image compression. Most of these cameras also used the “Exif” format to store JPEG compressed still images. Each Exif/JPEG image file includes JPEG compressed image data along with extensive image metadata, recorded using TIFF tags, which provides information about the image. Exif was initially standardized by the Japan Electronic Industry Development Association (JEIDA), later known as JEITA (Japan Electronic Industry Technology Association). Exif version 1.0 was published in October 1995, Exif version 1.1 was published in May 1997, Exif version 2.0 was published in November 1997, Exif version 2.1 was published by December 1998, and Exif version 2.2 was published in April 2002. I personally contributed to the image metadata tag definitions in Exif. This included tags which indicate *e.g.*, the exposure time, lens f/number, scene capture type (*e.g.*, portrait), and subject location, and additional “Exif Print” tags developed for improving the quality of prints made from Exif image files.

40. All versions of Exif, including Exif version 2.2, utilize many image metadata tags that were defined in the TIFF 6.0 specification, which are listed in table 3 of the Exif version 2.2 specification, shown below. These tags provide information such as the make and model of the digital camera which captured the image, the date and time the image was captured, and the size and orientation of the image.

Table 3 TIFF Rev. 6.0 Attribute Information Used in Exif

Tag Name	Field Name	Tag ID		Type	Count
		Dec	Hex		
A. Tags relating to image data structure					
Image width	ImageWidth	256	100	SHORT or LONG	1
Image height	ImageLength	257	101	SHORT or LONG	1
Number of bits per component	BitsPerSample	258	102	SHORT	3
Compression scheme	Compression	259	103	SHORT	1
Pixel composition	PhotometricInterpretation	262	106	SHORT	1
Orientation of image	Orientation	274	112	SHORT	1
Number of components	SamplesPerPixel	277	115	SHORT	1
Image data arrangement	PlanarConfiguration	284	11C	SHORT	1
Subsampling ratio of Y to C	YCbCrSubSampling	530	212	SHORT	2
Y and C positioning	YCbCrPositioning	531	213	SHORT	1
Image resolution in width direction	XResolution	282	11A	RATIONAL	1
Image resolution in height direction	YResolution	283	11B	RATIONAL	1
Unit of X and Y resolution	ResolutionUnit	296	128	SHORT	1
B. Tags relating to recording offset					
Image data location	StripOffsets	273	111	SHORT or LONG	*S
Number of rows per strip	RowsPerStrip	278	116	SHORT or LONG	1
Bytes per compressed strip	StripByteCounts	279	117	SHORT or LONG	*S
Offset to JPEG SOI	JPEGInterchangeFormat	513	201	LONG	1
Bytes of JPEG data	JPEGInterchangeFormatLength	514	202	LONG	1
C. Tags relating to image data characteristics					
Transfer function	TransferFunction	301	12D	SHORT	3 * 256
White point chromaticity	WhitePoint	318	13E	RATIONAL	2
Chromaticities of primaries	PrimaryChromaticities	319	13F	RATIONAL	6
Color space transformation matrix coefficients	YCbCrCoefficients	529	211	RATIONAL	3
Pair of black and white reference values	ReferenceBlackWhite	532	214	RATIONAL	6
D. Other tags					
File change date and time	DateTime	306	132	ASCII	20
Image title	ImageDescription	270	10E	ASCII	Any
Image input equipment manufacturer	Make	271	10F	ASCII	Any
Image input equipment model	Model	272	110	ASCII	Any
Software used	Software	305	131	ASCII	Any
Person who created the image	Artist	315	13B	ASCII	Any
Copyright holder	Copyright	33432	8298	ASCII	Any

41. Exif version 2.2 also includes many image metadata tags that provide information related to the digital camera settings and picture-taking conditions

used when the image was captured, which are listed in table 5 of the Exif version 2.2 specification, shown below. These image metadata tags include, for example, the image exposure time and the lens focal length and f-number. The metadata tags also include the scene capture type (e.g., portrait or landscape mode), the subject distance (e.g., the distance at which the camera is focused) and the subject location in the image frame (e.g., whether the main subject is in the center of the frame, or in a different location). The metadata tags also include information about the digital camera's image processing settings, such as the contrast, sharpness, and saturation settings.

Expert Declaration of Kenneth Parulski
U.S. Patent No. 8,355,574

Table 5 Exif IFD Attribute Information (2)

G. Tags Relating to Picture-Taking Conditions					
Exposure time	ExposureTime	33434	829A	RATIONAL	1
F number	FNumber	33437	829D	RATIONAL	1
Exposure program	ExposureProgram	34850	8822	SHORT	1
Spectral sensitivity	SpectralSensitivity	34852	8824	ASCII	Any
ISO speed rating	ISOSpeedRatings	34855	8827	SHORT	Any
Optoelectric conversion factor	OECF	34856	8828	UNDEFINED	Any
Shutter speed	ShutterSpeedValue	37377	9201	SRATIONAL	1
Aperture	ApertureValue	37378	9202	RATIONAL	1
Brightness	BrightnessValue	37379	9203	SRATIONAL	1
Exposure bias	ExposureBiasValue	37380	9204	SRATIONAL	1
Maximum lens aperture	MaxApertureValue	37381	9205	RATIONAL	1
Subject distance	SubjectDistance	37382	9206	RATIONAL	1
Metering mode	MeteringMode	37383	9207	SHORT	1
Light source	LightSource	37384	9208	SHORT	1
Flash	Flash	37385	9209	SHORT	1
Lens focal length	FocalLength	37386	920A	RATIONAL	1
Subject area	SubjectArea	37396	9214	SHORT	2 or 3 or 4
Flash energy	FlashEnergy	41483	A20B	RATIONAL	1
Spatial frequency response	SpatialFrequencyResponse	41484	A20C	UNDEFINED	Any
Focal plane X resolution	FocalPlaneXResolution	41486	A20E	RATIONAL	1
Focal plane Y resolution	FocalPlaneYResolution	41487	A20F	RATIONAL	1
Focal plane resolution unit	FocalPlaneResolutionUnit	41488	A210	SHORT	1
Subject location	SubjectLocation	41492	A214	SHORT	2
Exposure index	ExposureIndex	41493	A215	RATIONAL	1
Sensing method	SensingMethod	41495	A217	SHORT	1
File source	FileSource	41728	A300	UNDEFINED	1
Scene type	SceneType	41729	A301	UNDEFINED	1
CFA pattern	CFAPattern	41730	A302	UNDEFINED	Any
Custom image processing	CustomRendered	41985	A401	SHORT	1
Exposure mode	ExposureMode	41986	A402	SHORT	1
White balance	WhiteBalance	41987	A403	SHORT	1
Digital zoom ratio	DigitalZoomRatio	41988	A404	RATIONAL	1
Focal length in 35 mm film	FocalLengthIn35mmFilm	41989	A405	SHORT	1
Scene capture type	SceneCaptureType	41990	A406	SHORT	1
Gain control	GainControl	41991	A407	RATIONAL	1
Contrast	Contrast	41992	A408	SHORT	1
Saturation	Saturation	41993	A409	SHORT	1
Sharpness	Sharpness	41994	A40A	SHORT	1
Device settings description	DeviceSettingDescription	41995	A40B	UNDEFINED	Any
Subject distance range	SubjectDistanceRange	41996	A40C	SHORT	1

42. The scene capture type “indicates the type of scene that was shot” and “can also be used to record the mode in which the image was shot,” as described in the excerpt from the Exif 2.2 specification shown below. For example, the tag value “2” identifies a “portrait” scene and the tag value “3” identifies a “night scene”.

SceneCaptureType

This tag indicates the type of scene that was shot. It can also be used to record the mode in which the image was shot. Note that this differs from the scene type (SceneType) tag.

Tag = 41990 (A406.H)
Type = SHORT
Count = 1
Default = 0
0 = Standard
1 = Landscape
2 = Portrait
3 = Night scene
Other = reserved

43. The subject location tag specified in Exif version 2.2 is used to identify a circle of a specified diameter which is centered at a specific X and Y coordinate location, or a rectangle, having a specified height and width, centered at a specific X and Y coordinate location, as defined in Figures 12 and 13 of the Exif version 2.2 specification, shown below.

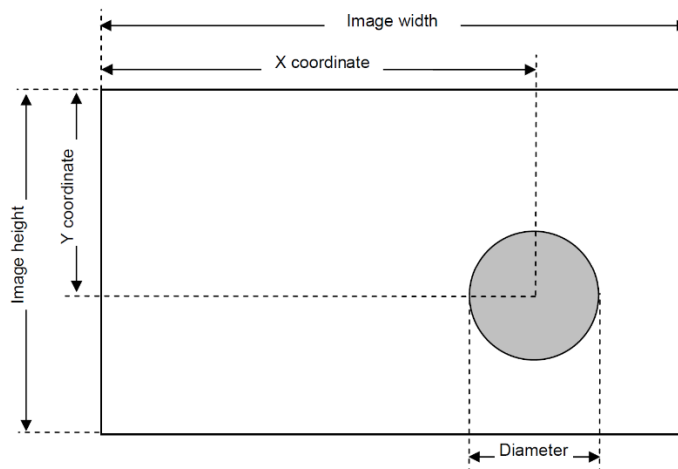


Figure 12 Circular area designation

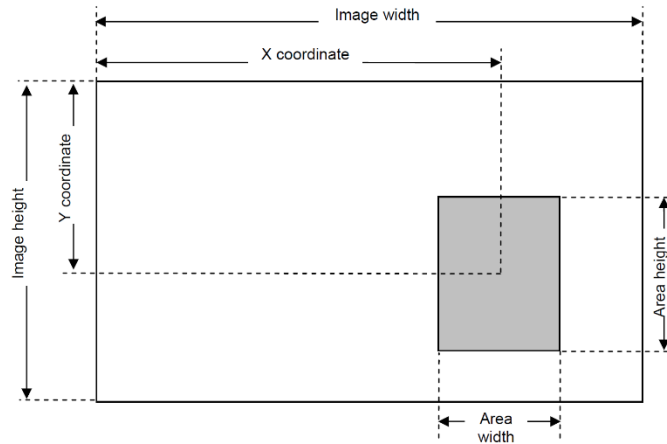


Figure 13 Rectangular area designation

44. In many digital cameras, the tag values for the Exif tags described above were automatically determined when the photograph was captured by the digital camera. For example, the date and time were determined using a real-time clock in the camera, and the scene capture type and subject location were determined either by user selection of the capture mode and focus location, or by automatic algorithms that selected the most appropriate scene capture type and recognized the location of the main subject in the captured image.

E. Subject determination and face recognition

45. By the early 2000s, various image processing systems and devices had been developed to analyze and detect objects in a scene being photographed by a digital camera, in order to classify the scene type. One example is described in U.S. Patent No. 6,301,440 to Bolle et al. (“Bolle”; Ex. 1019), titled “System and method for automatically setting image acquisition controls,” which was filed on April 13, 2000, and issued on October 9, 2001. As shown in Figure 2 of Bolle,

depicted below, a scene analysis unit uses input attributes, such as the image intensities 201, colors 230, and depth map 203, to extract raw features in the image. These raw features include geometric features 208, texture analysis 209, and scale determination 210. The raw features form the basis for finding and identifying scene components, such as face detection 211, person detection 212, building recognition 213, vegetation detection 214, and vehicle recognition 215. These scene components are used to determine the final scene classifications, such as portrait 216, close-up portrait 212, group shot 213, natural landscape 220, crowd scene 223, and night sky 225.

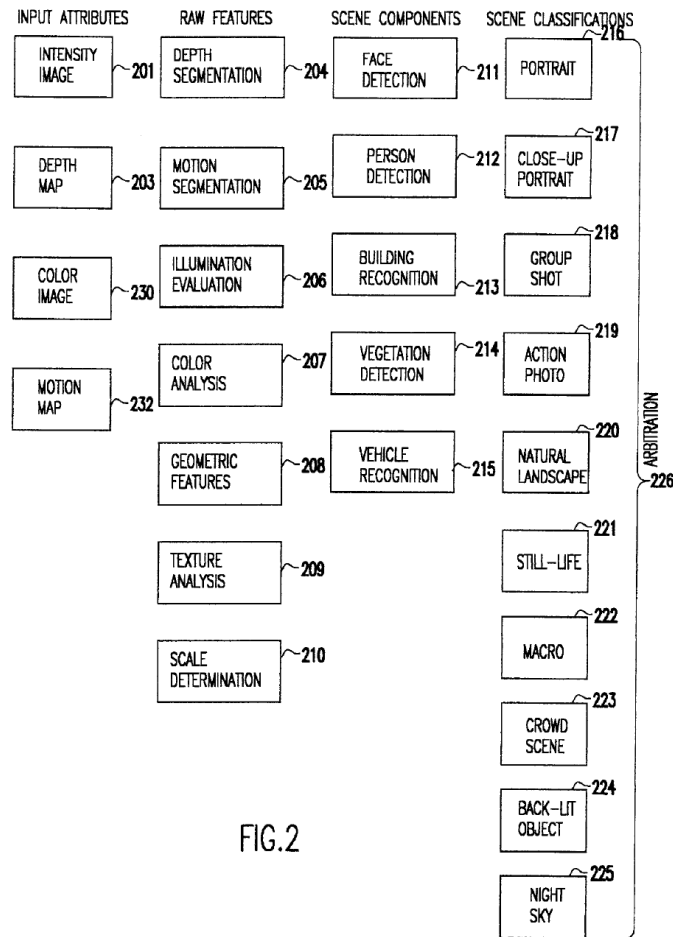


FIG.2

46. Bolle further discloses that “person detector 212 determines whether there are people in the scene. This step may be performed in accordance with any number of conventional techniques. Similarly, face detection 211 could be implemented by facial profile detection, skin-tone detection, etc. These classifications may also be parameterized with additional information such as location, average illumination, velocity, etc. such as “Face at position (x, y) with width W”, or “Landscape with horizon at height y.” Such a scene component module using one or more of these techniques could determine the sizes and locations of all the people in the scene. A subsidiary part of the scene analyzer

could process the output of the person detector 212 to determine the type of “person” scene that is being imaged. In one embodiment, simple rules would give the classification; e.g., one large face implies “close-up portrait” 217; one small face and entire body implies “portrait” 217 (labeled 216 in drawing, mistake in spec); many small faces nearly filling the image implies “crowd scene” 223; several medium to large faces in the central portion of image implies “group shot” 218; a few small figures implies some other mode —although people are present, they are not the subject of the photography.” Bolle, 4:16-38.

47. Bolle further discloses that “all of the extracted information can be recorded and used to control a subsequent rendering or reproduction phase. For instance, color information of the original scene can be used to limit the distortions of automatic color balancing on reproduction. Higher level information can also be stored and later used to index the images (e.g., scene classifications such as people, cars, foliage, landscape, night sky, etc.)” Bolle, 8:1-8. In other words, information such as a “portrait” having a “face at position (x, y) with width W” can be stored as image metadata in an image file, such as by using the scene capture type and subject location metadata tags specified in Exif version 2.2, as described above.

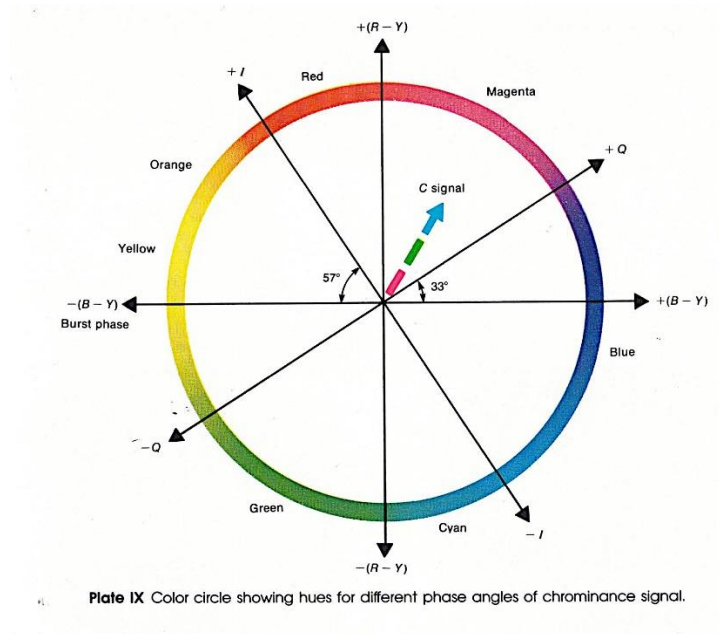
F. Image quality adjustments

48. The image quality of photographs captured by digital cameras depends on numerous image quality attributes, including the tone reproduction, color reproduction, sharpness, and noise. The tone reproduction is determined by factors such as the image brightness and contrast in the shadows, mid-tones, and highlights of the image. The color reproduction is determined by factors such as the color balance and color saturation, and by how faithfully the image reproduces memory colors such as flesh tones and sky. The sharpness depends on factors such as the lens quality, the focus setting, and the sensor pixel size and pixel count (*i.e.*, number of pixels on the image sensor). The noise depends on factors such as the sensor pixel size and the ambient light level. By the late 1990s, all of these image quality attributes could be adjusted by digital image processing algorithms to improve the quality of images captured by digital cameras.

