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(54) **FACIAL RECOGNITION SYSTEM, FACIAL RECOGNITION SERVER, AND FACIAL RECOGNITION METHOD**

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(57) **ABSTRACT**

A statistical processing is performed without performing complicated determination, so as not to repetitively include the same person. A facial feature extractor (**32**) in a facial recognition server (**30**) extracts features of facial image data including a face which is shown in an image obtained by a camera device (**10**) imaging an imaging area. A preservation unit (**35**) preserves features of facial image data including a face which has passed through the imaging area, in a pre-passing comparative original facial feature data memory (**41**). A statistics unit (**37**) performs statistical processing on the features of the facial image data, which are extracted by the facial feature extractor (**32**), in a case where feature having high similarity which is obtained by comparison with the features (extracted by the facial feature extractor (**32**)) of the facial image data imaged by the camera device (**10**) and is equal to or greater than a predetermined value are not preserved in the pre-passing comparative original facial feature data memory (**41**) until a predetermined time from an imaging time point by the camera device (**10**).

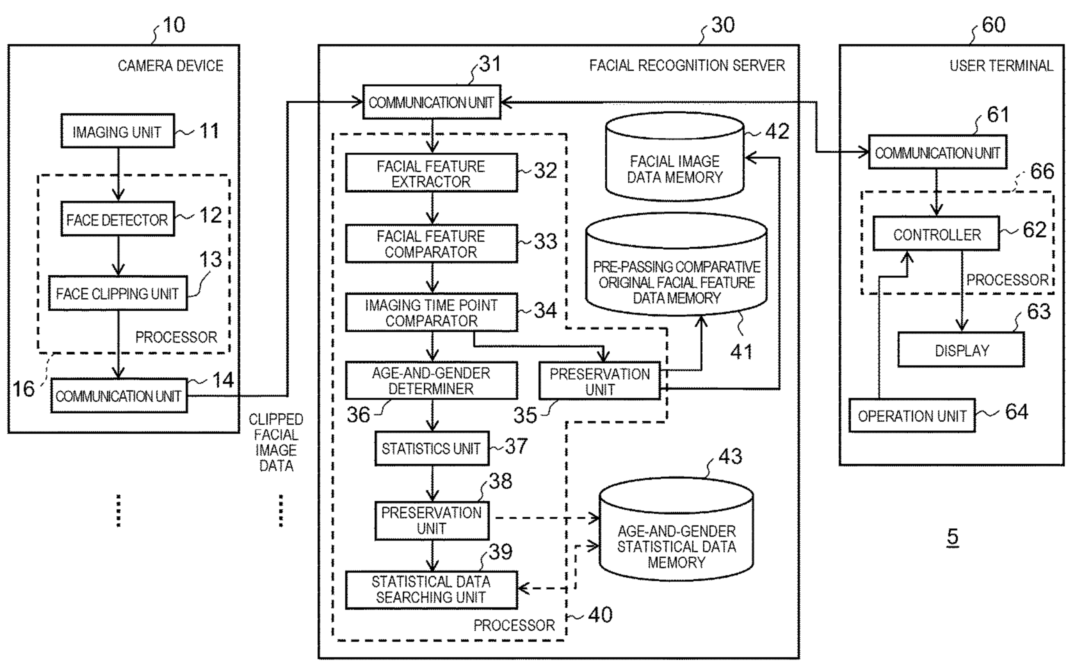
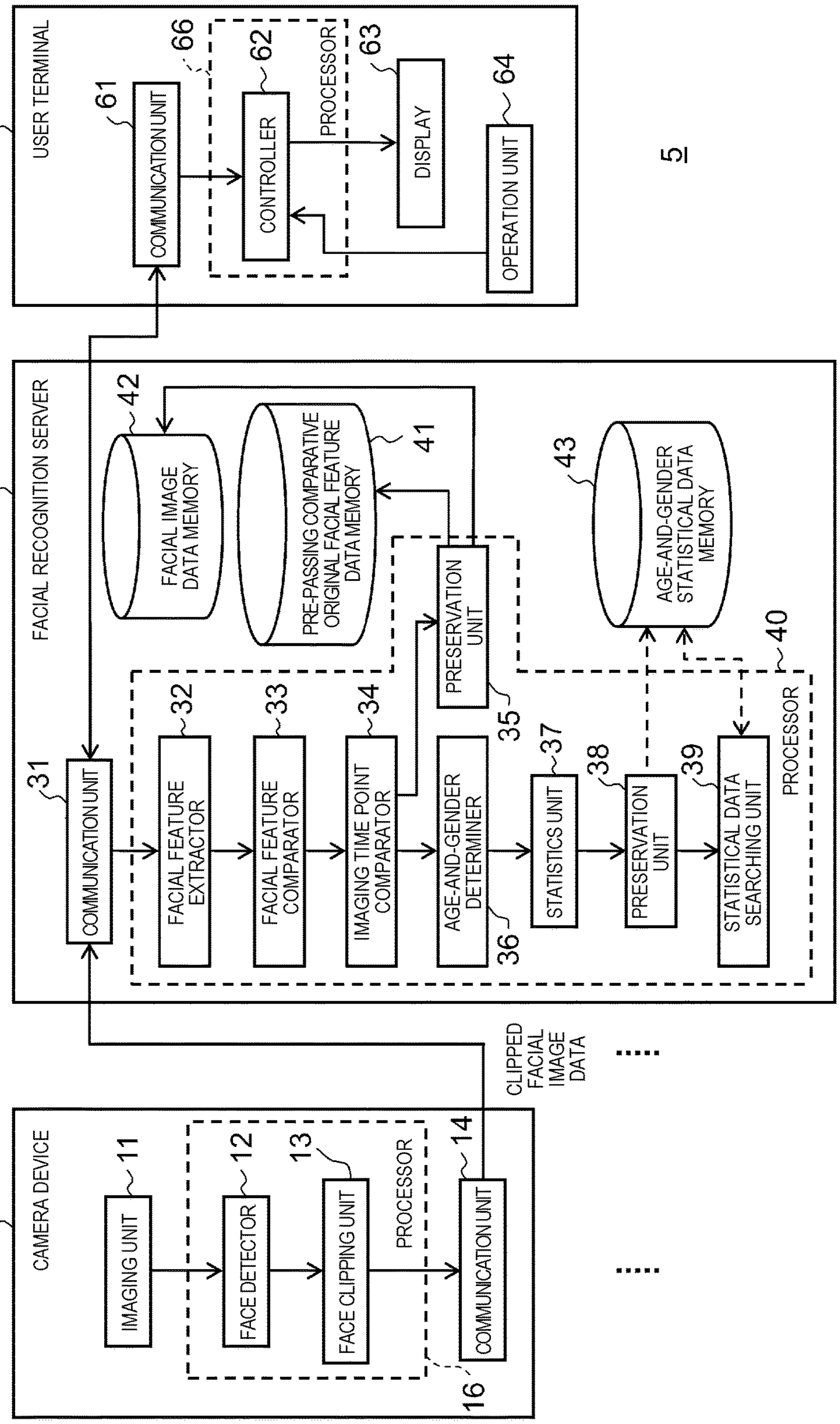


