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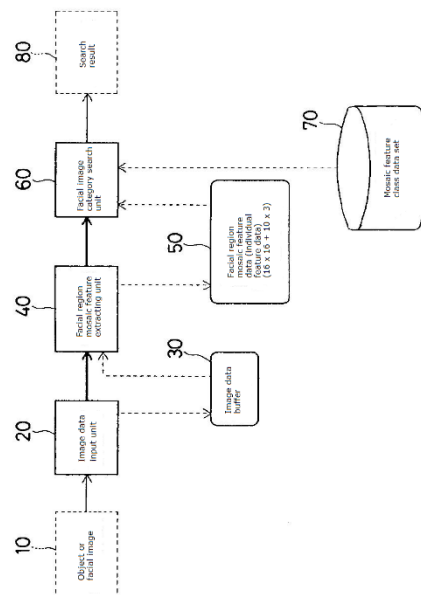
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(54) [Title of the Invention] Facial Image Classification Search Processing Method

(57) [Abstract]

[Problem] To provide a simple facial image classification search processing method that is able to extract data that efficiently describes the features of the facial region from a target object with high accuracy and speed.

[Solution] In a step performed by a facial region mosaic feature extracting unit 40, an image is mosaicked using a grayscale image that includes the facial region, and the facial region is extracted as facial region mosaic feature data by using the pattern difference between the inside and the outside of the facial region. Next, in a step performed by a facial image classification search unit 60, the class name of the classification is searched for using the facial region mosaic feature data. Thus, by focusing on the intensity pattern of the target region instead of focusing on the edges of the target, high-precision, high-speed extraction and search of facial regions, as well as classification searches can be performed.



[Claims]

[Claim 1] A facial image classification search processing method comprising: a facial region mosaic feature extracting step of mosaicking a grayscale image including the facial region of a person, and extracting the facial portion as facial region mosaic feature data; and a facial image classification search step of searching for the closest feature class data to the mosaic feature class set provided in advance for the facial region mosaic feature data, and outputting the class name as the search result.

[Claim 2] The facial image classification search processing method according to claim 1, wherein the mosaic feature class set is provided in advance by performing a step of extracting the facial region mosaic feature data from a plurality of pre-specified human facial images and a step of classifying the extracted mosaic feature class set of the plurality of human facial images into classes based on similarity to obtain a mosaic feature class set.

[Claim 3] The facial image classification search processing method according to claim 1 or claim 2, wherein the facial region mosaic feature extracting step further comprises: a head portion rough search step of searching for the general position of the head portion in roughly mosaicked human facial image data using a head portion rough search mosaic dictionary to obtain position information near the center of the head portion; a specific portion detailed search step of finely mosaicking a specific portion of the facial image data of a person based on the position information near the center of the head portion, and searching for the detailed position of the specified portion using the obtained specified region mosaic feature data and a specific portion mosaic detailed search mosaic dictionary provided in advance to obtain face-centered detailed position information; and a facial region mosaicking step of accurately determining the position of the facial region on the facial image data based on the face-centered detailed position information, mosaicking the facial region of the facial image data using the obtained facial region position information, and outputting the mosaicked facial image data as facial region mosaic feature data.

[Claim 4] The facial image classification search processing method according to claim 3, wherein the specific portion of the facial image data is the eye portion.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Applicability] The present invention relates to a facial image classification search processing method for classifying facial

image data obtained by camera input of real faces or scanner input of facial images in advance, and recognizing which facial image class that newly inputted facial image data is close to among the previously classified facial image classes.

[0002]

[Prior Art] In order to classify and retrieve a facial image (grayscale image), it is necessary to first detect the facial region on the image, and in conventional facial image classification search processing methods, generally edge detection is performed by performing differential operations, etc., resulting edge regions are extracted as a line figure by thinning or ridge tracking, and the geometrical structure of the line figure is analyzed for classification and retrieval.

[0003]

[Problem to Be Solved by the Invention] However, in the conventional image classification retrieval processing method described above, it is nearly impossible to accurately detect edge portions because images often contain gently fluctuating intensity regions and shadow regions. Moreover, the time required for computer processing is not insignificant because differential operations, etc., are involved.