49. Color reproduction is an important image quality attribute and relates to how the colors of objects in a scene are depicted in the captured and reproduced images. The colors of objects can be represented using a set of three parameters. In 1905, Albert Munsell published his notation for describing the color of objects. (See “Munsell, A. H., *“A color notation”*, 14th edition, 1981, p. 4). He used the parameters “hue,” “value,” and “chroma” to distinguish colors. Hue is the “name” of the color, such as red, yellow, green, blue, or purple. Value is the “lightness”

(i.e., brightness) of the color, and distinguishes dark colors from light colors, such as a dark red color from a bright red color. Chroma is the “strength” (i.e., saturation or intensity) of the color, and distinguishes vivid colors from those that are nearly grey. (*ibid*, pp. 15-16).

50. Color television systems developed in the 1950s, including NTSC and PAL, used a color subcarrier to transmit the hue and saturation of objects in the image. The high frequency modulated color subcarrier was added to the baseband luminance (i.e., brightness) signal. The color circle, reproduced below, shows the hue versus subcarrier phase for the NTSC color system transmitted in the United States. See Grob, Bernard, “*Basic television and video systems*,” McGraw-Hill, 1984. When the subcarrier level is near zero (i.e., near the center of the circle), the color is muted. As the level increases, the color becomes more saturated (i.e., more vivid).



Grob, plate IX.

51. The color reproduction of both color video systems and photographic systems is influenced by the color balance, which is referred to as the “white balance” in some situations. One important factor which influences the color balance is the type of light which illuminates the scene. Graphs of the relative spectral power distributions for typical tungsten and fluorescent lamps, and for three types of daylight illumination, are depicted in Figures 1.1 and 1.2 below. Giorgianni and Madden, *Digital Color Management*, Addison-Wesley, 1997, p. 562. Note that fluorescent and incandescent lamps were common in the early 2000s, but have been largely replaced by more efficient LEDs. Daylight has relatively equal relative radiant power between 400 and 700 nanometers, while a typical incandescent lamp has much lower power for blue (e.g., 450 nm) wavelengths than for red (e.g., 600 nm) wavelengths. As a result, a scene

photographed using incandescent illumination will have a red tint, unless color balance is performed.

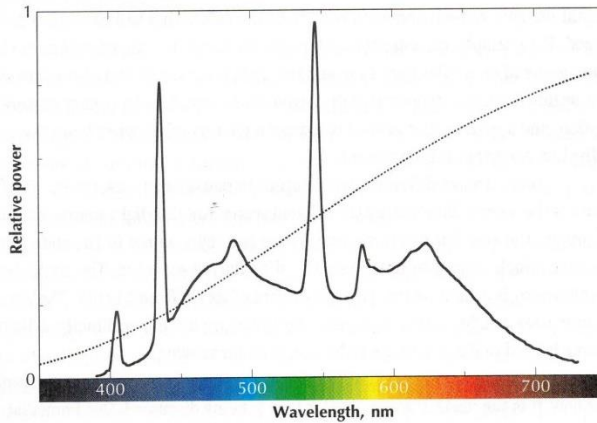


Figure 1.1
Comparison of the relative spectral power distributions for typical tungsten (dotted line) and fluorescent (solid line) light sources. The curves describe the relative power of each source's electromagnetic radiation as a function of wavelength.

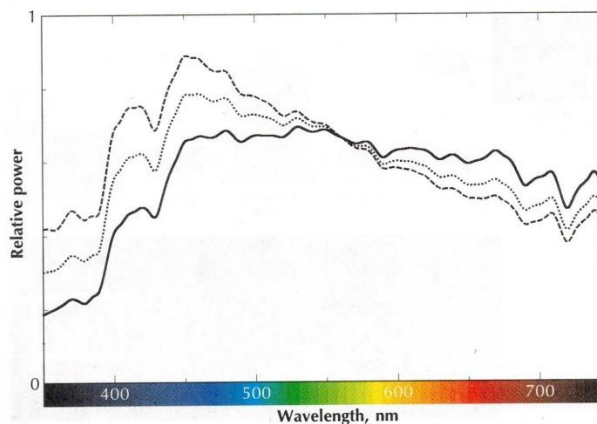


Figure 1.2
Relative spectral power distributions for three of many types of daylight illumination. The spectral characteristics of daylight can vary greatly depending on solar altitude, weather, and atmospheric conditions.

Giorgianni and Madden, p. 562.

52. Historically, the term “color balance” was used in the photographic industry. For example, when daylight balanced film was used under tungsten illumination, the color balance could be corrected by placing a color compensating filter (such as a Kodak Conversion Filter for Color Films) over the lens of the film camera. See “*Kodak filters for scientific and technical uses*,” 3rd edition, 1980, p. 25. In another example, when producing color prints from color negative film, the

color balance could be adjusted by placing the appropriate Kodak Color Printing filters in the enlarger beam to “control the light reaching the three light-sensitive emulsions of the color print material.” *Ibid*, p. 57.

53. By the 1950s, color correction was being used when making prints from color film. For example, U.S. Patent 2,571,697, titled “Method for correcting photographic color prints,” to Evans (“Evans”; Ex. 1016), which issued in 1951, describes “a method for overcoming the defects in images due to incorrect lighting conditions and emulsion sensitivity.” Evans, 1:31-34. The color of the integrated light from the film was measured using red, green, and blue photo-electric cells, and the quantity of the light from these three primary colors needed to make the print substantially gray was calculated. Evans, 2:15-31. The patent also discloses that “it is not always desirable ... to integrate exactly to neutral gray” and that it may be desirable to produce “a hue near gray” rather than “an exact neutral gray.” In other words, rather than performing a “full” color balance correction, it may be desirable to instead perform a “partial” correction.

54. By the 1980s, color video cameras often included an “auto white” balance feature which adjusted the RGB (red, green, and blue) signals of the camera so that equal signals were produced from an illuminated white object. White balance was achieved by momentarily pointing the camera at a white card illuminated by the light to be used for capturing the scene and pressing an “auto

white” button. The red and blue signal amplitudes were then measured and adjusted to match the green signal level from the white card, and the gain factors required for the red and blue channels were stored so that the camera remained color balanced for the particular light source. See Grob, *Basic television and video systems*, 5th edition, 1984, p.61.

55. By the 1990s, various color balance techniques were widely implemented in image processing software. For example, Photoshop 5.0 describes several ways to adjust the color balance of images. (Adobe Photoshop version 5.0 User Guide, 1998. (“Photoshop 5.0), p 131. For example, the “Color Balance” command in Photoshop 5.0 “lets you change the mixture of colors in a color image,” as described below.

To adjust the levels of a particular color in an image:

1 Open the Color Balance dialog box, as described in “Using color adjustment commands” on page 105.

Note: You must be viewing the composite channel to use the Color Balance command. (See “Using the Channels palette” on page 240.)

2 Choose Shadows, Midtones, or Highlights to select the tonal range on which you want to focus the changes.

3 With RGB images, select Preserve Luminosity to prevent changing the luminosity values in the image while changing the color. This option maintains the tonal balance in the image.

4 Drag a triangle toward a color you want to increase in the image; drag a triangle away from a color you want to decrease in the image.

The values above the color bars show the color changes for the red, green, and blue channels. (For Lab images, the values are for the *a* and *b* channels.) Values can range from -100 to +100.

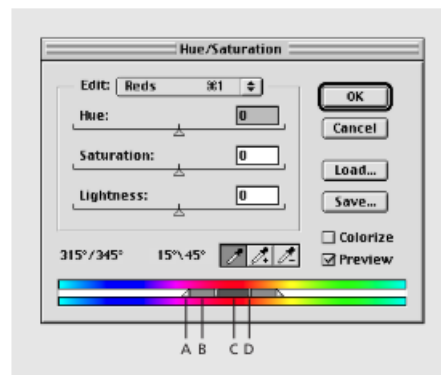
Photoshop 5.0, pp. 131-132.

56. In addition, the “Hue/Saturation” tool in Photoshop 5.0 “lets you adjust the hue, saturation, and lightness of individual color components in an

image file.” “Adjusting the hue, or color, represents a move around the color wheel. Adjusting the saturation, or purity of the color, represents a move across its radius.” Photoshop 5.0, p. 132. Adjusting the hue changes the color balance of the image, for example by making greenish-looking flesh caused by fluorescent lighting appear more natural.

To adjust an image using Hue/Saturation:

1 Open the Hue/Saturation dialog box, as described in “Using color adjustment commands” on page 105.



A. Adjusts fall off without affecting range B. Adjusts range without affecting fall off C. Moves entire slider D. Adjusts range of color component

Two color bars are displayed in the dialog box. These bars represent the colors in their order on the color wheel.

The upper color bar shows the color before the adjustment; the lower bar shows how the adjustment affects all of the hues at full saturation.

2 Choose which colors to adjust:

- Choose Master from the Edit menu in the dialog box to adjust all colors at once.
- Choose one of the other preset color ranges listed for the color you want to adjust. An adjustment slider appears between the color bars, which you can use to edit any range of hues. (For information on how to modify the slider's range, see the instructions later in this section.)

Using the Hue/Saturation command

The Hue/Saturation command lets you adjust the hue, saturation, and lightness of individual color components in an image. Like the Color Balance command, this command relies on the color wheel. Adjusting the hue, or color, represents a move around the color wheel. Adjusting the saturation, or purity of the color, represents a move across its radius.

3 For Hue, enter a value or drag the slider until the colors appear as you want.

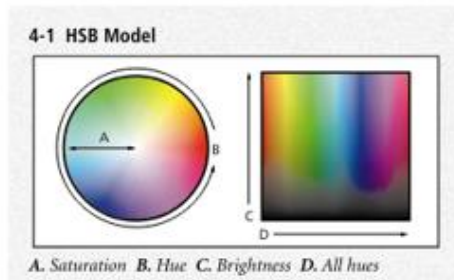
The values displayed in the text box reflect the number of degrees of rotation around the wheel from the pixel's original color. A positive value indicates clockwise rotation, a negative value counterclockwise rotation. Values can range from -180 to +180.

4 For Saturation, enter a value or drag the slider to the right to increase the saturation, left to decrease it. The color shifts away from or toward the center of the wheel, relative to the beginning color values of the selected pixels. Values can range from -100 to +100.

For a color illustration of saturation, see figure 6-5 on page 226.

5 For Lightness, enter a value or drag the slider to the right to increase the lightness, left to decrease it. Values can range from -100 to +100.

For a color illustration of hue, saturation, and brightness, see figure 4-1 on page 223.



57. In a digital camera, color balance typically includes adjusting the red, green, and blue signal levels provided by the image sensor in the camera to correct for the color temperature of the light source used to illuminate the scene. This is necessary because the human visual system (*i.e.*, the eye and brain) perceives colors almost the same under a wide range of light sources, due to chromatic adaptation. Therefore, the effective color sensitivity of the image sensor used in the camera must be adjusted to compensate for the light source which illuminates the scene, in order to mimic this chromatic adaptation.

58. The algorithms which perform color balance in a digital camera are often called “white balance” algorithms, since this term had been used for color balance in video cameras, as described earlier. By the early 2000s, many algorithms determined the appropriate color balance settings using image data

from the color sensor which had been averaged into blocks. The number of blocks typically ranged from twenty to several hundred. The average color values for each of the blocks were converted into color difference signals, such as “R-B” and “G-(R+B)/2” as shown in Figure 10 below. The color difference signals were then analyzed to determine which blocks included color values in the same regions of the color difference space as common illuminants, such as daylight, tungsten, and fluorescent illuminants. Once the likely scene illuminant was determined, RGB amplification factors were applied to correct the color balance of the captured images. See Parulski and Spaulding, Chapter 12, “Color image processing for digital cameras” in Digital Color Imaging Handbook, CRC Press, 2003, pp. 743-744.)

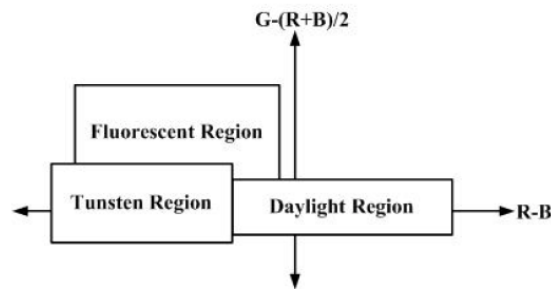
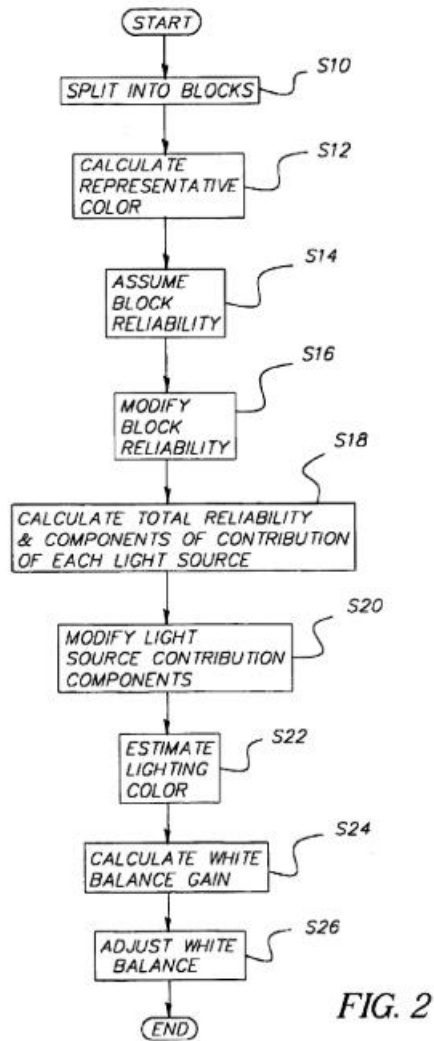


Fig. 10. Color difference space for white balance determination.

59. U.S. Patent 6,791,606, titled “Auto white balancing apparatus and method,” to Miyano (“Miyano”; Ex. 1017), which was filed on May 9, 2000, and issued on September 14, 2004, provides an example of a color balance algorithm used in Kodak digital cameras. As shown in Figure 2 below, the image is split into blocks in step S10, and each block is averaged in step S12 to calculate a

“representative color” value for each block. (Miyano, 3:66-4:33). The “reliability” of each block is determined in steps S14 and S16 by calculating the variance of the pixel values and the number of saturated pixels in each block, as well as the luminance of the block and the distance between the representative color value of the block and the prestored values of four different light sources, which can be daylight, shade-light, tungsten light and fluorescent light. *Ibid*, 4:59-5:33, 6:5-36, 6:61-7: 28. A large variance or many saturated pixels means that the block is less reliable and will have less influence on the color correction. *Ibid*, 8:7-47. A high luminance level means the scene is probably being taken outdoors, while a low level indicates an indoor scene. *Ibid*, 10:12-33. In step S18, the luminance and color difference values of each of the blocks are weighted according to their reliability and averaged. *Ibid*, 9:8-22. In step S20, the “components of contribution of each light source j are weighted and averaged with a standard color ... for each light source j” which was “previously stored in the apparatus.” *Ibid*, 9:28-48. In step 22, white balance gain values are calculated by estimating the “color of a white object under the composite lighting” from the weighted light sources. *Ibid*, 11:33-46. In step 24, white balance gain factors are calculated. Finally, in step S26, a white balance adjusting circuit performs color correction by multiplying the red, green, and blue pixel values of the image by these gain factors. *Ibid*, 11:33-45.



Miyano, FIG. 2

IV. MATERIALS CONSIDERED

60. In forming my opinions, I have analyzed the following exhibits, including the '574 patent, its file history, and the prior art cited in my analysis of the Petition Grounds, as well as the other materials cited in this declaration.

Exhibit	Description
Ex. 1001	U.S. Patent No. 8,355,574 to Imai ("the '574 patent")

Ex. 1002	File History of U.S. Patent No. 8,355,574
Ex. 1005	U.S. Patent Application Publication No. 2003/0108250 to Luo et al. (“Luo-250”)
Ex. 1006	Certified English Translation of Japanese Patent Publication No. JP2003-248825 to Hibi et al. (“Hibi”)
Ex. 1007	U.S. Patent Application Publication No. 2004/0239963 to Terashita (“Terashita”)
Ex. 1008	U.S. Patent No. 7,358,994 to Yano (“Yano”)
Ex. 1009	U.S. Patent No. 5,710,833 to Moghaddam et al. (“Moghaddam”)
Ex. 1010	Bernd Heisele et al., <i>Face Detection in Still Gray Images</i> , MIT Artificial Intelligence Lab, A.I. Memo No. 1687, C.B.C.L Paper No. 187 (May 2000) (“Heisele”)
Ex. 1011	U.S. Patent No. 7,013,042 to Yamada et al. (“Yamada”)
Ex. 1012	Japanese Patent Publication No. JP2003-248825 to Hibi et al.
Ex. 1013	Kenneth A. Parulski et al., <i>A High-Performance Digital Color Video Camera</i> , SPIE Vol. 1448 Camera and Input Scanner Systems, pp. 45-57 (1991) (“Parulski 1991”)
Ex. 1014	Adobe Photoshop version 5.0 User Guide (1998) (“Photoshop 5.0”)
Ex. 1015	Ken Parulski and David Lewis, <i>Digital, Still-Optimized Architecture for Electronic Photography</i> , IS&T’s 47th Annual Conference, pp. 665-67 (1994) (“Parulski 1994”)
Ex. 1016	U.S. Patent No. 2,571,697 to Evans (“Evans”)
Ex. 1017	U.S. Patent No. 6,791,606 to Miyano (“Miyano”)
Ex. 1018	U.S. Patent No. 7,454,056 to Hayaishi (“Hayaishi”)
Ex. 1019	U.S. Patent No. 6,301,440 to Bolle et al. (“Bolle”)

61. Exhibit 1013 is a true and accurate copy of a paper published in 1991 by SPIE, the Society of Photo-Optical Instrumentation Engineers, in their Conference Proceedings, titled “Camera and Input Scanner Systems, Volume 1448”, which I personally presented during the February 1991 Electronic Imaging Symposium in San Jose, California. This conference was widely attended by individuals interested and skilled in digital cameras and image processing, including by individuals that would have qualified as persons of ordinary skill in the art. I am one of the authors of this paper and have personal knowledge that this paper was publicly disseminated by SPIE without restriction in their Camera and Input Scanner Systems (Vol. 1448) Conference Proceedings.