FIG. 1



5
60
USER TERMINAL
61
COMMUNICATION UNIT
66
62
CONTROLLER
PROCESSOR
63
DISPLAY
64
OPERATION UNIT
30
FACIAL RECOGNITION SERVER
31
COMMUNICATION UNIT
42
FACIAL IMAGE DATA MEMORY
41
PRE-PASSING COMPARATIVE ORIGINAL FACIAL FEATURE DATA MEMORY
43
AGE-AND-GENDER STATISTICAL DATA MEMORY
40
32
FACIAL FEATURE EXTRACTOR
33
FACIAL FEATURE COMPARATOR
34
IMAGING TIME POINT COMPARATOR
35
PRESERVATION UNIT
36
AGE-AND-GENDER DETERMINER
37
STATISTICS UNIT
38
PRESERVATION UNIT
39
STATISTICAL DATA SEARCHING UNIT
PROCESSOR
CLIPPED FACIAL IMAGE DATA
10
CAMERA DEVICE
11
IMAGING UNIT
12
FACE DETECTOR
13
FACE CLIPPING UNIT
PROCESSOR
14
COMMUNICATION UNIT
16

FIG. 2

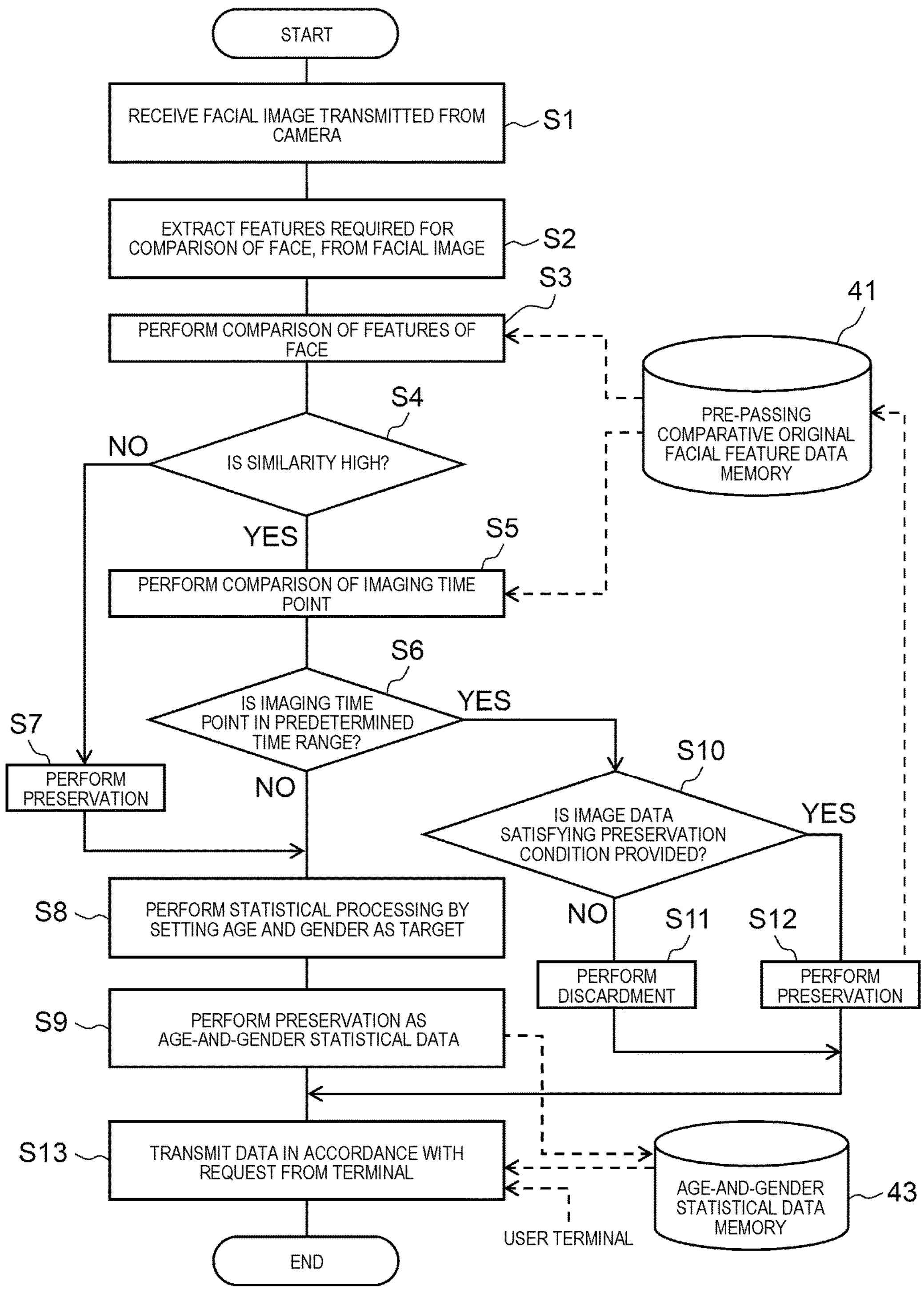

START
RECEIVE FACIAL IMAGE TRANSMITTED FROM CAMERA
S1
EXTRACT FEATURES REQUIRED FOR COMPARISON OF FACE, FROM FACIAL IMAGE
S2
S3
PERFORM COMPARISON OF FEATURES OF FACE
41
PRE-PASSING COMPARATIVE ORIGINAL FACIAL FEATURE DATA MEMORY
S4
NO
IS SIMILARITY HIGH?
YES
S5
PERFORM COMPARISON OF IMAGING TIME POINT
S6
IS IMAGING TIME POINT IN PREDETERMINED TIME RANGE?
YES
S7
PERFORM PRESERVATION
NO
S10
IS IMAGE DATA SATISFYING PRESERVATION CONDITION PROVIDED?
YES
S8
PERFORM STATISTICAL PROCESSING BY SETTING AGE AND GENDER AS TARGET
NO
S11
S12
PERFORM DISCARDMENT
PERFORM PRESERVATION
S9
PERFORM PRESERVATION AS AGE-AND-GENDER STATISTICAL DATA
S13
TRANSMIT DATA IN ACCORDANCE WITH REQUEST FROM TERMINAL
AGE-AND-GENDER STATISTICAL DATA MEMORY
43
USER TERMINAL
END