[0004] Therefore, no practical facial image classification search processing method has been disclosed to date.

[0005] The problem to be solved by the invention is to overcome the drawbacks of the conventional technique that attempt to extract and determine objects (for example, facial regions) based on the detection and analysis of edge portions, and provide a simple facial image classification search processing method that is able to extract data that efficiently describes the features of the facial region from a target object with high accuracy and speed.

[0006]

[Means for Solving the Problem] The means for solving this problem is a facial image classification search processing method comprising: a facial region mosaic feature extracting step of mosaicking a grayscale image including the facial region of a person, and extracting the facial portion as facial region mosaic feature data; and a facial image classification search step of searching for the closest feature class data to the mosaic feature class set provided in advance for the facial region mosaic feature data, and outputting the class name as the search result.

[0007] In this facial image classification search processing method, preferably the mosaic feature class set is provided in advance by

performing a step of extracting sets of facial region mosaic feature data from a plurality of pre-specified human facial images and a step of classifying the extracted mosaic feature class set of the plurality of human facial images into classes based on similarity to obtain a mosaic feature class set.

[0008] In this facial image classification search processing method, preferably the facial region

10 mosaic feature extracting step further comprises: a head portion rough search step of searching for the general position of the head portion in roughly mosaicked human facial image data using a head portion rough search mosaic dictionary to obtain position information near the center of the head portion; a specific portion detailed search step of finely mosaicking a specific portion of the facial image data of a person based on the position information near the center of the head portion, and searching
20 for the detailed position of the specified portion using the obtained specified region mosaic feature data and a specific portion mosaic detailed search mosaic dictionary provided in advance to obtain face-centered detailed position information; and a facial region mosaicking step of accurately determining the position of the facial region on the facial image data based on the face-centered detailed
30 position information, mosaicking the facial region of the facial image data using the obtained facial region position information, and outputting the mosaicked facial image data as facial region mosaic feature data. Preferably, the specific portion of the facial image data is the eye portion.

[0009]

[Operation] In the facial image classification search processing method of the present
40 invention, a grayscale image including a facial region is mosaicked, the facial region is extracted as mosaic feature data using the difference in the mosaic pattern between the inside and outside of the facial region, which is then used for classification and retrieval. By focusing on the intensity pattern of the target region instead of focusing on the edge portions of the target when extracting the facial region, it is possible to extract, classify, and search for
50 facial regions with high accuracy and speed.

[0010]

[Examples] The following is a detailed description of an example of the present invention with reference to the drawings.

[0011] FIG. 1 is a block diagram showing an example of a portion of the facial image classification search processing method of the present invention, and FIG. 2 is a block diagram showing an example of the mosaic feature class

data set calculating and acquiring method portion in FIG. 1.

[0012] In FIG. 1 and FIG. 2, 10 is an actual face or photograph of a face that is the subject of image input.

[0013] In the figures, 20 is an image data input unit that inputs an actual face or a photograph of a face using a camera or scanner, and stores the resulting image data in an image data buffer 30.

[0014] Also, 40 is a unit that handles the step of mosaicking the image data captured by the image data input unit 20 and stored in the image data buffer 30, scanning the mosaic data to detects regions that match within a certain range with a mosaic pattern for a representative facial region that has been provided in advance, and a step of outputting the mosaic data for that portion as the mosaic feature data for the facial region in the inputted image 50.

[0015] The facial image classification search unit 60 in FIG. 1 handles the step of searching for the class that best matches the extent of the match with each mosaic feature class in a mosaic feature class data set 70 in relation to the facial region mosaic feature data (mosaic pattern) 50 obtained by the facial region mosaic feature extracting unit 40, and outputting the class name as a search result 80.

[0016] The mosaic feature data collecting unit 90 in FIG. 2 handles the step of repeatedly using the image data input unit 20 and facial region mosaic feature extracting unit 40 in FIG. 2 to sequentially collect facial region mosaic data from each set of facial image data and obtain a mosaic feature data set 100.

[0017] The facial image clustering unit 110 handles the step of using multidimensional scaling, etc., to classify the mosaic feature data set 100 by class, and outputting representative (for example, average) sets of mosaic feature data belonging to each class as mosaic feature classes 70. A database of these mosaic feature classes 70 is preferably created.