62. Exhibit 1014 is a true and accurate copy of the Adobe Photoshop version 5.0 User Guide which was available by 1998. I personally used Adobe Photoshop version 5.0 in my work at Kodak. In 1998, I completed a course developed by Adobe which taught me to use the image processing and editing features provided by Photoshop version 5.0. I have personal knowledge that this user guide was publicly disseminated without restriction by Adobe to individuals interested and skilled in image processing, including by individuals that would have qualified as persons of ordinary skill in the art.

63. Exhibit 1015 is a true and accurate copy of a paper published in May 1994 and presented at IS&T’s 47th Annual Conference. IS&T stands for the

Society for Imaging Science and Technology, and this conference was widely attended by individuals interested and skilled in image processing, including by individuals that would have qualified as persons of ordinary skill in the art. I am one of the authors of this paper and have personal knowledge that this paper was publicly disseminated without restriction at IS&T's 47th Annual Conference in the Final Program and Advance Printing of Papers.

64. My opinions are based on my experience, knowledge of the relevant art, the documents identified above, and the documents discussed in this declaration.

V. LEGAL STANDARDS

65. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I sought to faithfully apply these legal standards to the Challenged Claims.

A. Claim Construction

66. I have been instructed that the terms appearing in the '574 patent should be interpreted in view of the claim language itself, the specification, the prosecution history of the patent, and any relevant extrinsic evidence. The words of

a claim are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art at the time of the invention, which I am assuming here is March 8, 2004. While claim limitations cannot be read in from the specification, the specification is the single best guide to the meaning of a disputed term. I have followed these principles in reviewing the claims of the '574 patent and forming the opinions set forth in this declaration.

B. Level of Ordinary Skill

67. I understand a person of ordinary skill in the art is determined by looking at (i) the type of problems encountered in the art; (ii) the prior art solutions to those problems; (iii) the rapidity with which innovations are made; (iv) the sophistication of the technology; and (v) the educational level of active workers in the field.

68. In my opinion, based on these factors, a person of ordinary skill in the art ("POSITA") would have had a bachelor's degree or equivalent in electrical engineering, computer science, or a related field, in addition to three years in research, design, or development in digital image processing. This is based, for example, on the language and level of detail included in the patent specification and claims. Each of the claims requires determining a main object in an image and adjusting image quality of the main object, wherein a parameter used in adjusting

the image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color. But the specification provides few (if any) details of how to use a highlight, a shadow, brightness, contrast, color balance, or memory color as a parameter in adjusting the image quality, and assumes that the reader would know how to use these parameters. *See, e.g.*, Ex. 1001, 16:21-24, 16:48-53, 17:6-10. A POSITA as defined above would have been aware of various techniques for determining a main object and adjusting image quality of the main object using one of the parameters identified above. Moreover, workers in this field commonly had a bachelor's degree or equivalent in electrical engineering, computer science, or a related field.

69. I was at least a POSITA as of March 8, 2004, and supervised others who were at least a POSITA.

C. Obviousness

70. I have been told that under 35 U.S.C. § 103, a patent claim may be obvious if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

71. I have been told that a proper obviousness analysis requires the following:

- a. Determining the scope and content of the prior art;
- b. Ascertaining the differences between the prior art and the claims at issue;
- c. Resolving the level of ordinary skill in the pertinent art; and
- d. Considering evidence of secondary indicia of non-obviousness (if available).

72. I have been told that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For purposes of my analysis, I assumed that the date of invention for the Challenged Claims is March 8, 2004.

73. I have been told that a reference may be modified or combined with other references or with the person of ordinary skill's own knowledge, if the person would have found the modification or combination obvious. I have also been told that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

74. I have been told that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been told that, while there is no requirement that the prior art

contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

75. I have been told that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also have been told that the “teaching, suggestion, or motivation” test can be used in establishing a rationale for combining elements of the prior art. I have also been told to be aware of distortions caused by hindsight bias, and that reading into the prior art the teachings of the invention at issue is improper.

76. I am aware that a claim may be obvious where the claim represents nothing more than a combination of prior art elements according to understood methods that yields predictable results. I am further aware that a claim may be obvious where it merely involves the simple substitution of one known element for another to achieve predictable results. I am additionally aware that it may be

obvious to try a particular combination of claim features if selecting them requires merely choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.

77. I have been informed that, in an obviousness analysis, prior art must be analogous art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

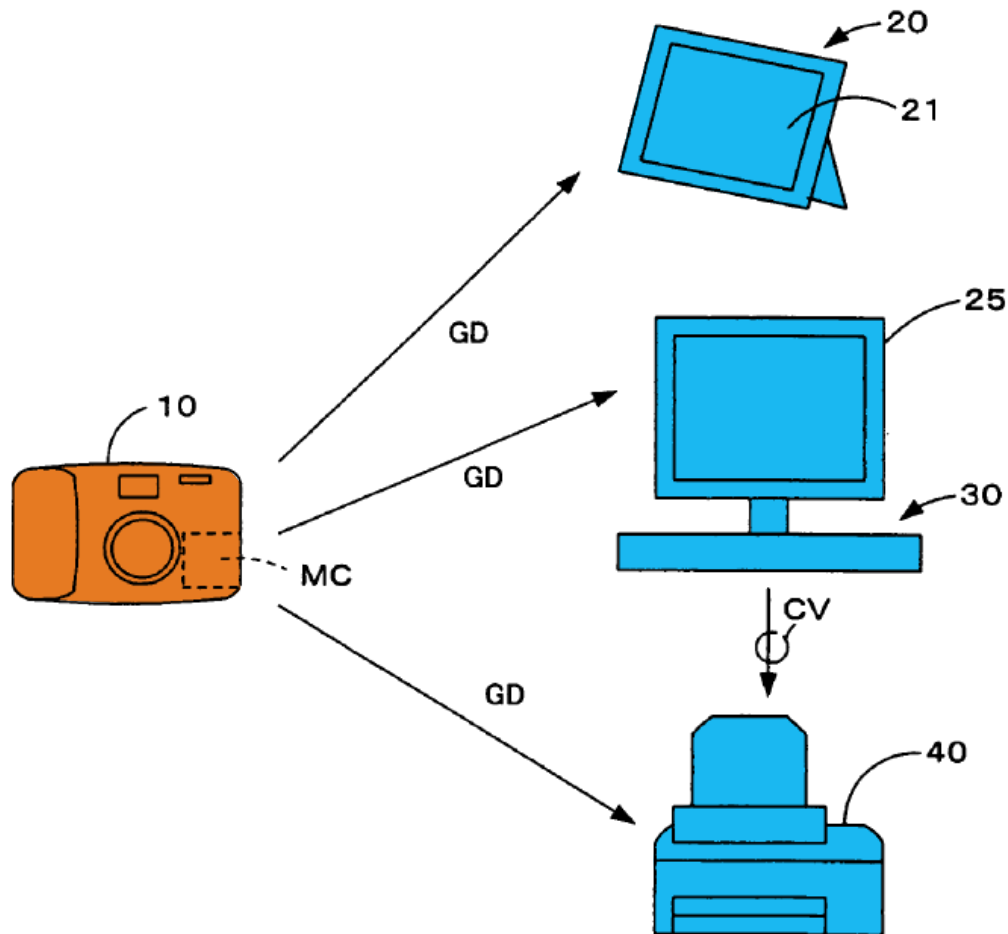
VI. BACKGROUND

A. The '574 Patent

78. The '574 patent “relates to a technique that determines the main object characterizing an image” and “that adjusts the picture quality of the image data.” Ex. 1001, 1:16-18. According to the '574 patent, techniques for adjusting picture quality assume “that the main object characterizing the image has been correctly determined,” so improperly determining the main object can “result in poor picture quality.” *Id.*, 1:28-32. The '574 patent purportedly seeks “to properly identify the main object characterizing an image” and “improve the picture quality of the main object.” *Id.*, 1:52-56.

79. The '574 patent discloses an image processing system, depicted below, comprising “a digital still camera 10 as an image data generating device” and an “image processing device,” such as a display device 20, a personal computer 30, and a color printer 40, for processing image data generated by the image data generating device. *Id.*, 6:2-59, 14:1-4.

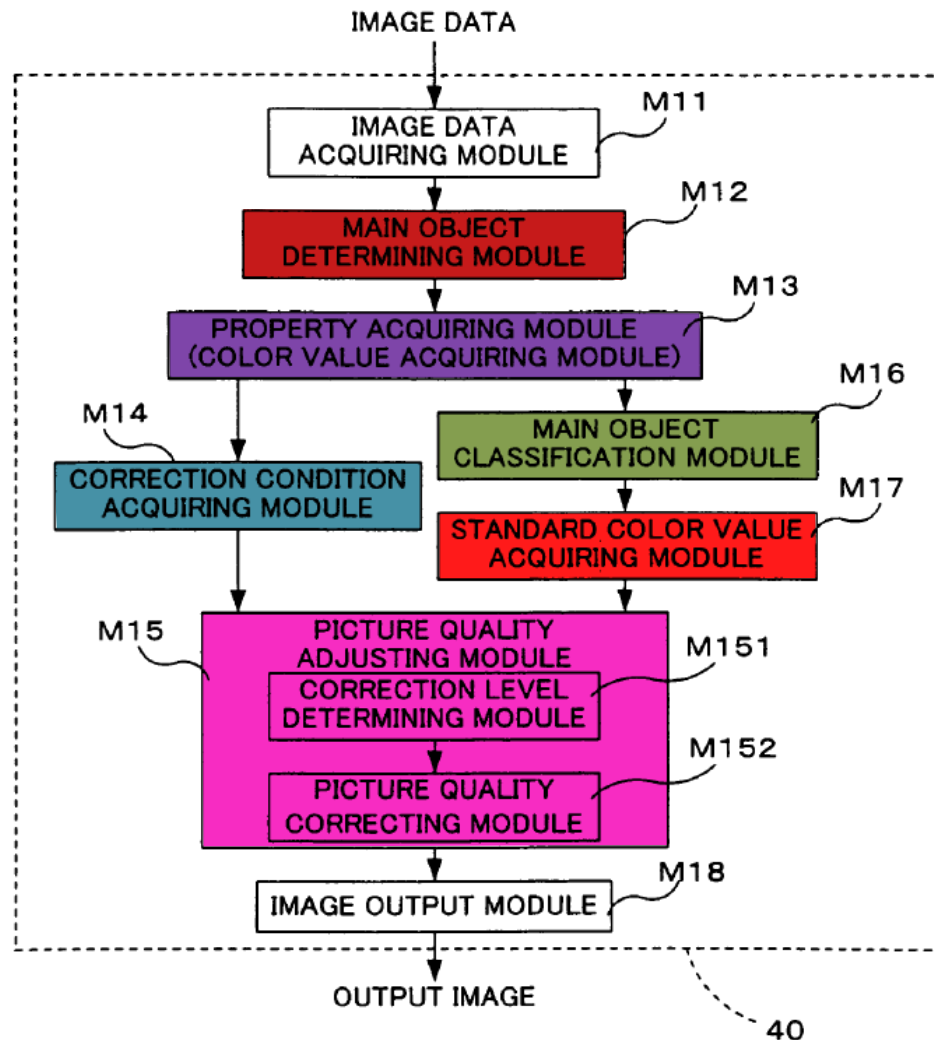
Fig.1



Id., FIG. 1 (annotated).

80. Figure 13, below, depicts “a block diagram of the functional modules realized by” an image processing device in one embodiment. *Id.*, 14:28-35.

Fig.13



Id., FIG. 13 (annotated).

81. In this embodiment, image data acquired by the image processing device is passed to a **main object determining module M12**, which “determines the image data areas corresponding to the ma[i]n object characterizing the image, that

is, the main object image data,” using, for example, color range data and position data for areas of the image. *Id.*, 14:36-46. “The main object(s) can be one or more main objects that are the same or different among the image.” *Id.*, 14:47-48. Examples of main objects that may be determined include “[s]ky,” “people (faces),” “vegetation,” and the like.” *Id.*, 18:63-65.

82. A “property acquiring module M13” then acquires the properties of the main object image data (such as statistical values and color values).” *Id.*, 14:49-52. From here, the processing may follow one of two paths. In the first path, a “correction condition acquiring module M14 acquires correction conditions” (e.g., correction standard values) “corresponding to the acquired properties ... of the main object image data.” *Id.*, 14:49-56, 14:66-15:5. In the second path, a “main object classification module M16 uses the acquired data corresponding to the main object to classify the main object in greater detail, such as clear sky, ordinary sky, and dark sky.” *Id.*, 15:10-15. Then, a “standard color value acquiring module M17 acquires standard color values corresponding to the classified main object.” *Id.*, 15:16-20.

83. Both paths converge into a picture quality adjusting module M15, which adjusts the picture quality of the main object image data by determining and applying a “correction level so as to eliminate or reduce color range differences between” the acquired correction standard values/standard color values and the

property values of the main object image data. *Id.*, 14:60-15:5, 15:21-33. The correction standard values/standard color values are the “ideal” values for the main object. *Id.*, 15:18-20, 16:19-21. “When different types of main object image data” are determined, the applied correction level may take “the different types of main object image data” into consideration to make the image “more harmonious” as a whole. *Id.*, 18:49-62.

84. “The picture quality adjusting ... process is carried out on picture quality parameters such as shadow, highlight, brightness, contrast, color balance, and memory color correction” *Id.*, 16:48-53. Figures 15 and 16, below, depict tables “storing correction standard values and classification color values,” and “storing standard color values,” respectively, either of which may be used in the picture quality adjusting process, for when the main object is sky. *Id.*, 15:49-52, 18:23-25.

Fig.15

CLASSIFIED MAIN OBJECT	CLASSIFICATION COLOR VALUE	CORRECTION STANDARD LEVEL
BRIGHT SKY	Hcsb, Scsb, Bcsb	CONTRAST b, BRIGHTNESS b, COLOR BALANCE b
ORDINARY SKY	Hcsn, Scsn, Bcsn	CONTRAST n, BRIGHTNESS n, COLOR BALANCE n
DARK SKY	Hcsd, Scsd, Bcsd	CONTRAST d, BRIGHTNESS d, COLOR BALANCE d

Id., FIG. 15.

Fig.16

CLASSIFIED MAIN OBJECT	STANDARD COLOR VALUE
BRIGHT SKY	Hrefsb, Srefsb, Brefsb
ORDINARY SKY	Hrefsn, Srefsn, Brefsn
DARK SKY	Hrefsd, Srefsd, Brefsd

Id., FIG. 16.

B. Prosecution History

85. The '574 patent was filed on November 10, 2009, and claims priority to U.S. Patent No. 7,668,365 (“’365 patent”), filed on March 7, 2005. In the first rejection, the Examiner rejected the claims as directed to ineligible subject matter under § 101 and as anticipated by Bolle. Ex. 1002, 482-487.

86. Applicant then amended the method claims to require “wherein each operation of the method of image processing is executed by a computer” and added similar computer-related features to the apparatus and computer-program-product claims. *Id.*, 499-501. Applicant argued that the claims recited statutory subject matter under § 101 based on these amendments. *Id.*, 502. Applicant argued that Bolle does not anticipate the claims because it discloses “a technique regarding camera controls performed *before* and *when shooting*,” rather than “a technique for allowing an image processing apparatus to adjust the image quality of a shot image.” *Id.*, 503-504.

87. The Examiner again rejected the claims as anticipated by Bolle, finding Applicant's arguments unpersuasive. *Id.*, 523-524. In response, Applicant amended the claims to require that the main-object determination in an image be "in an image generated by an image generating apparatus." *Id.*, 531-533. Applicant argued that Bolle's person detection "is carried out at the time of image shooting, and is therefore different from person detection performed using a shot image after shooting." *Id.*, 534-535. Applicant also argued that Bolle determines "image shooting parameters," not "image processing parameters." *Id.*, 535-536.

88. The Examiner again found the claims anticipated by Bolle. *Id.*, 544-545. In response, Applicant amended the claims to require that "a parameter used in adjusting the image quality is a highlight, a shadow, brightness, contrast, color balance, or memory color" and specified that the processing is performed by "a personal computer, a printer, or a display device." *Id.*, 549-552. Applicant argued that "because no shot image exists" in Bolle, it cannot "determine various parameters for image processing to be performed on a shot image based on the shot image itself." *Id.*, 554. Applicant also argued that Bolle's technique "is to be used with a camera, e.g., a digital camera, at the time of image shooting" and that Bolle's "imaging parameters" used during the shooting process differ from "[t]he claimed parameter used in adjusting the image quality." *Id.*, 554-555. However, the Applicant failed to address Bolle 8:1-6, which states that "all of the extracted

information can be recorded and used to control a subsequent rendering or reproduction phase.” This means that the scene classifications and imaging parameters disclosed in Bolle can be used to adjust the image quality of the shot image at a later time, when the image is displayed or printed.