FIG. 3

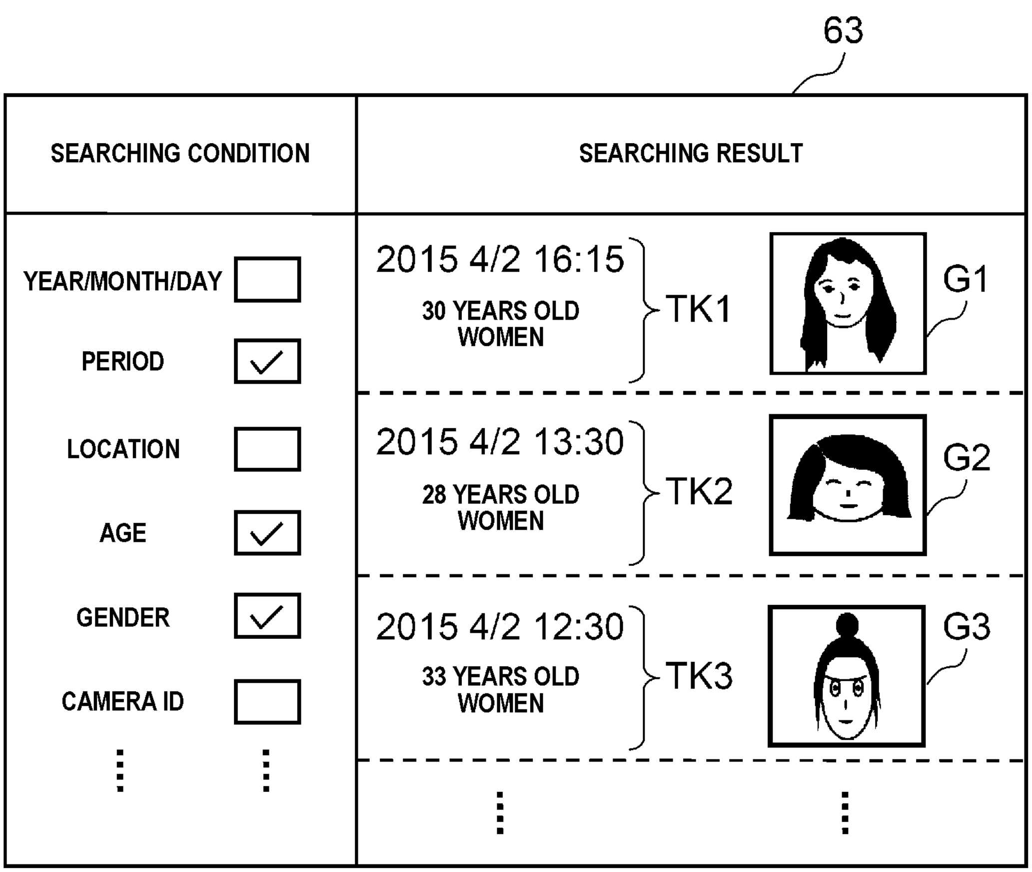
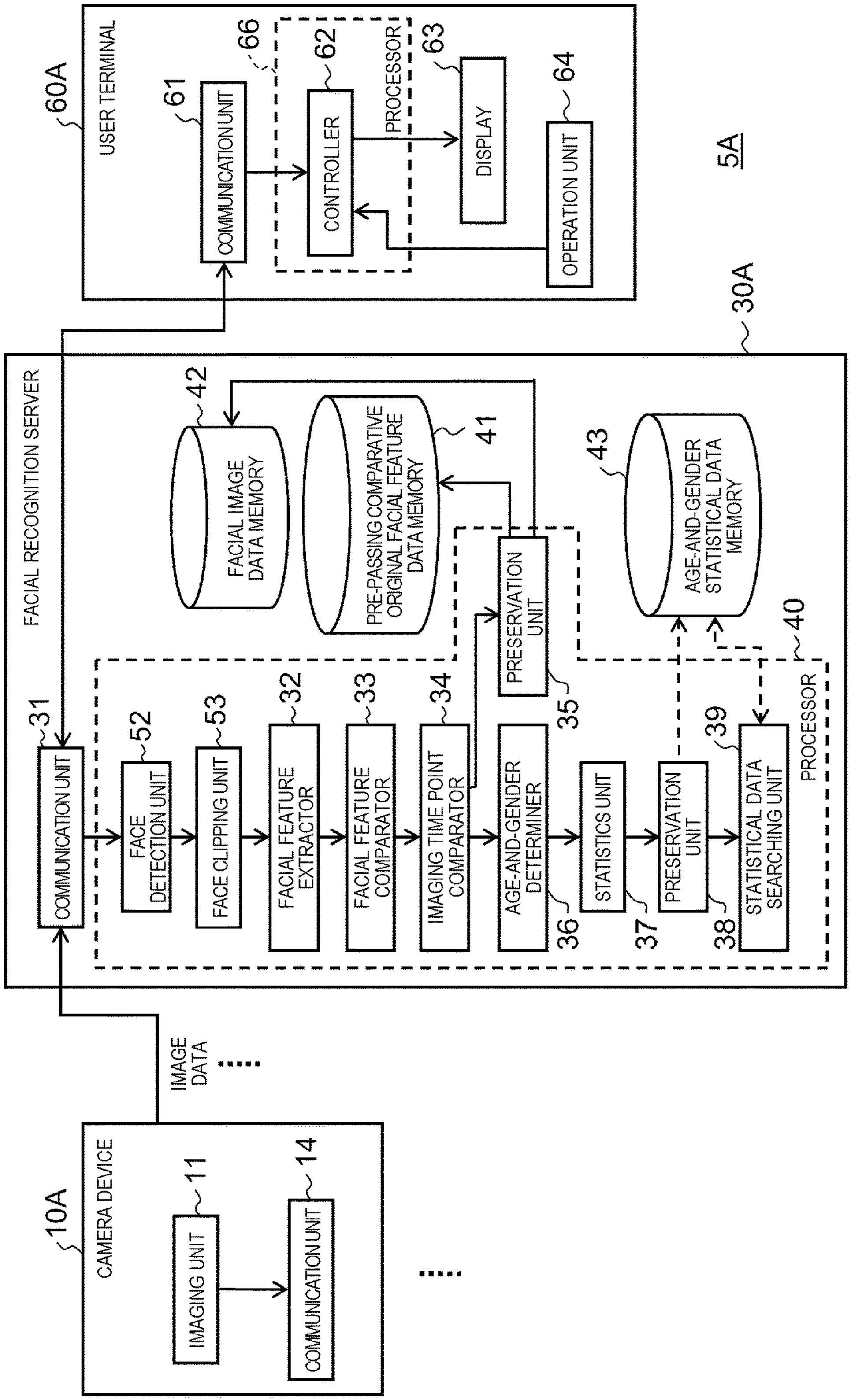

63
SEARCHING CONDITION
SEARCHING RESULT
YEAR/MONTH/DAY
PERIOD
LOCATION
AGE
GENDER
CAMERA ID
2015 4/2 16:15
30 YEARS OLD
WOMEN
TK1
G1
2015 4/2 13:30
28 YEARS OLD
WOMEN
TK2
G2
2015 4/2 12:30
33 YEARS OLD
WOMEN
TK3
G3