[0018] FIG. 3 is a block diagram showing an example of the facial region mosaic feature extraction unit 40 in FIG. 1 or FIG. 2. The following is a description of this figure.

[0019] The entire region mosaicking unit 401 handles the step of mosaicking the image data in the image data buffer 30 over an entire region using a rough block size and outputting the entire region as mosaic feature data 402.

[0020] The head portion rough search unit 403 handles the step of roughly scanning the image data buffer 30 using the mosaic features (for example, 4 (horizontal) x 5 (vertical) blocks) of a typical general-shaped head (the portion above the neck) as a head portion rough search

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mosaic dictionary 404, detecting the head region in an image, and outputting the approximate midpoint between the positions of both eyes as head-centered position information 405.

[0021] The eye portion mosaicking unit 406 handles the step of mosaicking the adjacent region including both eyes provided by the head-centered position information 405 using a

10 finer block size in relation to the image data in the image data buffer 30, and outputting this as eye portion feature data 407.

[0022] The eye portion detailed search unit 408 handles the step of scanning the eye region mosaic feature data 407 in more detail using, for example, 8 (horizontal) x 3 (vertical) block mosaic features of the region that includes both eyes of a typical general shape as the eye portion detailed search mosaic dictionary 409

20 (the block size being considerably smaller than that of the head portion rough search mosaic dictionary 404, such as, for example, about 1/5th) to detect the eye region in more detail, and outputting the obtained midpoint of both eyes as face-centered detailed position information 410.

[0023] The facial center/facial region positioning unit 411 handles the step of accurately determining the position of both eye regions using pixel value information such as intensity changes and histograms in the vicinity of the position provided by the face-centered detailed position information 410 in the image data buffer 30, determining the mouth portion in the same way, and determining the facial region (the region determined by the width of the face and the region between the forehead and chin) based on both the eye and mouth location information, which is outputted as facial

40 region position information 412.

[0024] The facial region mosaicking unit 413 handles the step of mosaicking the region provided by the facial region position information 412 in relation to the image data buffer 30, obtaining, for example, mosaic features with a 16 x 16 and 10 x 3 horizontal and vertical size (corresponding to the chin portion, the block size generally being slightly smaller than that of the eye region mosaic feature data 407), and outputting this as facial

50 region mosaic feature data 50.

[0025] Note that when the size of the facial image inputted from the image data input unit 20 is not fixed, the size of the mosaics is preferably changed before searching the mosaic dictionary.

[0026] The facial image classification search processing method composed of the steps performed by the various units in the example

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described above allows for the high-precision, high-speed extraction, classification, and retrieval of facial regions, while resolving the shortcomings of the conventional technique that primarily focuses on edge detection and shape analysis of regions. Here, in a step performed by a facial region mosaic feature extracting unit 40, an image is mosaicked using a grayscale image that includes the facial region, and the facial region is extracted as facial region mosaic feature data by using the pattern difference between the inside and the outside of the facial region. Next, in a step performed by a facial image classification search unit 60, the class name of the classification is searched for using the facial region mosaic feature data. Then, in a step performed by the facial image classification search unit 60, the class name for the classification is searched for using the facial region mosaic feature data. In a step performed by the mosaic feature data collecting unit 90, the mosaic feature data is collected from a large number of facial images, and in a step performed by the facial image clustering unit 110, classification is performed by class. Also, use of the mosaic feature data from facial regions makes it possible to efficiently describe the features of an inputted facial image.

[0027] The facial image classification search processing method composed of the steps performed by the various units shown in FIG. 3 in the example described above makes it easier to search for and determine the position of the facial region in an image, which further improves extraction accuracy and reduces processing times because when extracting facial region mosaic feature data in the facial region mosaic feature extracting step, the features of mosaics of various sizes are used in stages (entire-region mosaic characteristics, eye-region mosaic characteristics) in the step performed by the head portion rough search unit 403 and in the step performed by the eye portion detailed search unit 408.

[0028] Note that in a detailed search to determine face-centered detailed information, specific portions of the facial image other than the eye regions may be mosaicked and searched for, but by mosaicking and searching for the eye regions, where the most distinctive intensity patterns appear, extraction accuracy can be further improved and the search for and determination the facial region made easier.