89. The Examiner then issued a notice of allowance. Ex. 1002, 564.

VII. CLAIM CONSTRUCTION

90. I am told that claim construction is not necessary where there is no controversy as to the meaning of the terms with respect to the prior art. In my opinion, the prior art asserted in the petition ground discloses an embodiment within the indisputable scope of the ordinary and customary meaning of the claims. Therefore, it is my opinion that no explicit claim constructions are needed to apply the prior art to the Challenged Claims.

VIII. ANALYSIS OF PETITION GROUNDS

A. Overview of the Asserted References

1. Overview of Luo-250 (Ex. 1005)

91. Luo-250, like the '574 patent, discloses enhancing an image “depending on detecting different objects or subject matters contained within the image.” Luo-250, [0016]-[0017], [0030]. Luo-250 identifies the same problem as the '574 patent, namely that “[f]ailure to reliably detect the presence of primary subject matters ... may lead to failures in the downstream applications,” and provides “a more robust primary subject detection method.” *Id.*, [0041].

92. Luo-250's image processing method includes applying a "subject matter detector" that generates "a map of detected subject matter regions," called a "subject matter belief map." *Id.*, [0032], [0042]. This map is generated by "assigning to each pixel a belief value" that it belongs to a target subject matter region "based on color and texture features," "forming spatially contiguous candidate subject matter regions by thresholding the belief values," and analyzing whether each region belongs to the subject matter "based on one or more unique characteristics of the subject matter." *Id.* In one example, the target subject matter is "human faces." *Id.*, [0040].

93. Once the subject matter is determined, "various image operations can be performed." *Id.*, [0046]-[0051]. For example, Luo-250 discloses modifying "the color of skin regions in an image" towards "a pre-determined 'preferred' or 'memory' color of the skin (e.g., tanned skin)." *Id.*, [0049]. Luo-250 also discloses adjusting "the scene balance (brightness and color balance) based on the color and brightness of certain target subject matters," like "the skin (face) region." *Id.*, [0050].

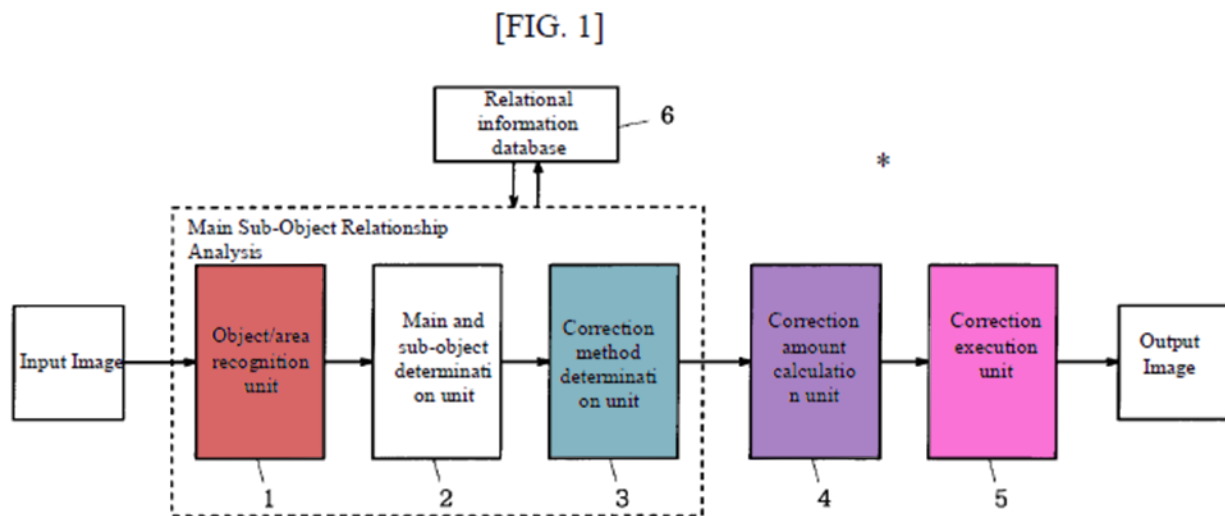
2. Overview of Hibi (Ex. 1006)

94. Hibi, like the '574 patent, discloses an image processing device, method, and program for correcting an image, where "a plurality of objects are recognized from an image, and a correction method is determined for those objects

based on the recognition results of the scene of the image.” Hibi, [0010], [0014].

Hibi discloses that its image processing “can be realized in a personal computer ... that provides such image processing” on an image “taken with a digital camera” or “obtained by scanning film taken with a film camera.” *Id.*, [0014], [0048].

95. Figure 1, below, depicts “a block diagram showing one embodiment of” Hibi’s image processing device. *Id.*, [0015].



Id., FIG. 1 (annotated).

96. Hibi’s “object/area recognition unit 1 recognizes a plurality of objects from the entered images,” such as “people and faces.” *Id.*, [0015]. From the multiple objects recognized, a “main and sub-object determination unit 2 determines the main object and the sub-object.” *Id.*, [0016]. A “correction method determination unit 3” then “recognizes the scene of the image and determines a correction method for each object based on the recognition result.” *Id.* [0017]. A “correction amount calculation unit 4” extracts a “feature amount” of the specified

object and calculates “the correction amount of the object to be corrected” from the feature amount based on the determined correction method. *Id.*, [0018], [0046]. A

“**correction execution unit 5** performs the actual correction processing.”

Id., [0019]. Hibi discloses that “correction processing of image elements such as brightness, saturation, contrast, memory color, and sharpness can be performed.”

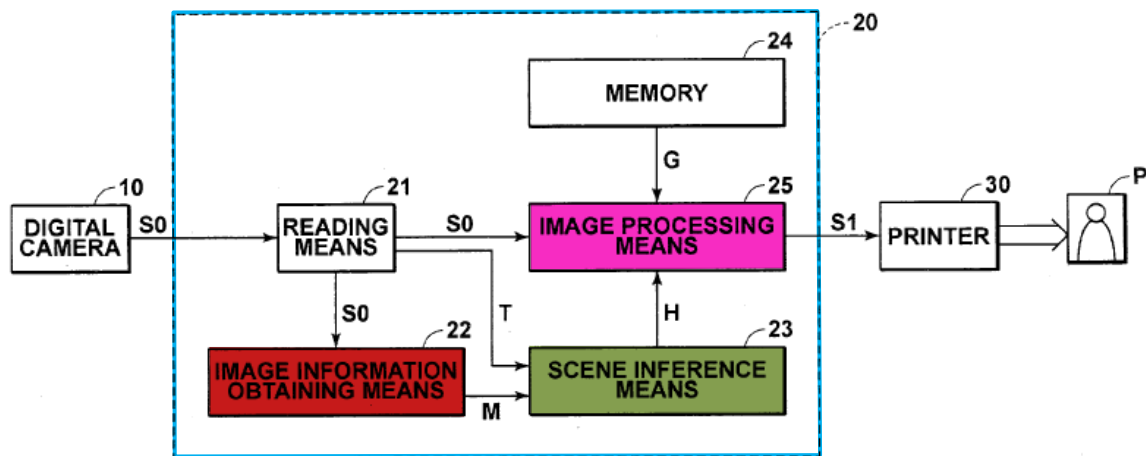
Id., [0047].

3. Overview of Terashita (Ex. 1007)

97. Terashita discloses “a method and an apparatus for carrying out image processing on image data obtained by a digital camera” based on the scene in the image. Terashita, [0002], [0032]. Terashita discloses that prior-art image-processing methods that used only photography information “attached as tag information to image data obtained by a digital camera” to execute image processing before printing could not accurately determine “an appropriate condition for the image processing” if the type of subject in an image varied or if the user erroneously set the photography mode. *Id.*, [0005]-[0008]. Terashita sought to improve the accuracy of an image processing condition by basing it on a photography scene inferred using “the photography information attached to the image data” and “the image information regarding the image represented by the image data.” *Id.*, [0032].

98. Figure 1, below, depicts an image processing apparatus 20 “for outputting a print or prints P ... from a printer 30 by carrying out various kinds of image processing on image data S0 obtained by photography of a subject with a digital camera 10.” *Id.*, [0038]. The apparatus “comprises reading means 21, **image information obtaining means 22**, **scene inference means 23**, a memory 24, and **image processing means 25**.” Terashita, [0039].

FIG.1



Id., FIG. 1 (annotated).

99. The **image information obtaining means 22** “obtains image information M regarding an image represented by the image data S0” read from a recording medium. *Id.*, [0039]. This includes determining the “presence or absence of a human face in the image” and “includ[ing] a result of the judgment in the image information M.” *Id.*, [0042]. “More specifically, a skin-color area is extracted from the image data S0 and the image is judged to include a human face

if an area of the skin-color area is not smaller than a predetermined threshold value.” *Id.*, [0042]. The image information M may also include other information determined from the image data. *Id.*, [0043]-[0046].

100. The **scene inference means 23** “infer[s] a photography scene, based on the image information M and photograph[y] information T included in tag information attached to the image data S0,” and “outputs the scene information H representing the inferred photography scene to the **image processing means 25**.” *Id.*, [0039], [0049]. Figure 2, below, provides one example of a table stored in the **scene inference means** and used to infer a scene. *Id.*, [0047]. If a main part, such as a face, was determined to be present, a portrait scene may be inferred. *Id.*, [0020], [0047]-[0048], FIG. 2. Depending on other information, the inferred scene may be a portrait in normal lighting or a portrait outdoors at nighttime, indicated by the highlighted rows below. *Id.*, [0047]-[0048], FIG. 2.

FIG.2

NO	MAIN PART INFORMATION	SUBJECT DISTANCE	MAGNIFICATION	SUBJECT BRIGHTNESS	FLASH INFORMATION	OTHER INFORMATION	INFERRED SCENE	IMAGE PROCESSING
1	AVAILABLE		$> \beta 1$	$> B1$	OFF	BACKGROUND INFORMATION	NORMAL LIGHTING, PORTRAIT	1
2	AVAILABLE		$> \beta 2$	$> B2$	OFF	BACKGROUND INFORMATION	BACK LIGHTING, PORTRAIT	2
3	NOT AVAILABLE	∞		$> B3$	OFF	FREQUENCY INFORMATION	DISTANT VIEW (SCENERY,BUILDING)	3
4	NOT AVAILABLE	$< K4$	$> \beta 4$	$> B4$	OFF	BRIGHTNESS AT THE POINT OF FORCUS	NORMAL LIGHTING, STILL OBJECT/ANIMAL	4
5	NOT AVAILABLE	$< K5$	$> \beta 5$	$> B5$	OFF	BRIGHTNESS AT THE POINT OF FORCUS	BACKLIGHT, STILL OBJECT/ANIMAL	5
6	NOT AVAILABLE	$K61 < K62$	$> \beta 6$	$> B6$	OFF	HISTOGRAM INFORMATION	MIDDLE-DISTANCE VIEW (LOW-KEY TONES)	6
7	NOT AVAILABLE	$K61 < K62$	$> \beta 7$	$> B7$	OFF	HISTOGRAM INFORMATION	MIDDLE-DISTANCE VIEW (HIGH-KEY TONES)	7
8	AVAILABLE	$< K8$	$> \beta 8$	$> B8$	ON		DAYTIME SYNCHRONOUS PHOTOGRAPHY,PORTRAIT	8
9	NOT AVAILABLE	$< K9$	$> \beta 9$	$> B9$	ON		DAYTIME SYNCHRONOUS PHOTOGRAPHY,STILL OBJECT	9
10	AVAILABLE	$< K10$	$> \beta 10$	$< B10$	ON		NIGHTTIME OUTDOOR, PORTRAIT	10
11	AVAILABLE	$< K11$	$> \beta 11$	$B111 < B112$	ON		INDOOR, PORTRAIT	11
12	NOT AVAILABLE	∞		$< B12$	OFF	SHUTTER SPEED $< S11$	NIGHT VIEW	12
13	NOT AVAILABLE	∞		$< B13$	OFF	SHUTTER SPEED $> S12$	FIREWORKS/NIGHT VIEW	13
14	NOT AVAILABLE	∞		$B151 < B152$	OFF	COLOR TEMPERATURE	SUNSET VIEW	14
15	AVAILABLE	$K161 < K162$				SHUTTER SPEED $< S16$	MOVING OBJECT	15
16	NOT AVAILABLE			$B171 < B172$		IMAGE INFORMATION (COLOR)	IN WATER	16

Id., FIG. 2 (annotated).

101. “The image processing means 25 reads a corresponding set of the image processing conditions in accordance with the scene information H,” referred to as “image processing conditions G,” “from the memory 24” and carries out “image processing on the image data S0 according to the image processing conditions G that have been read.” Terashita, [0039]. For example, if “the scene information H represents a portrait in normal lighting,” image processing conditions 1 are selected from the memory that “cause highlight tones to be soften[ed] so that black hair color can be sharpened” and that “cause only the skin color to have a preferable hue.” Terashita, [0050]. Scene information H

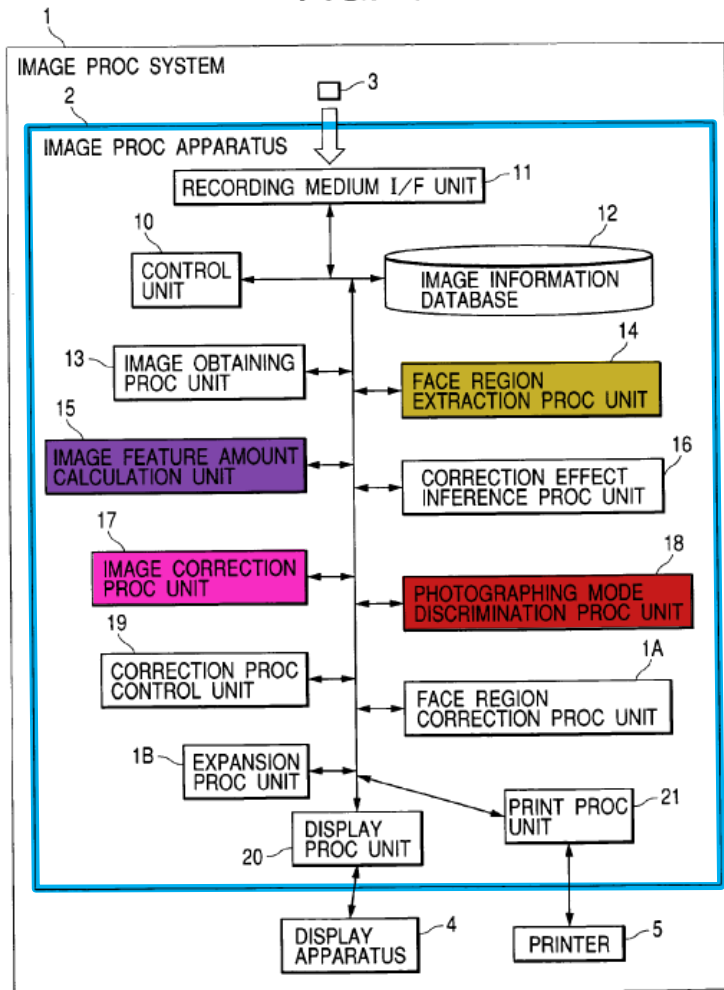
representing a portrait at nighttime outdoors corresponds to a different set of image processing conditions, which are identified as image processing conditions 10.

Terashita, [0050], FIG. 2.

4. Overview of Yano (Ex. 1008)

102. Like the '574 patent, Yano discloses “using an image processing apparatus which displays and prints a person image photographed (or shot) by a digital camera” to “automatically correct image data and thus output the person image of an optimum characteristic.” Yano, 1:65-2:2. Figure 1, below, depicts “a block diagram showing the functional structure” of one embodiment of an [image processing apparatus](#). *Id.*, 2:15-19.

FIG. 1

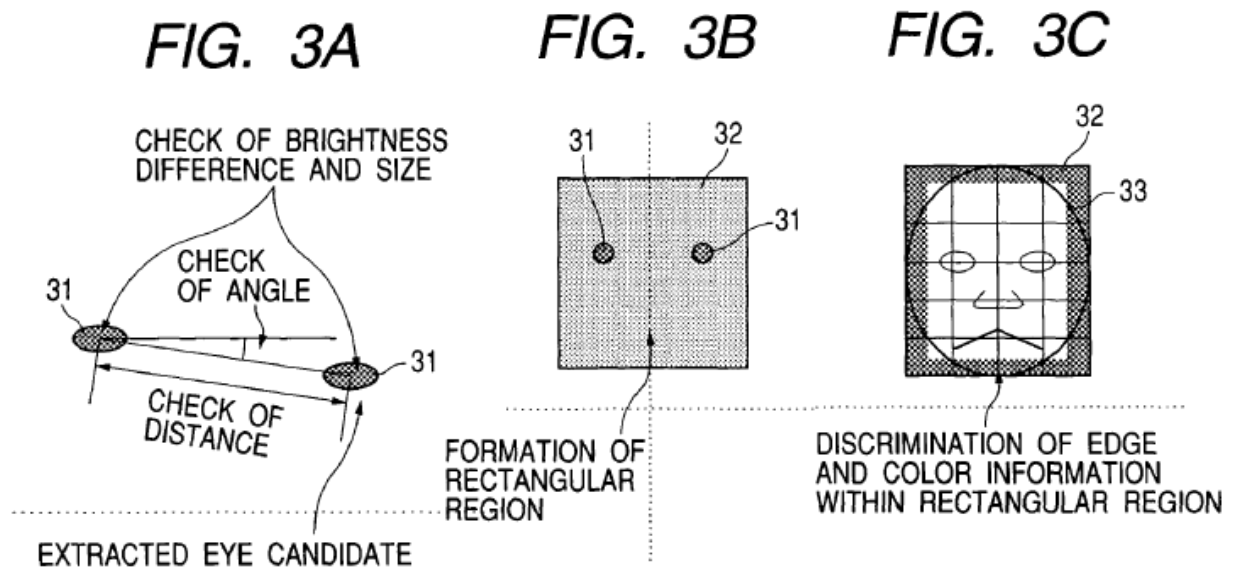


Id., FIG. 1 (annotated).