[0029] In addition, because the processing times and memory capacity required by the computer are reduced, a simple facial image classification search method can be configured using a personal computer.

[0030]

[Effects of the Invention] As explained above, because the facial image classification search processing method of the present invention mosaicks a grayscale image that includes the facial region, the facial region is extracted as facial region mosaic feature data by using the pattern difference between the inside and the outside of the facial region, and this is used to perform extraction and classification of and

10 searches for facial regions can be performed with high precision and speed, while resolving the problems of conventional technique, which is primarily based on edge detection and shape analysis of regions. In addition, use of the mosaic features of the facial region makes it possible to efficiently describe the features of an inputted facial image.

[0031] Moreover, when extracting facial region mosaic feature data by obtaining facial region position information in the manner described above, when mosaic features of various sizes are used in stages by first performing a rough search for the facial region and then performing a detailed search for specific portions of the facial region, extraction accuracy can be further improved and processing times reduced.

[0032] In addition, if the eye portions are used as the specific portions of the face region in the detailed search described above, the search becomes even easier and extraction accuracy can be further improved.

[0033] Furthermore, because the processing times and memory capacity required by the computer are reduced, a simple facial image classification search method can be configured using a PC or similar device.

[Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a block diagram showing an example of a portion of the facial image classification search processing method of the present invention.

[FIG. 2] FIG. 2 is a block diagram showing an example of the mosaic feature class data set acquiring method portion in FIG. 1.

[FIG. 3] FIG. 3 is a block diagram showing an example of the portion that handles the facial region mosaic feature extraction step in FIG. 1 or FIG. 2.

[Reference Numbers]