103. Yano discloses that digital cameras have multiple photographing modes, one of which is a “person mode.” *Id.*, 2:46-52. Yano’s image processing apparatus includes a “photographing mode discrimination processing unit 18” that determines whether “the image data was photographed and obtained in the person mode” based on photographing information. *Id.*, 7:33-38. Yano’s image processing apparatus only performs its image processing when “the photographing mode

information incidental to the image data indicates the person mode, whereby it is possible to avoid erroneously applying the correction process to a landscape image or the like.” *Id.*, 12:23-28. Alternately, Yano discloses using “various methods of discriminating that a person (particularly a face portion of the person) is included in the image data.” *Id.*, 7:47-54.

104. If photographed in the person mode, a “face region extraction processing unit 14 extracts the face region 33 as shown in FIG. 3C from the image data.” *Id.*, 7:55-58. Portions of a process for extracting face region 33 are shown in Figures 3A-3C, below. *Id.*, 6:4-60.



Id., FIGS. 3A-3C.

105. An image feature amount calculation unit 15 then calculates a “feature amount” of the extracted face region 33. *Id.*, 7:58-62. This feature amount includes, for example, “the lightness and hue histograms in regard to each pixel,

the average value, the distribution value, and the total number of pixels included in the face region 33.” *Id.*, 10:43-61.

106. If the **image processing apparatus** determines that the face region 33 is of a sufficient size and that a correction effect can be obtained, an “**image correction processing unit 17** obtains the parameters for the color correction from the image feature amount of the feature region 33, and then actually performs” an image correction process. *Id.*, 10:62-11:61. This process includes obtaining the “center value and distribution value” of “a range of hue of the flesh color that human beings feel desirable” that are “stored in the **image correction processing unit 17**” and using them to obtain corrected pixel values for either the image as a whole or just the face region 33. *Id.*, 11:36-61, 12:30-35.

B. Luo-250, Hibi, Terashita, and Yano Are Analogous Art

107. Luo-250, Hibi, Terashita, and Yano are analogous art to the ’574 patent because they are in the same field of endeavor, namely, image-processing techniques that determine a main object in an image and adjust the picture quality of the image. Ex. 1001, 1:16-18; Luo-250, [0001], [0043]-[0051]; Hibi, [0010]; Terashita, [0042], [0047]-[0052]; Yano, 6:4-60, 7:11-11:67. Luo-250, Hibi, Terashita, and Yano are also analogous art to the ’574 patent because they are reasonably pertinent to the problems of accurately identifying a main object of the image and accounting for the main object when adjusting the image, which the

'574 patent purports to solve. Ex. 1001, 1:28-48; Luo-250, [0041]-[0051]; Hibi, [0013], [0041]-[0042]; Terashita, [0008]; [0042], [0047]-[0052]; Yano, 6:4-60, 7:11-11:67.

C. Ground 1: Luo-250 and Hibi Would Have Rendered Obvious Claims 1, 3, 5, 7, 9, and 11

1. Independent Claim 1

a. [1.pre]: “A method of image processing, the method comprising:”

108. If limiting, Luo-250 discloses or suggests [1.pre].

109. Luo-250 discloses “a method for processing a digital color image,” including “applying image enhancement to the digital image by varying the control signal” according to “a belief map indicating the degree of belief that pixels in the image belong to target subject matter.” Luo-250, [0017]. Figure 1, below, illustrates a method of image processing “to obtain an enhanced output image.” Luo-250, [0030], FIG. 1.

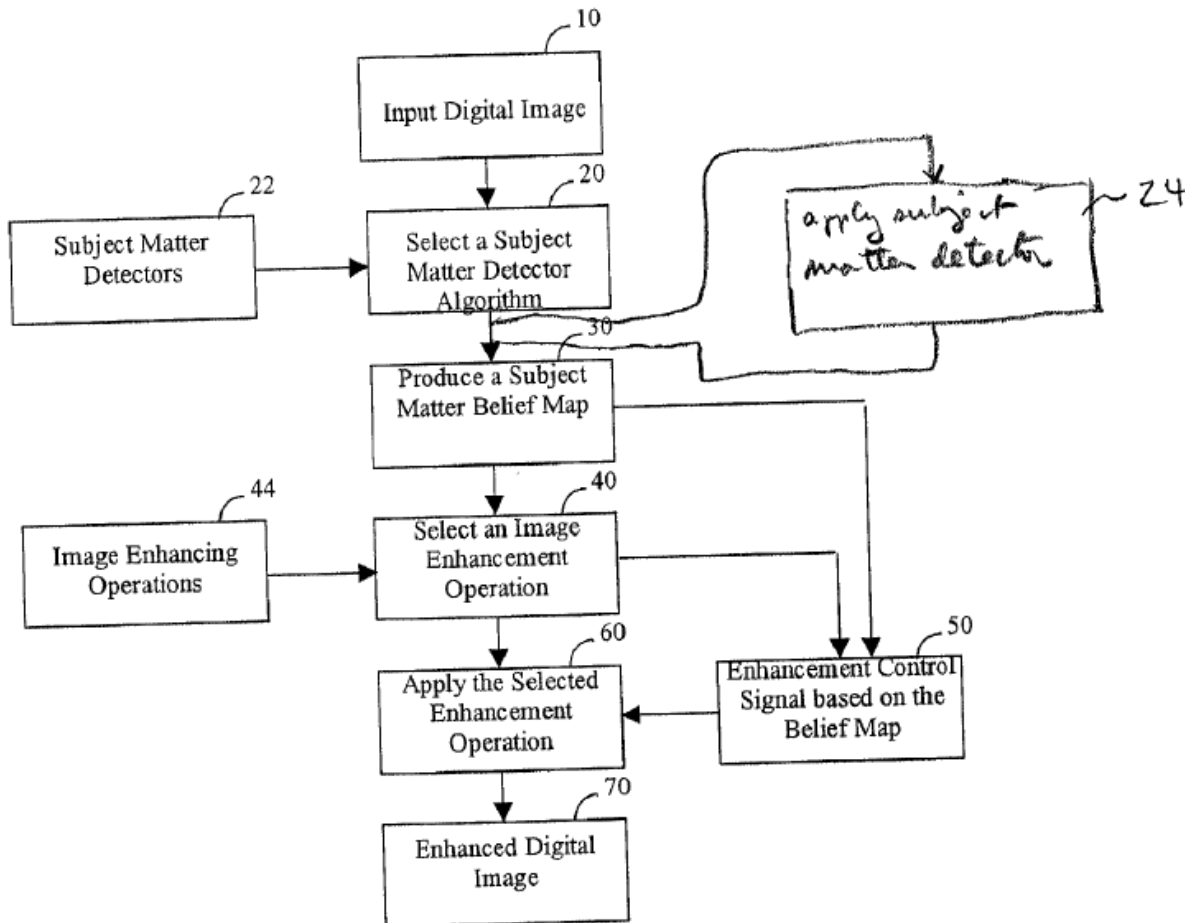


FIG. 1

Luo-250, FIG. 1.

- b. [1.a]: “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;”

110. Luo-250 and Hibi render obvious [1.a].

111. Luo-250 discloses obtaining “a digital color image” and applying a “subject matter detector” to identify a “primary,” or “target,” subject matter in the

image (“*determining a main object in an image*”). Luo-250, [0032], [0041]-[0042].

Luo-250’s subject matter detector detects the primary/target subject matter by

assigning to each pixel a belief value as belonging to the subject matter region based on color and texture features, forming spatially contiguous candidate subject matter regions by thresholding the belief values, analyzing the spatially contiguous regions based on one or more unique characteristics of the subject matter to determine the probability that a region belongs to the subject matter, and generating a map of detected subject matter regions and associated probability that regions belong to the subject matter.

Luo-250, [0041]-[0042].

112. Luo-250 discloses that “a collection of target subject matters can be pre-determined,” one of which may be a human face (“*the main object includes at least a human face*”). Luo-250, [0032], [0038], [0040]. For example, Luo-250 discloses using a face detection algorithm “to find human face regions in the input color digital image” and then extracting “[r]egions of skin-tone colors ... from the detected face regions.” Luo-250, [0038] (disclosing that U.S. Patent No. 5,710,833 (“Moghaddam”; Ex. 1009) describes “a face detection method”). Luo-250 also discloses that, instead of extracting the skin-tone colors from the face regions, “human faces” themselves may be the target subject matter and that automated

techniques for detecting a human face are “described in many articles.”

Luo-250, [0032], [0040] (identifying “Heisele et al., Face Detection in Still Gray Images, *MIT Artificial Intelligence Lab*, A. I. Memo 1687, C.B.C.L Paper No. 187, May 2000” (“Heisele”; Ex. 1010) as an example); *see* Heisele, Abstract (disclosing a “system for detecting frontal and near-frontal views of faces in still gray images”); Hibi, [0015] (disclosing that faces “can be recognized by using known techniques, such as detecting skin color areas and facial structures”); Yano, 6:4-60. These face-detection techniques disclose that “the determining of the main object is implemented by determining whether the image includes the human face,” as recited in claim 1. Luo-250, [0032], [0038], [0040].

113. Luo-250’s determining whether the image includes the human face is further apparent by Luo-250’s disclosure that the amount of image enhancement is “determined by the subject matter(s) or objects within the image.”

Luo-250, [0030]. Luo-250 discloses that “small faces are sharpened less than large faces, both of which are sharpened less than non-face regions.” Luo-250, [0076].

Accordingly, Luo-250 discloses implementing the determining of the main object by determining whether the image includes the human face so that it determines the appropriate amount of image enhancement for when the image includes a face.

114. Luo-250 does not explicitly disclose where the “digital color image” that is subjected to processing is generated. Hibi discloses determining a main object in an image generated by a digital camera.

115. Hibi discloses “an image processing program that allows a computer to execute” image processing, which “can be realized in a personal computer.” Hibi, [0014]. This personal computer executes the image processing on an image “taken with a digital camera.” Hibi, [0047]-[0048]. Like Luo-250’s subject matter detector, Hibi’s image processing includes an “object/area recognition unit 1 [that] recognizes a plurality of objects from the entered images,” including “people and faces,” by applying “known techniques, such as detecting skin color areas and facial structures.” Hibi, [0015].

116. A POSITA would have found it obvious to apply Luo-250’s image processing, including its main-object determination, to an image generated by a digital camera (“*image generating apparatus*”) in view of Hibi. Digital cameras were well-known image generating apparatuses at the time widely used for generating digital color images. A POSITA would have been motivated to apply Luo-250’s image processing to an image generated by a digital camera because such images were ubiquitous at the time, and applying Luo-250’s image processing would have improved the image enhancement “depending on detecting different objects or subject matters contained within the image.” Luo-250, [0016]-[0017].

117. Luo-250 already discloses “detecting subject matter regions in a digital color image” using “a computer program having instructions for controlling one or more computers.” Luo-250, [0042], [0090]. Hibi discloses a similar “image processing program that allows a computer to execute” image processing, which “can be realized in a personal computer.” Hibi, [0014]. Given Hibi’s disclosure of performing such image processing on an image “taken with a digital camera” using a personal computer and the similarity between Luo-250’s and Hibi’s face detection, using a personal computer to apply Luo-250’s image processing to a digital color image taken with a digital camera would have been an obvious combination of familiar elements according to known methods to yield predictable results. Hibi, [0014], [0047]-[0048].

118. A POSITA would have reasonably expected success in applying Luo-250’s image processing to images generated by image generating apparatuses like digital cameras. Both personal computers and digital cameras were widely available at the time, and digital cameras were commonly used to generate digital color images that are the subject of Luo-250’s image processing. Combining Luo-250 and Hibi to process images generated by a digital camera would have required applying only conventional techniques for transferring image data from a digital camera to a personal computer (e.g., using a memory card) that were well within the skill of a POSITA. Terashita, [0004], [0038]-[0039].

c. [1.b]: “acquiring properties of the determined main object;”

119. Luo-250 discloses or suggests [1.b].

120. Luo-250 discloses acquiring various properties of the determined main object, depending on the image processing, including color, brightness, contrast, and tone scale. For example, Luo-250 discloses “automatically determin[ing] the amount of image enhancement for each region in an image based on the subject matter content of the region.” Luo-250, [0018]. Such image enhancement includes “modify[ing] the colors (color re-mapping) of certain target subject matters.” Luo-250, [0045], [0049]. When the determined main object is a face, this involves modifying “the color of skin regions ... in the direction of a pre-determined ‘preferred’ or ‘memory’ color of the skin (e.g., tanned skin).” Luo-250, [0049]. A POSITA would have understood that modifying “the color of skin regions ... in the direction of a pre-determined ‘preferred’ or ‘memory’ color of the skin” teaches acquiring the color properties of those regions so that they are modified in the desired direction. Such color properties include the hue, lightness, and/or saturation of a color. Luo-250, [0049].

121. Such image enhancement also includes adjusting “the scene balance (brightness and color balance) based on the color and brightness of certain target subject matters.” Luo-250, [0045]-[0046], [0050]. Luo-250 discloses using “the color and brightness of the skin (face) region ... to determine the overall scene

balance or local scene balance if there are multiple light sources.” Luo-250, [0050].

A POSITA would have understood that this teaches acquiring the color and brightness properties of the face region for use in determining the overall or local scene balance.

122. Such image enhancement also includes modifying “the contrast and tone scale of face regions ... in the direction of a predetermined ‘preferred’ or ‘memory’ tone scale of faces (e.g., that of studio portraits).” Luo-250, [0045], [0051]. A POSITA would have understood that this teaches acquiring the contrast and tone scale properties of the face regions so that they are modified in the desired direction.

d. [1.c]: “acquiring correction conditions corresponding to the acquired properties; and”

123. Luo-250 discloses or suggests [1.c].

124. Luo-250 discloses acquiring various correction conditions, depending on the image processing, including a memory color, brightness, color balance, contrast, and tone scale. For example, Luo-250 discloses several types of image enhancements that may be applied, including “modify[ing] the colors (color re-mapping) of certain target subject matters.” Luo-250, [0045], [0049]. When the determined main object is a face, this involves modifying “the color of skin regions ... in the direction of a pre-determined ‘preferred’ or ‘memory’ color of the skin (e.g., tanned skin).” Luo-250, [0049]. A POSITA would have understood that

modifying “the color of skin regions ... in the direction of a pre-determined ‘preferred’ or ‘memory’ color of the skin” teaches acquiring the pre-determined memory color of the skin (“*correction conditions*”) corresponding to the color properties of the skin regions (“*acquired properties*”) to determine how to modify the skin regions towards the memory color. Such color properties include the hue, lightness, and/or saturation of a color such as “tanned skin,” so that color re-mapping can be used to modify the hue, lightness and/or saturation of the skin regions “in the direction of” the predetermined color of tanned skin.

Luo-250, [0049].

125. As another example, Luo-250 discloses adjusting “the scene balance (brightness and color balance) based on the color and brightness of certain target subject matters.” Luo-250, [0045]-[0046], [0050]. Luo-250 discloses using “the color and brightness of the skin (face) region ... to determine the overall scene balance or local scene balance if there are multiple light sources.” Luo-250, [0050]. A POSITA would have understood that this teaches acquiring the desired brightness and color balance (“*correction conditions*”) corresponding to the color and brightness properties of the face region (“*acquired properties*”) to determine how to adjust the overall or local scene balance towards the desired brightness and color balance.

126. As another example, Luo-250 discloses modifying “the contrast and tone scale of face regions ... in the direction of a predetermined ‘preferred’ or ‘memory’ tone scale of faces (e.g., that of studio portraits).” Luo-250, [0045], [0051]. A POSITA would have understood that this teaches acquiring the desired contrast and tone scale (“*correction conditions*”) corresponding to the contrast and tone scale properties of the face regions (“*acquired properties*”) to determine how to modify the face regions towards the desired contrast and tone scale.

- e. **[1.d]: “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”**

127. Luo-250 discloses or suggests [1.d].

128. Luo-250 discloses that, “[b]ased on the selected image enhancement operation, an enhancement control signal 50 is generated for controlling the amount of selected enhancement appropriate for the target subject matter and the background subject matters.” Luo-250, [0045]. “The selected image enhancement according to the controlling signal is applied 60 to the input digital image 10 to produce an enhanced image 70” (“*adjusting image quality of the main object*”). *Id.*, [0045].

129. Luo-250 discloses several types of image enhancements that may be applied, including “modify[ing] the colors (color re-mapping) of certain target

subject matters.” Luo-250, [0045]-[0046], [0049]. When the determined main object is a face, this involves modifying “the color of skin regions ... in the direction of a pre-determined ‘preferred’ or ‘memory’ color of the skin (e.g., tanned skin).” Luo-250, [0049]. A POSITA would have understood that this teaches adjusting the image quality of the face using the acquired memory color of the skin (“*the acquired correction conditions*”), wherein a parameter used in adjusting the image quality is memory color.

130. As another example, Luo-250 discloses adjusting “the scene balance (brightness and color balance) based on the color and brightness of certain target subject matters.” Luo-250, [0045], [0050]. Luo-250 discloses using “the color and brightness of the skin (face) region ... to determine the overall scene balance or local scene balance if there are multiple light sources.” Luo-250, [0050]. A POSITA would have understood that this teaches adjusting the image quality of the face using the acquired desired brightness and color balance (“*the acquired correction conditions*”), wherein parameters used in adjusting the image quality are brightness and color balance.

131. As another example, Luo-250 discloses modifying “the contrast and tone scale of face regions ... in the direction of a predetermined ‘preferred’ or ‘memory’ tone scale of faces (e.g., that of studio portraits).” Luo-250, [0045], [0051]. A POSITA would have understood that this teaches adjusting the image

quality of the face using the acquired desired contrast and tone scale (“*the acquired correction conditions*”), wherein a parameter used in adjusting the image quality is contrast.

f. [1.e]: “wherein each operation of the method of image processing is executed by one of a personal computer, a printer, or a display device.”

132. Luo-250 and Hibi render obvious [1.e].

133. Luo-250 discloses implementing its image processing method “in a computer program product,” which may include any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method.” Luo-250, [0017], [0090]. Luo-250 does not explicitly disclose what kind of computer to use, so a POSITA would have looked to Hibi for implementation details.

134. Hibi discloses a similar image processing method that recognizes “a plurality of objects” from an image and corrects the image “according to the surrounding situation.” Hibi, [0010]. Like Luo-250, Hibi discloses “an image processing program that allows a computer to execute the[] image processing method.” Hibi, [0014]. Hibi discloses that this image processing program “can be realized in a personal computer ... that provides such image processing.” Hibi, [0014].

135. A POSITA would have found it obvious to implement Luo-250's computer program product on a personal computer in view of Hibi. Luo-250 already discloses executing each step of its image processing method on a "computer" based on instructions provided by the computer program product. Luo-250, [0017], [0090]. Personal computers were well-known types of computers used for processing images.

136. A POSITA would have been motivated to execute each step of its image processing method on a personal computer because these were commonly owned by photographers desiring to adjust their images captured via a camera and would have provided a convenient and user-friendly device for these photographers to use. Hibi, [0002]-[0004]. Accordingly, implementing Luo-250's computer program product on a personal computer would have made its image processing method widely accessible to photographers, particularly those who would otherwise struggle to manually correct images from their digital cameras. Hibi, [0002]-[0004]. A POSITA would have seen implementing Luo-250's image processing on a personal computer as desirable because personal computers commonly provided a display, allowing users to see the results of the image processing and determine whether any further processing is desired.

137. A POSITA would have reasonably expected success in implementing Luo-250's image processing on a personal computer. Personal computers included

the type of “storage media” and processor needed to store and execute Luo-250’s computer program product, so implementing Luo-250’s computer program product on Hibi’s personal computer would have required applying only conventional techniques for storing and executing a program on a computer that were well within the skill of a POSITA.

2. Independent Claim 3

a. [3.pre]: “A method of image processing, the method comprising:”

138. If limiting, Luo-250 discloses or suggests [3.pre] for the reasons explained for [1.pre]. *Supra* Section VIII.C.1.a.

b. [3.a]: “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”

139. Luo-250 and Hibi render obvious [3.a] for the reasons explained for [1.a]. *Supra* Section VIII.C.1.b.

c. [3.b]: “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”

140. Luo-250 discloses or suggests [3.b] for the reasons explained for [1.b]-[1.d]. *Supra* in Sections VIII.C.1.c-VIII.C.1.e.

- d. **[3.c]: “wherein each operation of the method of image processing is executed by one of a personal computer, a printer, or a display device.”**

141. Luo-250 and Hibi render obvious [3.c] for the reasons explained for [1.e]. *Supra* Section VIII.C.1.f.

3. **Independent Claim 5**

- a. **[5.pre]: “An image processing apparatus comprising:”**

142. If limiting, Luo-250 discloses or suggests [5.pre].

143. As explained for [1.pre], Luo-250 discloses an image processing method. *Supra* Section VIII.C.1.a. Luo-250 discloses implementing this image processing method “in a computer program product,” which includes any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method.” Luo-250, [0017], [0090]. Such a computer discloses an image processing apparatus. Luo-250 also discloses that the “equivalent of” a “software program” implementing Luo-250’s image processing method “may also be constructed in hardware.” Luo-250, [0029]

- b. **[5.a]: “one or more processors;”**

144. Luo-250 discloses or suggests or Luo-250 and Hibi render obvious [5.a].

145. Luo-250 discloses “a computer program product,” which includes any “physical device or media employed to store a computer program having

instructions for controlling one or more computers to practice the method.”

Luo-250, [0017], [0090]. These instructions may be stored on RAM or ROM, for example. Luo-250, [0090]. A POSITA would have understood that Luo-250’s disclosure of “one or more computers” that execute the instructions of a computer program stored on RAM or ROM teaches “one or more processors” because processors were known to execute instructions stored in storage media.

Luo-250, [0090].

146. To the extent Patent Owner contends or the Board finds otherwise, Luo-250 and Hibi render obvious [5.a]. As explained for [1.e], it would have been obvious to combine Luo-250 and Hibi to implement Luo-250’s computer program product on a personal computer. *Supra* Section VIII.C.1.f. Such personal computers were well understood to include one or more processors, such as a CPU, for executing instructions according to computer programs stored thereon. *E.g.*, Yano, 2:36-43, 6:61-7:1 (disclosing a “PC” executing “an image process based on an application program installed” thereon using a CPU); U.S. Patent No. 7,013,042 (“Yamada”; Ex. 1011), 2:62-3:4 (disclosing a personal computer that includes a CPU executing “a program stored in a ROM 101 ... using a RAM 103 ... as a work memory”). At a minimum, a POSITA would have been motivated to incorporate such a processor in the personal computer to allow the personal computer to execute a wide variety of computer programs, making the computer

more customizable and improving user experience. A POSITA would have reasonably expected success in implementing a processor in a personal computer because these were ubiquitous at the time, so a POSITA would have needed to apply only conventional knowledge and techniques for providing a general-purpose processor to execute instructions stored in a storage medium.

c. [5.b]: “memory;”

147. Luo-250 discloses or suggests [5.b].

148. Luo-250 discloses that its “computer program product may include one or more storage media” (“*memory*”), including RAM or ROM.

Luo-250, [0090].

d. [5.c]: “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;”

149. Luo-250 and Hibi render obvious [5.c].

150. As explained for [1.a], Luo-250 and Hibi render obvious 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. *Supra* Section VIII.C.1.b. A POSITA would have found it obvious to implement this determining step as a determining module, such as a subject matter

detector that determines a human face in the image, that forms part of Luo-250's computer program product or the "equivalent of such software ... constructed in hardware." Luo-250, [0029], [0032], [0038], [0040], [0090]; *see* Ex. 1001, 14:32-35 (disclosing that the modules "can be realized in terms of the CPU 411 alone or the control circuit 41, and can be realized by either hardware or software").

151. A POSITA would have been motivated and found it obvious to do so because Luo-250 envisions the computer program product being implemented through any "physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method," and also discloses that "the equivalent of such software may also be constructed in hardware." Luo-250, [0029], [0090]. Likewise, Luo-250 teaches that its method is "a method implemented as a software program," which commonly included modules. Luo-250, [0029]. Accordingly, incorporating this determining step into the computer program product as a determination module configured to perform this determining step would have merely required the use of known software techniques (or alternatively, known hardware techniques) to predictably implement Luo-250's image processing method. A POSITA would have reasonably expected success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software (or alternatively, conventional techniques for implementing hardware). Luo-250, [0029] ("all software

implementation[s]” of Luo-250’s image processing method are “conventional and within the ordinary skill in such arts”).

e. [5.d]: “a property acquirer configured to acquire properties of the determined main object;”

152. Luo-250 renders obvious [5.d].

153. As explained for [1.b], Luo-250 discloses acquiring properties of the determined main object. *Supra* Section VIII.C.1.c.

154. A POSITA would have been motivated and found it obvious to implement this acquiring step as a property acquirer in a computer program product that is configured to perform this acquiring step because Luo-250 envisions the computer program product being implemented through any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method,” and also discloses that “the equivalent of such software may also be constructed in hardware.”

Luo-250, [0029], [0090]. Likewise, Luo-250 teaches that its method is “a method implemented as a software program.” Luo-250, [0029]. Accordingly, incorporating this acquiring step into the computer program product as software configured to perform the acquiring step would have merely required the use of known software techniques (or alternatively, known hardware techniques) to predictably implement Luo-250’s image processing method. A POSITA would have reasonably expected success in doing so because it would have required a POSITA to apply only

conventional techniques for implementing software (or alternatively, conventional techniques for implementing hardware). Luo-250, [0029].

f. [5.e]: “a correction condition acquirer configured to acquire correction conditions corresponding to the acquired properties; and”

155. Luo-250 renders obvious [5.e].

156. As explained for [1.c], Luo-250 discloses acquiring correction conditions corresponding to the acquired properties. *Supra* Section VIII.C.1.d.

157. A POSITA would have been motivated and found it obvious to implement this acquiring step as a correction condition acquirer in a computer program product that is configured to perform this acquiring step because Luo-250 envisions the computer program product being implemented through any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method,” and also discloses that “the equivalent of such software may also be constructed in hardware.”

Luo-250, [0029], [0090]. Likewise, Luo-250 teaches that its method is “a method implemented as a software program.” Luo-250, [0029]. Accordingly, incorporating this acquiring step into the computer program product as software configured to perform the acquiring step would have merely required the use of known software techniques (or alternatively, known hardware techniques) to predictably implement Luo-250’s image processing method. A POSITA would have reasonably expected

success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software (or alternatively, conventional techniques for implementing hardware). Luo-250, [0029].

- g. [5.f]: “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”**

158. Luo-250 renders obvious [5.f].

159. As explained for [1.d], Luo-250 discloses adjusting the 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. *Supra* Section VIII.C.1.e.

160. A POSITA would have been motivated and found it obvious to implement this adjusting step as an image quality adjuster in a computer program product that is configured to perform this adjusting step because Luo-250 envisions the computer program product being implemented through any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method,” and also discloses that “the equivalent of such software may also be constructed in hardware.”

Luo-250, [0029], [0090]. Likewise, Luo-250 teaches that its method is “a method implemented as a software program.” Luo-250, [0029]. Accordingly, incorporating

this adjusting step into the computer program product as software configured to perform the adjusting step would have merely required the use of known software techniques (or alternatively, known hardware techniques) to predictably implement Luo-250's image processing method. A POSITA would have reasonably expected success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software (or alternatively, conventional techniques for implementing hardware). Luo-250, [0029].

- h. [5.g]: “wherein the image processing apparatus is either a personal computer or a printer or a display device.”**

161. Luo-250 and Hibi render obvious [5.g] for the reasons explained for [1.e]. *Supra* Section VIII.C.1.f.

4. Independent Claim 7

- a. [7.pre]: “An image processing apparatus comprising:”**

162. If limiting, Luo-250 and Hibi render obvious [7.pre] for the reasons explained for [5.pre]. *Supra* Section VIII.C.3.a.

- b. [7.a]: “one or more processors;”**

163. Luo-250 discloses or suggests or Luo-250 and Hibi render obvious [7.a] for the reasons explained for [5.a]. *Supra* Section VIII.C.3.b.

c. [7.b]: “memory;”

164. Luo-250 discloses or suggests [7.b] for the reasons explained for [5.b]. *Supra* Section VIII.C.3.c.

d. [7.c]: “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”

165. Luo-250 and Hibi render obvious [7.c] for the reasons explained for [5.c]. *Supra* Section VIII.C.3.d.

e. [7.d]: “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”

166. Luo-250 renders obvious [7.d] for the reasons explained for [5.d]-[5.f]. *Supra* Sections VIII.C.3.e-VIII.C.3.g.

f. [7.e]: “wherein the image processing apparatus is either a personal computer or a printer or a display device.”

167. Luo-250 and Hibi render obvious [7.e] for the reasons explained for [1.e]. *Supra* Section VIII.C.1.f.

5. Independent Claim 9

a. [9.pre]: “A computer program product for image processing comprising:”

168. If limiting, Luo-250 discloses or suggests [9.pre].

169. As explained for [1.pre], Luo-250 discloses an image processing method. *Supra* Section VIII.C.1.a. Luo-250 discloses implementing this image processing method “in a computer program product,” which includes any “physical device or media employed to store a computer program having instructions for controlling one or more computers to practice the method.” Luo-250, [0017], [0090].

b. [9.a]: “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:”

170. Luo-250 and Hibi render obvious [9.a].

171. Luo-250 discloses that its “computer program product may include one or more storage media,” including an optical disk or ROM (“*a non-transitory computer readable medium*”) storing “a computer program having instructions for controlling one or more computers to practice the” image processing method (“*storing computer readable code therein for execution*”). Luo-250, [0017], [0090]. For the reasons explained for [1.e], it would have been obvious to combine

Luo-250 and Hibi to have a personal computer execute the instructions according to the computer program. *Supra* Section VIII.C.1.f.

- c. **[9.b]: “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;”**

172. Luo-250 and Hibi render obvious [9.b].

173. As explained for [1.a], Luo-250 and Hibi render obvious 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. *Supra* Section VIII.C.1.b. Luo-250 discloses implementing its image processing method in a “computer program product” including “a computer program having instructions for controlling one or more computers to practice the method.” Luo-250, [0017], [0090]. A POSITA would have understood that instructions for controlling one or more computers disclose computer readable code. Accordingly, Luo-250 teaches implementing this determining step as computer readable code.

- d. **[9.c]: “computer readable code for acquiring properties of the determined main object;”**

174. Luo-250 discloses or suggests [9.c].

175. As explained for [1.b], Luo-250 discloses acquiring properties of the determined main object. *Supra* Section VIII.C.1.c. For the same reasons explained for [9.b], Luo-250 teaches implementing this acquiring step as computer readable code. *Supra* Section VIII.C.5.c.

e. [9.d]: “computer readable code for acquiring correction conditions corresponding to the acquired properties; and”

176. Luo-250 discloses or suggests [9.d].

177. As explained for [1.c], Luo-250 discloses acquiring correction conditions corresponding to the acquired properties. *Supra* Section VIII.C.1.d. For the same reasons explained for [9.b], Luo-250 teaches implementing this acquiring step as computer readable code. *Supra* Section VIII.C.5.c.

f. [9.e]: “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.”

178. Luo-250 discloses or suggests [9.e].

179. As explained for [1.d], Luo-250 discloses 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. *Supra* Section VIII.C.1.e. For the same reasons

explained for [9.b], Luo-250 teaches implementing this adjusting step as computer readable code. *Supra* Section VIII.C.5.c.

6. Independent Claim 11

a. [11.pre]: “A computer program product for image processing comprising:”

180. If limiting, Luo-250 discloses or suggests [11.pre] for the reasons explained for [9.pre]. *Supra* Section VIII.C.5.a.

b. [11.a]: “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:”

181. Luo-250 and Hibi render obvious [11.a] for the reasons explained for [9.a]. *Supra* Section VIII.C.5.b.

c. [11.b]: “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”

182. Luo-250 and Hibi render obvious [11.b] for the reasons explained for [9.b]. *Supra* Section VIII.C.5.c.

- d. **[11.c]: “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.”**

183. Luo-250 discloses or suggests [11.c] for the reasons explained for [9.c]-[9.e]. *Supra* Sections VIII.C.5.d-VIII.C.5.f.

D. Ground 2: Luo-250, Hibi, and Terashita Would Have Rendered Obvious Claims 2, 4, 6, 8, 10, and 12

184. Luo-250 and Hibi render obvious independent claims 1, 3, 5, 7, 9, and 11 for the reasons explained in Section VIII.C. For the reasons explained below, Luo-250, Hibi, and Terashita render obvious the additional limitation, “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,” which appears in each of dependent claims 2, 4, 6, 8, 10, and 12.

1. Dependent Claims 2, 4, 6, 8, 10, and 12

- a. **[2], [4], [6], [8], [10], [12]: “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.”**

185. Luo-250, Hibi, and Terashita render obvious “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” in each of claims 2, 4, 6, 8, 10, and 12.

186. Terashita discloses an image processing apparatus containing a scene inference means 23 that “infers the photography scene based on the image information M and the photography information T.” Terashita, [0039], [0047], FIG. 1. The image information M includes an indication of whether the image includes “a main part like a human face.” Terashita, [0020], [0042]. If the image information M indicates the presence of a face, then the scene may be inferred as a portrait in normal lighting or a portrait at nighttime outdoors (“*the main object is determined as a human face*” and “*the main object is determined as a night time scene and a human face*,” respectively), depending on whether other criteria determined from the photography information attached to the image data are met, as depicted in Figure 2, below.¹ Terashita, [0039], [0047]-[0048], FIG. 2.