10: Object or facial image

20: Image data input unit

30: Image data buffer

40: Facial region mosaic feature extracting unit

60: Facial image classification search unit

70: Mosaic feature class data set

110: Facial image clustering unit

401: Entire region mosaicking unit

403: Head portion rough search unit

404: Head portion rough search mosaic dictionary

406: Eye portion mosaicking unit

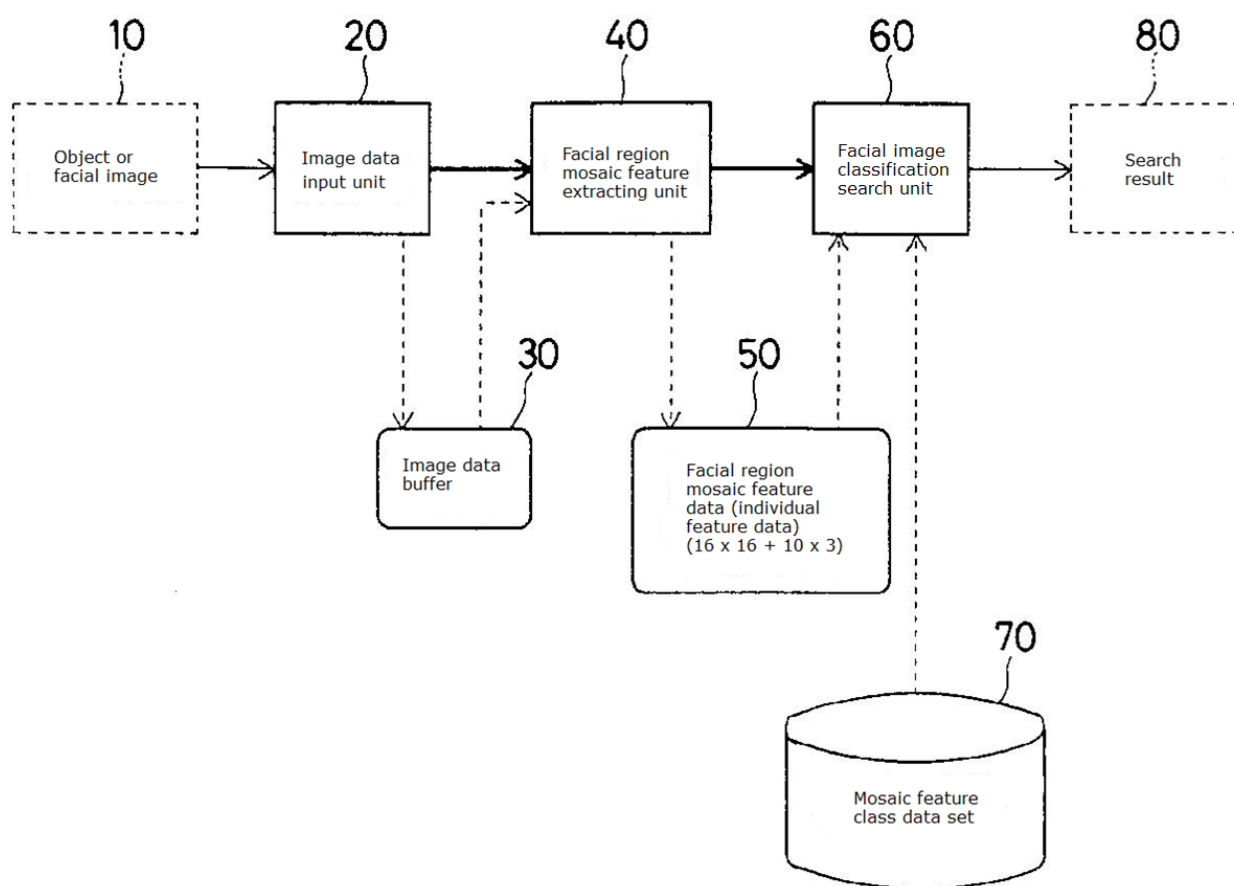
408: Eye portion detailed search unit

409: Eye portion detailed search mosaic dictionary

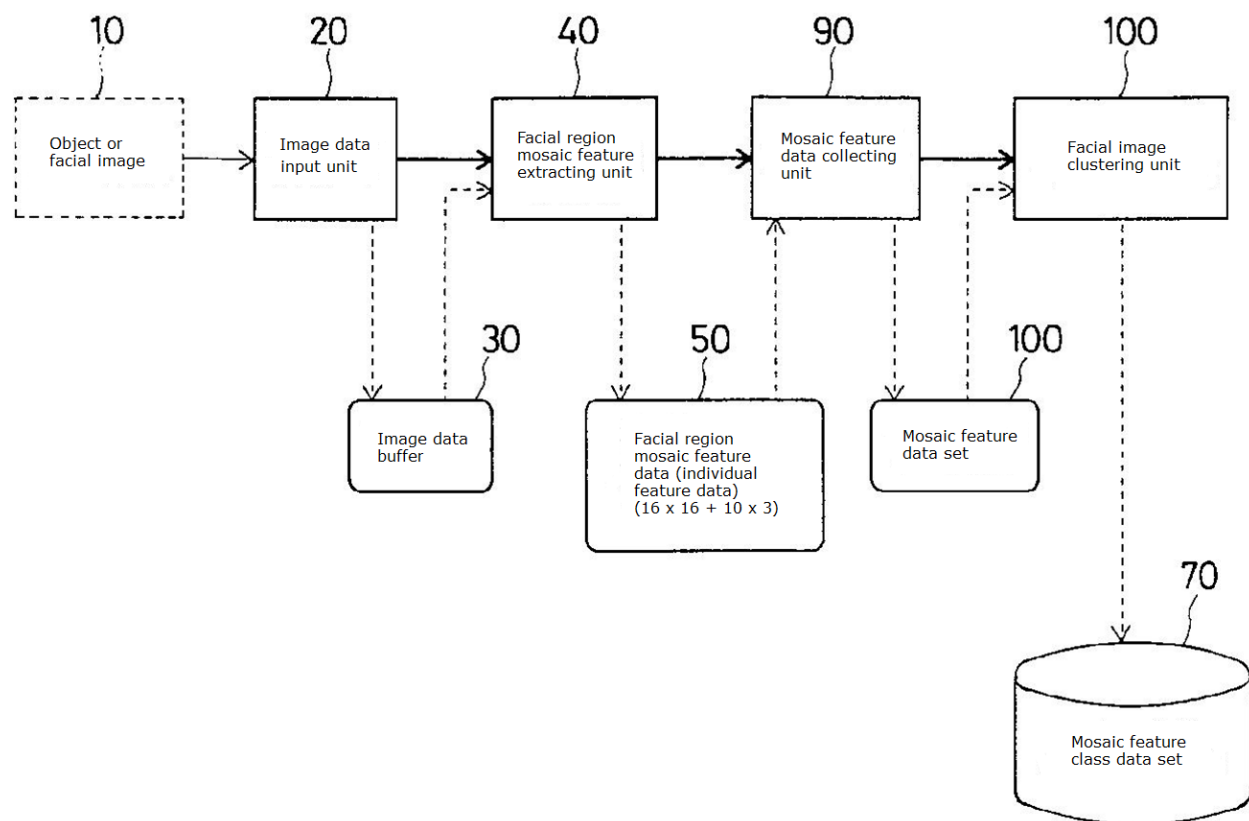
411: Facial center/facial region positioning unit