¹ Terashita discloses that “the photography information does not include information on a photography mode,” such as “night view/fireworks mode,” because it determines a nighttime scene from other information. Terashita, [0018], [0047]-[0048], FIG. 2.

FIG.2

NO	MAIN PART INFORMATION	SUBJECT DISTANCE	MAGNIFICATION	SUBJECT BRIGHTNESS	FLASH INFORMATION	OTHER INFORMATION	INFERRED SCENE	IMAGE PROCESSING
1	AVAILABLE		$> \beta 1$	$> B1$	OFF	BACKGROUND INFORMATION	NORMAL LIGHTING, PORTRAIT	1
2	AVAILABLE		$> \beta 2$	$> B2$	OFF	BACKGROUND INFORMATION	BACK LIGHTING, PORTRAIT	2
3	NOT AVAILABLE	∞		$> B3$	OFF	FREQUENCY INFORMATION	DISTANT VIEW (SCENERY,BUILDING)	3
4	NOT AVAILABLE	$< K4$	$> \beta 4$	$> B4$	OFF	BRIGHTNESS AT THE POINT OF FOCUS	NORMAL LIGHTING, STILL OBJECT/ANIMAL	4
5	NOT AVAILABLE	$< K5$	$> \beta 5$	$> B5$	OFF	BRIGHTNESS AT THE POINT OF FOCUS	BACKLIGHT, STILL OBJECT/ANIMAL	5
6	NOT AVAILABLE	$K61 < K62$	$> \beta 6$	$> B6$	OFF	HISTOGRAM INFORMATION	MIDDLE-DISTANCE VIEW (LOW-KEY TONES)	6
7	NOT AVAILABLE	$K61 < K62$	$> \beta 7$	$> B7$	OFF	HISTOGRAM INFORMATION	MIDDLE-DISTANCE VIEW (HIGH-KEY TONES)	7
8	AVAILABLE	$< K8$	$> \beta 8$	$> B8$	ON		DAYTIME SYNCHRONOUS PHOTOGRAPHY,PORTRAIT	8
9	NOT AVAILABLE	$< K9$	$> \beta 9$	$> B9$	ON		DAYTIME SYNCHRONOUS PHOTOGRAPHY,STILL OBJECT	9
10	AVAILABLE	$< K10$	$> \beta 10$	$< B10$	ON		NIGHTTIME OUTDOOR, PORTRAIT	10
11	AVAILABLE	$< K11$	$> \beta 11$	$B111 < B112$	ON		INDOOR, PORTRAIT	11
12	NOT AVAILABLE	∞		$< B12$	OFF	SHUTTER SPEED $< S11$	NIGHT VIEW	12
13	NOT AVAILABLE	∞		$< B13$	OFF	SHUTTER SPEED $> S12$	FIREWORKS/NIGHT VIEW	13
14	NOT AVAILABLE	∞		$B151 < B152$	OFF	COLOR TEMPERATURE	SUNSET VIEW	14
15	AVAILABLE	$K161 < K162$				SHUTTER SPEED $< S16$	MOVING OBJECT	15
16	NOT AVAILABLE			$B171 < B172$		IMAGE INFORMATION (COLOR)	IN WATER	16

Terashita, FIG. 2 (annotated).

187. These inferred scenes correspond to different sets of image processing conditions (“*the correction conditions are different*”) stored in the memory 24 of the image processing apparatus 20 and used to carry out image processing, as indicated by the “Image Processing” column in Figure 2, above. Terashita, [0050]-[0051], FIG. 2.

188. A POSITA would have found it obvious to implement Terashita’s use of different image processing conditions, depending on whether the inferred scene is a human face or a human face at nighttime outdoors, in the image processing of Luo-250 and Hibi discussed for Ground 1. A POSITA would have been motivated

to do so to more accurately process the image based on the scene, including whether the image was photographed at night, thus “enabl[ing] reproduction of a high-quality image.” Terashita, [0054]. Luo-250 and Hibi already both disclose determining the image processing based on the objects identified in the image. Luo-250 discloses using multiple target subject matters “as a criterion for selective image enhancement.” Luo-250, [0046]. Hibi discloses changing “the reproduction method” of an image containing both a mountain and a sky, depending on “whether [a] ‘sky’ is a clear sky or a sunset sky.” Hibi, [0043]. Hibi also discloses changing the target color when “correcting the skin color of a person,” depending on whether only the person is used to determine the correction method or whether “the features of the scene as a whole” are used, such as when a person is photographed by the sea. Hibi, [0020].

189. Accordingly, modifying the Luo-250-Hibi combination discussed for Ground 1 to process the face region differently when it is detected in normal light versus in a nighttime scene, as disclosed in Terashita, would have been a combination of familiar elements (e.g., processing an image based on the features of a scene) according to known methods to predictably yield the result of an improved image-processing technique that improves the quality of an image by accounting for whether the face was photographed in normal conditions or at nighttime outdoors. A POSITA would have understood from Hibi that determining

the correction conditions based on the features of the scene and adjusting the image processing based on lighting differences are beneficial. Hibi, [0043]-[0045].

Terashita would have motivated a POSITA to acquire different correction conditions, depending on whether a person was photographed in normal light or in a nighttime scene, to improve the quality of the image. Terashita, [0050]-[0051],

FIG. 2.

190. A POSITA would have reasonably expected success in such a combination in light of the similarity between Luo-250, Hibi, and Terashita. Additionally, both Hibi and Terashita teach accessing memory to acquire different correction conditions, depending on the scene, so a POSITA would have reasonably expected success in Luo-250's computer program product doing the same to access different image processing conditions, depending on the determination of the scene. Hibi, [0045] (disclosing a "relational information database 6" providing "an attribute value table," where "the feature value calculation data and correction data may be switched based on the attribute values"); Terashita, [0039], [0050]-[0051] (disclosing a memory that "stores various image processing conditions corresponding to the scene information H"). A POSITA would have seen Luo-250, Hibi, and Terashita as complementary disclosures that could be readily combined with predictable success to improve the image processing depending on the scene determined in the image.

191. Terashita discloses that the “photography information” used in determining outdoor nighttime conditions was “attached as tag information to image data obtained by a digital camera” according to an image-file standard like Exif and teaches how an image processing apparatus would acquire the photography information. Terashita, [0005], [0018]-[0019], [0039], [0047], FIG. 2. Accordingly, acquiring the necessary information to make the nighttime determination would have required applying only conventional techniques for reading and analyzing information acquired from an image file, that were well within the skill of a POSITA. Terashita, [0005], [0018]-[0019], [0039], [0047], FIG. 2. Applying Terashita’s scene inference from Figure 2 would have been a straightforward application of known, conventional software operations (comparing photography information and main part information to information in a table) used according to their known functions to yield predictable results (determining the scene).

E. Ground 3: Yano and Terashita Would Have Rendered Obvious Claims 1-12

1. Independent Claim 1

a. [1.pre]: “A method of image processing, the method comprising:”

192. If limiting, Yano discloses or suggests [1.pre].

193. Yano discloses “an image processing apparatus which corrects gradation and color reproduction characteristics of an image photographed (or

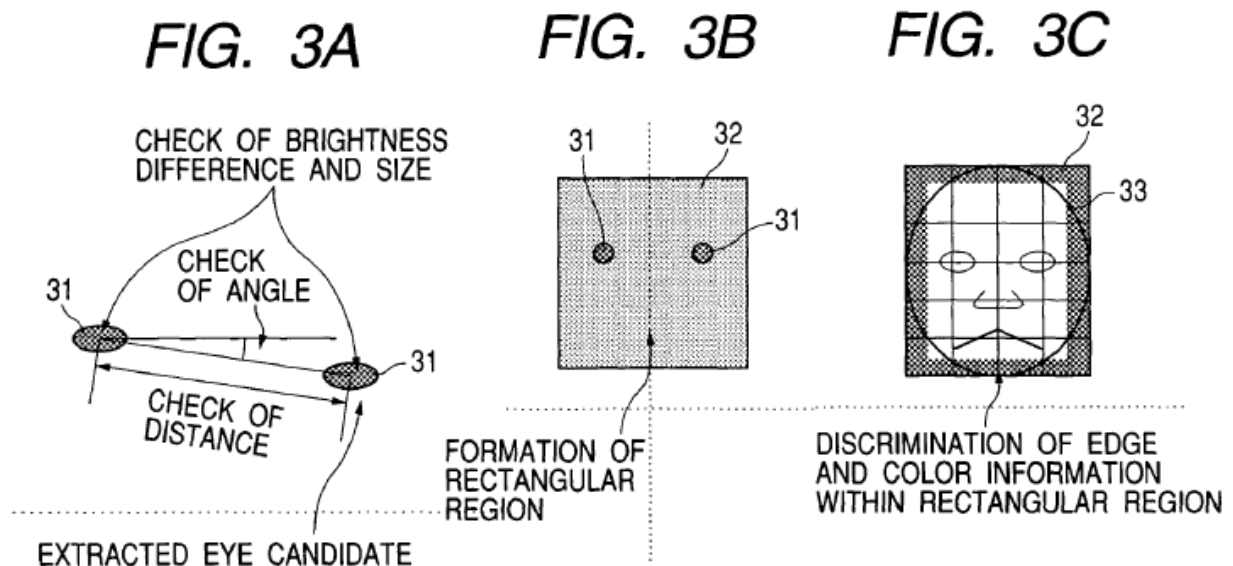
shot) by a digital camera or the like” and “an image processing method which is applied to the image processing apparatus.” Yano, 1:9-15.

- b. **[1.a]: “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;”**

194. Yano and Terashita render obvious this limitation. Yano’s primary embodiment relies on “the photographing mode” to determine whether a person is in an image but also discloses using other “various methods of discriminating that a person (particularly a face portion of the person) is included in the image data.” Yano, 7:33-54. A POSITA would have found it obvious to implement Terashita’s technique for determining that a face is included in the image data in Yano’s image processing method.

195. For example, Yano discloses that “image data photographed (or shot) by a digital camera” (“*an image generated by an image generating apparatus*”) “is subjected to an image process based on an application program installed in an image processing apparatus such as a PC.” Yano, 2:36-43. Yano’s digital camera used to shoot the image includes multiple photographing modes, one of which is the “person mode.” Yano, 2:46-52. The digital camera includes the photographing mode used when the image was shot as part of the photographing information that “is recorded as incidental information” to the image data. *Id.*, 3:25-34, 3:59-4:9.

196. The image processing apparatus includes a photographing mode discrimination processing unit 18 that “discriminates whether or not the image data was photographed and obtained in the person mode, by referring to the photographing mode included in the photographing information incidental to the expanded image data.” Yano, 7:33-38. If so, a “face region extraction processing unit 14 extracts the face region 33 as shown in FIG. 3C from the image data.” Yano, 7:38-41, 7:55-58. Figures 3A-3C, below, depict portions of a process for extracting face region 33 from the image data. Yano, 6:4-60, FIGS. 3A-3C.



Yano, FIGS. 3A-3C.

197. If the photographing mode discrimination processing unit 18 determines that “the image data was photographed in a mode other than the person mode,” Yano discloses that the above face extraction is not performed, and

“another process is performed under the control of the correction process control unit 19 in this case.” Yano, 7:41-47.

198. Yano’s image processing method “is not limited to” determining whether a person is included in the image by referencing “the information concerning the photographing mode.” Yano, 7:47-51. Yano discloses that “it is preferably possible to use various methods of discriminating that a person (particularly a face portion of the person) is included in the image data” (*“determining a main object in an image ... , wherein ... the determining of the main object is implemented by determining whether the image includes the human face”*). Yano, 7:51-54. A POSITA would have looked to Terashita for implementation details on one such method.

199. Terashita discloses an image processing method similar to Yano’s that includes “obtaining image information on an image represented by the image data,” where the image information includes “information on presence or absence of a human face in the image represented by the image data” (*“determining a main object in an image generated by an image generating apparatus, wherein ... the determining of the main object is implemented by determining whether the image includes the human face”*). Terashita, [0010]-[0015], [0020]-[0021]. This is carried out by an “image information obtaining means 22” that “judges presence or absence of a human face in the image represented by the image data S0, and

includes a result of the judgment in the image information M.” Terashita, [0042].

“More specifically, a skin-color area is extracted from the image data S0 and the image is judged to include a human face if an area of the skin-color area is not smaller than a predetermined threshold value.” Terashita, [0042].

200. A POSITA would have been motivated to combine Yano and Terashita to implement the determination of the main part by determining whether the image includes the human face because doing so would have improved the accuracy of determining that a person is included in the image. Yano only performs its face extraction process when it determines that an image was photographed in the person mode, but Terashita discloses that relying only on the photography mode to determine the image processing may result in improperly finding the image processing condition if the photography mode is set erroneously in the digital camera. Yano, 7:33-45, FIG. 4; Terashita, [0008]. Terashita solves this problem by determining the presence of a face without referencing the photography mode. Terashita, [0008], [0042]. A POSITA would have been motivated to combine Yano and Terashita so that Yano’s image processing is performed when the image includes a face, regardless of the photography mode set by the photographer, as Terashita discloses that doing so ensures “a high-quality reproduced image.” Terashita, [0009]. Moreover, Yano suggests implementing Terashita’s technique by disclosing that “it is preferably possible to use various

methods of discriminating that a person (particularly a face portion of the person) is included in the image data,” motivating a POSITA to combine Yano with Terashita because Terashita discloses details for one such method. Yano, 7:47-54.

201. A POSITA would have had a reasonable expectation of success because Yano already discloses carrying out a similar process. Yano discloses that “when the area of the face region 33 is smaller than a predetermined threshold value, it is inferred that the correction effect of the image cannot be expected.” Yano, 8:13-39. This is because correcting a small face region “to have the optimum lightness does not necessarily bring[] about a desirable image” and because the influence of “noises in the image” may make the calculation of the image feature amount inaccurate. Yano, 8:25-44. Terashita’s process for determining the presence of a face relies on a similar comparison of “an area of skin color” to “a predetermined area after carrying out skin color extraction processing or the like on the image data.” Terashita, [0021]. Accordingly, implementing Terashita’s process for determining the presence of a face in Yano’s image processing method would have required applying only known image processing steps that were well within the skill of a POSITA, and were readily combinable with Yano’s image processing method, given that Yano’s method already includes a similar process.

c. [1.b]: “acquiring properties of the determined main object;”

202. Yano discloses or suggests [1.b].

203. Yano discloses that the image processing apparatus includes an image feature amount calculation unit 15 that “calculates the image feature amount being the feature amount of the image within the face region 33 extracted by the face region extraction processing unit 14” (“*acquiring properties of the determined main object*”). Yano, 7:58-62. The image feature amount may include “histograms,” including “the lightness and hue histograms in regard to each pixel”; “average values and distribution values of the lightness, hue and the like in regard to each pixel of the face region 33”; and “the total number of pixels included in the face region 33.” Yano, 7:62-8:12, 10:36-61.

d. [1.c]: “acquiring correction conditions corresponding to the acquired properties; and”

204. Yano discloses or suggests [1.c].

205. Yano discloses performing processes to correct the face region to have “optimum lightness” and “an appropriate flesh color that human beings feel desirable.” Yano, 8:23-25, 10:14-22. Yano discloses an image correction processing unit 17 that stores the center value and distribution value for both the “range of lightness of the flesh color” and the “range of hue of the flesh color that human beings feel desirable” (“*correction conditions corresponding to the*

acquired properties”). Yano, 9:35-39, 11:36-41. Yano discloses that image correction processing unit 17 uses the center and distribution values for each range to obtain corrected lightness and hue values of the pixels for the image data. Yano, 9:23-57, 11:29-61. To obtain these corrected values, a POSITA would have understood that image correction processing unit 17 first acquires the center value and distribution value of each range from memory. Yano, 9:35-49, 11:42-51.

- e. **[1.d]: “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”**

206. Yano discloses or suggests [1.d].

207. Yano discloses performing a “lightness correction from the image feature amount of the face region” and “correcting the face region of the person to generate the image of an appropriate flesh color that human beings feel desirable” (*“adjusting image quality of the main object using the acquired correction conditions, wherein a parameter used in adjusting the image quality is ... brightness, ... color balance, or memory color”*). Yano, 9:23-57, 10:19-22, 11:29-61. For generating the appropriate flesh color, Yano discloses that “[t]he image correction processing unit 17 obtains the parameters for the color correction from the image feature amount of the face region 33, and then actually performs the following image correction process.” Yano, 11:29-32. To perform this process, the

hue of each pixel in “the entire image,” including the face region, is converted to a new value using the following formulas:

$$208. \quad h' = k_h \times h + \hat{i}_h' - \hat{i}_h, \quad k_h = \hat{o}_h' / \hat{o}_h$$

Yano, 11:42-61. In these formulas, “hue of the pixel before the correction is h , hue thereof after the correction is h' , average hue of the flesh color in the face region 33 is $\hat{i}_h$, a standard deviation (square root of the distribution value) is $\hat{o}_h$, the center value of the target value of the hue is $\hat{i}_h'$, and a standard deviation thereof is $\hat{o}_h'$.” Yano, 11:42-49. Accordingly, this adjusting uses the acquired correction conditions. Yano discloses a similar process for adjusting lightness using the acquired correction conditions. Yano, 9:23-57.