413: Facial region mosaicking unit

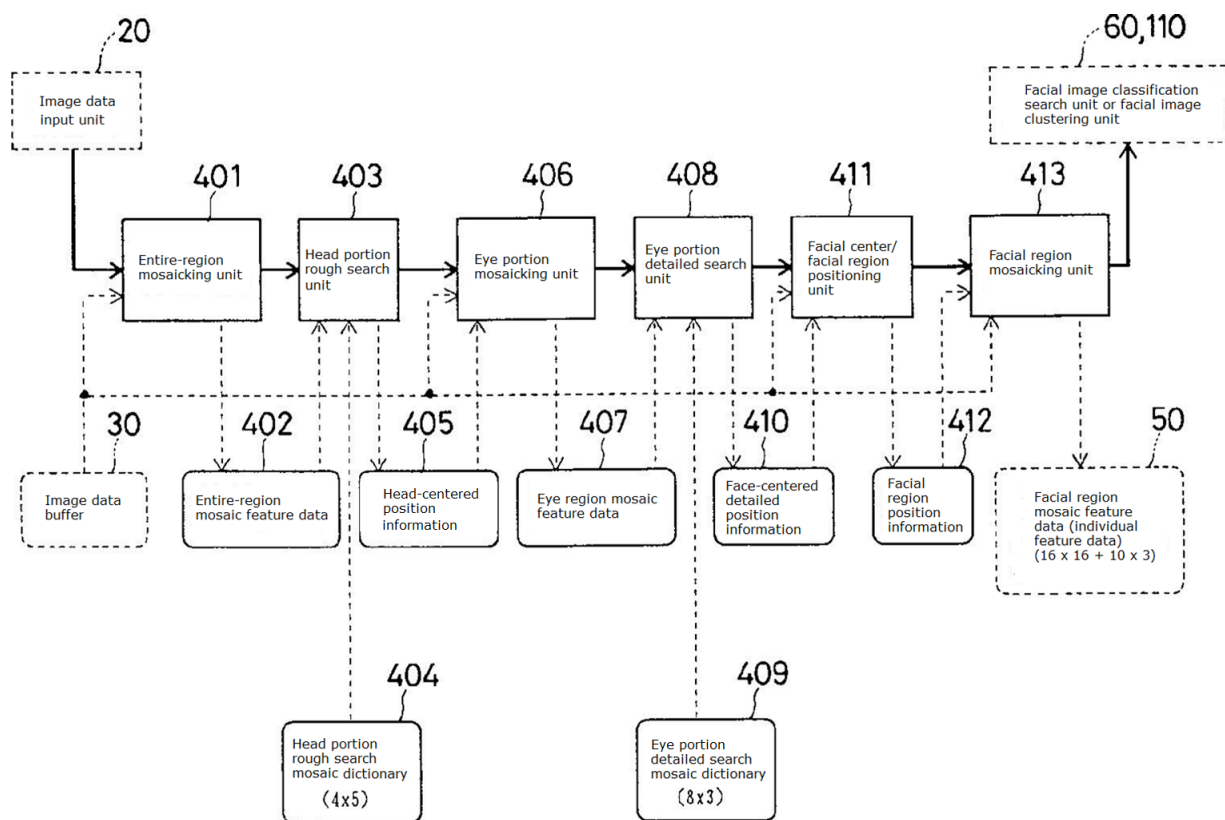
[FIG. 1]



[FIG. 2]



[FIG. 3]



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