209. After determining the corrected hue values, “the image correction processing unit 17 obtains the R, G and B component values in regard to each pixel” such that they maintain the original lightness and saturation values but include the corrected hue value based on the above equation. Yano, 11:56-60. This “process is performed to the entire image.” Yano, 11:60-61. A POSITA would have understood that this adjusting of the hue values of the pixels in the entire image based on a target flesh color discloses using color balance in adjusting the image quality. Indeed, U.S. Patent No. 7,454,056, another Seiko Epson patent filed around the same time as the '574 patent, discloses that “it is possible to correct the color balance according to the hue of the specific subject.” Ex. 1018, 2:32-33. This

is consistent with a POSITA's understanding of color balance at the relevant time.

Supra Section III.F. In addition, since flesh is a memory color, Yano discloses using memory color in adjusting the image quality, for example, by performing the correction based on a target flesh color (memory color) "by converting the entire image" or by converting only the extracted face region 33. Yano, 12:30-42.

210. Additionally, a POSITA would have understood that lightness is one way of expressing brightness and that Yano's lightness correction teaches using brightness in adjusting the image quality.

- f. **[1.e]: "wherein each operation of the method of image processing is executed by one of a personal computer, a printer, or a display device."**

211. Yano discloses or suggests [1.e].

212. Yano discloses that its image processing is "based on an application program installed in an image processing apparatus such as a PC" ("*personal computer*"). Yano, 2:36-43, 1:17-23.

2. Independent Claim 3

- a. **[3.pre]: "A method of image processing, the method comprising:"**

213. If limiting, Yano discloses or suggests [3.pre] for the reasons explained for [1.pre]. *Supra* Section VIII.E.1.a.

- b. **[3.a]: “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”**

214. Yano and Terashita render obvious [3.a] for the reasons explained for [1.a]. *Supra* Section VIII.E.1.b.

- c. **[3.b]: “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”**

215. Yano discloses or suggests [3.b] for the reasons explained for [1.b]-[1.d]. *Supra* Sections VIII.E.1.c-VIII.E.1.e.

- d. **[3.c]: “wherein each operation of the method of image processing is executed by one of a personal computer, a printer, or a display device.”**

216. Yano discloses or suggests [3.c] for the reasons explained for [1.e].
Supra Section VIII.E.1.f.

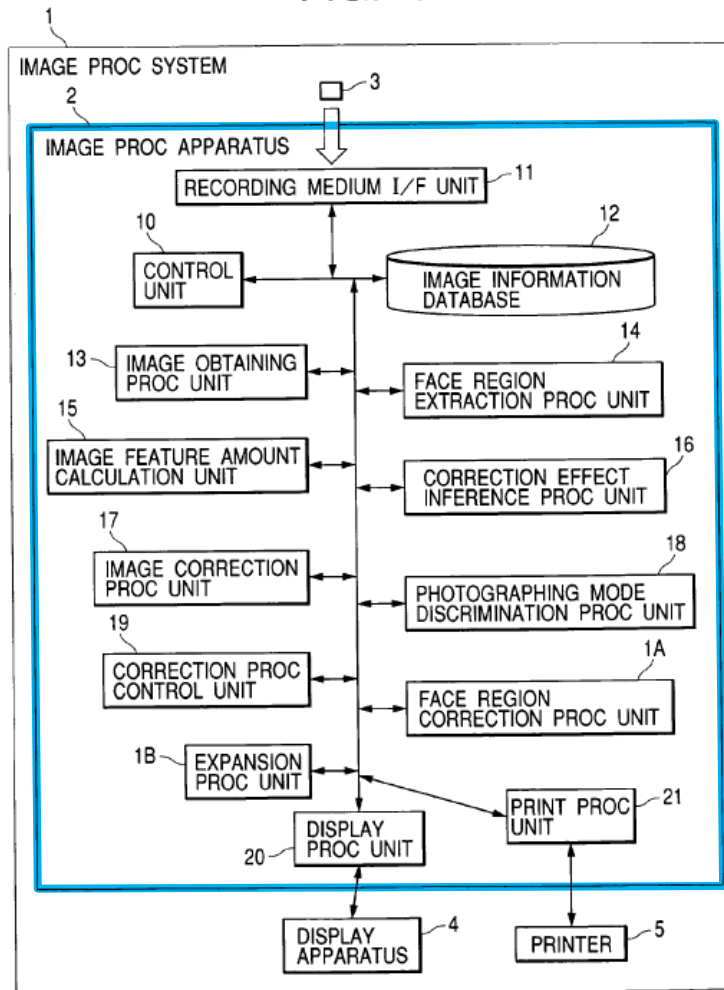
3. Independent Claim 5

- a. **[5.pre]: “An image processing apparatus comprising:”**

217. If limiting, Yano discloses or suggests [5.pre].

218. Yano discloses “an image processing apparatus,” a block diagram of which is depicted below in blue. Yano, 2:15-19, 2:35-43, FIG. 1.

FIG. 1



Yano, FIG. 1 (annotated).

b. [5.a]: “one or more processors;”

219. Yano discloses or suggests [5.a].

220. Yano discloses a “CPU” (“one or more processors”) that executes the image processing program stored in the image processing apparatus. Yano, 6:61-7:7, 2:62-67, FIG. 1.

c. [5.b]: “memory;”

221. Yano discloses or suggests [5.b].

222. Yano discloses a “memory,” like a hard disk, that stores “a program for achieving the function of each unit” of the image processing apparatus. Yano, 6:61-7:7, 2:62-67, FIG. 1.

- d. **[5.c]: “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;”**

223. Yano and Terashita render obvious [5.c].

224. As explained for [1.a], Yano and Terashita render obvious 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. *Supra* Section VIII.E.1.b. A POSITA would have found it obvious to implement this determining step as a determining module that forms part of Yano’s image processing program. Yano, 6:62-66; *see* Ex. 1001, 14:32-35 (disclosing that the modules “can be realized in terms of the CPU 411 alone or the control circuit 41, and can be realized by either hardware or software”).

225. A POSITA would have been motivated and found it obvious to do so because Yano discloses processing an image “based on an application program installed in an image processing apparatus such as a PC.” Yano, 2:35-43. Such application programs commonly included modules. Indeed, Yano teaches that each

step in its image processing method may be structured as “a program for achieving the function” and “may be a part of an application program for the entire image process.” Yano, 6:61-7:1. Accordingly, incorporating this determining step into the application program as a determination module configured to perform this determining step would have merely required the use of known software techniques to predictably implement Yano’s image processing method. A POSITA would have reasonably expected success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software. Yano, 6:61-7:1.

e. [5.d]: “a property acquirer configured to acquire properties of the determined main object;”

226. Yano renders obvious [5.d].

227. As explained for [1.b], Yano discloses acquiring properties of the determined main object. *Supra* Section VIII.E.1.c.

228. A POSITA would have been motivated and found it obvious to implement this acquiring step as a property acquirer in an application program that is configured to perform this acquiring step because Yano teaches that each step in its image processing method may be structured as “a program for achieving the function” and “may be a part of an application program for the entire image process.” Yano, 6:61-7:1. Accordingly, incorporating this acquiring step into the application program as a property acquirer configured to perform this acquiring

step would have merely required the use of known software techniques to predictably implement Yano's image processing method. A POSITA would have reasonably expected success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software. Yano, 6:61-7:1.

f. [5.e]: “a correction condition acquirer configured to acquire correction conditions corresponding to the acquired properties; and”

229. Yano renders obvious [5.e].

230. As explained for [1.c], Yano discloses acquiring correction conditions corresponding to the acquired properties. *Supra* Section VIII.E.1.d.

231. A POSITA would have been motivated and found it obvious to implement this acquiring step as a correction condition acquirer in an application program that is configured to perform this acquiring step because Yano teaches that each step in its image processing method may be structured as “a program for achieving the function” and “may be a part of an application program for the entire image process.” Yano, 6:61-7:1. Accordingly, incorporating this acquiring step into the application program as a correction condition acquirer configured to perform this acquiring step would have merely required the use of known software techniques to predictably implement Yano's image processing method. A POSITA would have reasonably expected success in doing so because it would have

required a POSITA to apply only conventional techniques for implementing software. Yano, 6:61-7:1.

- g. [5.f]: “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”**

232. Yano renders obvious [5.f].

233. As explained for [1.d], Yano discloses 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. *Supra* Section VIII.E.1.e.

234. A POSITA would have been motivated and found it obvious to implement this adjusting step as an image quality adjuster in an application program that is configured to perform this adjusting step because Yano teaches that each step in its image processing method may be structured as “a program for achieving the function” and “may be a part of an application program for the entire image process.” Yano, 6:61-7:1. Accordingly, incorporating this adjusting step into the application program as an image quality adjuster configured to perform this adjusting step would have merely required the use of known software techniques to predictably implement Yano’s image processing method. A POSITA would have

reasonably expected success in doing so because it would have required a POSITA to apply only conventional techniques for implementing software. Yano, 6:61-7:1.

- h. [5.g]: “wherein the image processing apparatus is either a personal computer or a printer or a display device.”**

235. Yano discloses or suggests [5.g] for the reasons explained for [1.e].

Supra Section VIII.E.1.f.

4. Independent Claim 7

- a. [7.pre]: “An image processing apparatus comprising:”**

236. Yano discloses or suggests [7.pre] for the reasons explained for [5.pre]. *Supra* Section VIII.E.3.a.

- b. [7.a]: “one or more processors;”**

237. Yano discloses or suggests [7.a] for the reasons explained for [5.a].
Supra Section VIII.E.3.b.

- c. [7.b]: “memory;”**

238. Yano discloses or suggests [7.b] for the reasons explained for [5.b].
Supra Section VIII.E.3.c.

- d. **[7.c]: “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”**

239. Yano and Terashita render obvious [7.c] for the reasons explained for [5.c]. *Supra* Section VIII.E.3.d.

- e. **[7.d]: “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”**

240. Yano discloses or suggests [7.d] for the reasons explained for [5.d]-[5.f]. *Supra* Sections VIII.E.3.e-VIII.E.3.g.

- f. **[7.e]: “wherein the image processing apparatus is either a personal computer or a printer or a display device.”**

241. Yano discloses or suggests [7.e] for the reasons explained for [1.e]. *Supra* Section VIII.E.1.f.

5. Independent Claim 9

- a. **[9.pre]: “A computer program product for image processing comprising:”**

242. Yano discloses or suggests [9.pre].

243. As explained for [1.pre], Yano discloses an image processing method.

Supra Section VIII.E.1.a. Yano discloses implementing this image processing

method as “a program product such as a computer readable recording medium,” on which a program for performing the image processing method has been recorded.

Yano, 12:59-13:34.

- b. **[9.a]: “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:”**

244. Yano discloses or suggests [9.a].

245. Yano discloses “a computer-readable recording medium,” such as a ROM or hard disk, storing Yano’s image processing program (“*a non-transitory computer readable medium storing computer readable code therein*”) for execution by the CPU of a personal computer. Yano, 2:36-43, 6:61-7:7, 13:4-34.

- c. **[9.b]: “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;”**

246. Yano and Terashita render obvious [9.b].

247. As explained for [1.a], Yano and Terashita render obvious 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. *Supra* Section VIII.E.1.b. Yano discloses that each function of its program may be stored in computer readable memory and executed by a CPU, which discloses computer readable code. Yano, 6:61-7:7, 12:59-13:34. Accordingly, Yano teaches implementing this determining step as computer readable code.

d. [9.c]: “computer readable code for acquiring properties of the determined main object;”

248. Yano discloses or suggests [9.c].

249. As explained for [1.b], Yano discloses acquiring properties of the determined main object. *Supra* Section VIII.E.1.c. For the same reasons explained for [9.b], Yano teaches implementing this acquiring step as computer readable code. *Supra* Section VIII.E.5.c.

e. [9.d]: “computer readable code for acquiring correction conditions corresponding to the acquired properties; and”

250. Yano discloses or suggests [9.d].

251. As explained for [1.c], Yano discloses acquiring correction conditions corresponding to the acquired properties. *Supra* Section VIII.E.1.d. For the same reasons explained for [9.b], Yano teaches implementing this acquiring step as computer readable code. *Supra* Section VIII.E.5.c.

- f. **[9.e]: “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.”**

252. Yano discloses or suggests [9.e].

253. As explained for [1.d], Yano discloses “adjusting image quality of the main object using the acquired correction conditions, wherein a parameter used in adjusting the image quality is ... brightness, ... color balance, or memory color.”

Supra Section VIII.E.1.e. For the same reasons explained for [9.b], Yano teaches implementing this adjusting step as computer readable code. *Supra* Section VIII.E.5.c.

6. Independent Claim 11

- a. **[11.pre]: “A computer program product for image processing comprising:”**

254. If limiting, Yano discloses or suggests [11.pre] for the reasons explained for [9.pre]. *Supra* Section VIII.E.5.a.

- b. **[11.a]: “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:”**

255. Yano discloses or suggests [11.a] for the reasons explained for [9.a].
Supra Section VIII.E.5.b.

- c. **[11.b]: “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”**

256. Yano and Terashita render obvious [11.b] for the reasons explained for [9.b]. *Supra* Section VIII.E.5.c.

- d. **[11.c]: “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.”**

257. Yano discloses or suggests [11.c] for the reasons explained for [9.c]-[9.e]. *Supra* Sections VIII.E.5.d-VIII.E.5.f.

7. Dependent Claims 2, 4, 6, 8, 10, and 12

258. Yano and Terashita render obvious independent claims 1, 3, 5, 7, 9, and 11 for the reasons explained in Sections VIII.E.1-VIII.E.6. For the reasons explained below, Yano and Terashita also render obvious the additional limitation, “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,” which appears in each of dependent claims 2, 4, 6, 8, 10, and 12.

- a. [2], [4], [6], [8], [10], [12]: **“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.”**

259. Yano and Terashita render obvious “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” in each of claims 2, 4, 6, 8, 10, and 12.

260. As explained for the dependent claims in Ground 2, Terashita discloses using different sets of image processing conditions stored in memory of an image processing apparatus, depending on whether the scene is inferred to include a face in normal lighting or at nighttime outdoors (“*the main object is determined as a human face*” and “*the main object is determined as a night time scene and a human face*,” respectively). Terashita, [0020], [0039], [0042], [0047]-[0048], FIGS. 1-2; *supra* Section VIII.D.1.a.

261. A POSITA would have found it obvious to implement Terashita’s use of different image processing conditions, depending on whether the inferred scene is a human face or a human face at nighttime outdoors in the image processing of Yano. A POSITA would have been motivated to do so to more accurately process the image based on the scene, including whether the image was photographed at night, thus “enabl[ing] reproduction of a high-quality image.” Terashita, [0054].

Terashita discloses that doing so is advantageous because “the image processing condition can be set with more accuracy” and “in a short time,” thus enabling the image processing to “be carried out efficiently” and to reproduce “a high-quality image.” Terashita, [0032]-[0033], [0054]. For example, it was known in the art that setting the target color according to “the features of the scene as a whole” when “correcting the skin color of a person” results in correction processing that is more “optimum” compared to when the target color is the same regardless of the scene. Hibi, [0020]. A POSITA would have been motivated to apply this to Yano so that its lightness and flesh-color correction use different target values based on the features of the scene, including whether the scene includes a face at nighttime outdoors.

262. Accordingly, modifying Yano’s image processing to process the face region differently when it is detected in normal light versus in a nighttime scene, as disclosed in Terashita, would have been a combination of familiar elements (e.g., processing an image based on a scene) according to known methods to predictably yield the result of an improved image-processing technique that improves the quality of an image by accounting for whether the face was photographed in normal conditions or at nighttime outdoors. A POSITA would have understood that determining the correction conditions based on the features of the scene and adjusting the image processing based on lighting differences are beneficial.

Hibi, [0043]-[0045]. Terashita would have motivated a POSITA to acquire different correction conditions, depending on whether a person was photographed in normal light or in a nighttime scene to improve the quality of the image.

Terashita, [0050]-[0051], FIG. 2.

263. A POSITA would have reasonably expected success in such a combination in light of the similarity between Yano and Terashita. Yano already discloses providing “photographing information” with the image data, similar to Terashita’s “photography information” that is provided with the image data. Yano, 3:25-38, 5:10-15; Terashita, [0039]. Accordingly, Yano already discloses the image processing apparatus receiving the same types of information needed to perform Terashita’s scene inference, meaning a POSITA would have needed to apply only conventional techniques for reading and analyzing information acquired from a standard image file, that were well within the skill of a POSITA.

Terashita, [0005], [0018]-[0019], [0039], [0047]. A POSITA would have seen Yano and Terashita as complementary disclosures readily combined with predictable success to improve the image processing depending on the features of the scene.

264. Additionally, Terashita teaches accessing memory to acquire different correction conditions, depending on the scene, so a POSITA would have reasonably expected success in Yano’s image processing apparatus doing the same.

Terashita, [0039], [0050]-[0051] (disclosing a memory that “stores various image processing conditions corresponding to the scene information H”). Applying Terashita’s scene inference from Figure 2 would have been a straightforward application of known, conventional software operations (comparing photography information and main part information to information in a table) used according to their known functions to yield predictable results (determining the scene).

* * *

265. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

266. I declare that all statements made herein of my 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 knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

267. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on this 20th day of June 2024.

By: 
Kenneth Parulski