FIG. 4


60A
USER TERMINAL
61
COMMUNICATION UNIT
66
62
CONTROLLER
PROCESSOR
63
DISPLAY
64
OPERATION UNIT
5A
30A
FACIAL RECOGNITION SERVER
42
FACIAL IMAGE DATA MEMORY
41
PRE-PASSING COMPARATIVE ORIGINAL FACIAL FEATURE DATA MEMORY
43
AGE-AND-GENDER STATISTICAL DATA MEMORY
40
PROCESSOR
31
COMMUNICATION UNIT
52
FACE DETECTION UNIT
53
FACE CLIPPING UNIT
32
FACIAL FEATURE EXTRACTOR
33
FACIAL FEATURE COMPARATOR
34
IMAGING TIME POINT COMPARATOR
35
PRESERVATION UNIT
36
AGE-AND-GENDER DETERMINER
37
STATISTICS UNIT
38
PRESERVATION UNIT
39
STATISTICAL DATA SEARCHING UNIT
IMAGE DATA
10A
CAMERA DEVICE
11
IMAGING UNIT
14
COMMUNICATION UNIT

FACIAL RECOGNITION SYSTEM, FACIAL RECOGNITION SERVER, AND FACIAL RECOGNITION METHOD

TECHNICAL FIELD

[0001] The disclosure relates to a facial recognition system, a facial recognition server, and a facial recognition method of recognizing a face of a person by using a video image which is imaged by a camera device.

BACKGROUND ART

[0002] In the related art, a customer analysis system as follows is known (for example, see PTL 1). When the customer base of a person shown in an imaging area set in a store is determined, the customer analysis system determines whether or not the person is a customer as an analysis target, based on an action pattern of the person, and excludes the person who is determined not to be the analysis target, from the analysis target. Thus, the customer analysis system analyzes the customer base of a customer who comes to a store, with high accuracy.

[0003] In the customer analysis system, for example, the imaging area is set such that a customer who is directed toward a seat from a guide waiting area in the vicinity of a doorway in a store is imaged from the front. A person who performs an action which is different from an action of moving toward the seat is detected, and the detected person is excluded from the analysis target. Thus, a person such as a clerk, which is not a customer is included as the analysis target, and an occurrence of a situation in which the same customer is repetitively included as the analysis target is avoided.

CITATION LIST

Patent Literature

[0004] PTL 1: Japanese Patent Unexamined Publication No. 2014-232495

SUMMARY OF THE INVENTION

[0005] However, in the configuration in PTL 1, in a case where a person does not take a predetermined action pattern, it is possible to exclude this person from the analysis target. However, complicated determination processing is required for determining whether or not a person does a predetermined action pattern.

[0006] Even in a case where it can be determined that a person does a predetermined action pattern, if the same person goes to the doorway of a store and back twice or more because of a certain business, it is considered that the person is repetitively counted. In the configuration in PTL 1, it is considered that, in a case where a person does not do a predetermined action pattern, the person is excluded from the analysis target even though the person is a customer as the analysis target.

[0007] The disclosure has been made considering the above-described circumstances in the related art. An object of the disclosure is to provide a facial recognition system, a facial recognition server, and a facial recognition method in which it is possible to efficiently perform statistical processing without performing complicated determination, so as not to repetitively include the same person.

[0008] According to the disclosure, there is provided a facial recognition system in which a camera device and a facial recognition server are connected to each other. The facial recognition server includes a feature extractor, a preservation unit, and a statistical processing unit. The feature extractor extracts features of facial image data including the face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area. The preservation unit preserves the features of the facial image data, which are extracted by the feature extractor, in a facial feature memory. The statistical processing unit performs statistical processing by using the features of the facial image data, which are extracted by the feature extractor, in a case where the features of facial image data, which has similarity which is obtained by comparison with the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than a predetermined value are preserved in the facial feature memory over a predetermined time from an imaging time point of the camera device.

[0009] According to the disclosure, there is provided a facial recognition server connected to a camera device. The facial recognition server includes a feature extractor, a preservation unit, and a statistical processing unit. The feature extractor extracts features of facial image data including the face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area. The preservation unit preserves the features of the facial image data, which are extracted by the feature extractor, in a facial feature memory. The statistical processing unit performs statistical processing by using the features of the facial image data, which are extracted by the feature extractor, in a case where the features of facial image data, which has similarity which is obtained by comparison with the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than a predetermined value are preserved in the facial feature memory over a predetermined time from an imaging time point of the camera device.

[0010] According to the disclosure, there is provided a facial recognition method in a facial recognition system in which a camera device and a facial recognition server are connected to each other. The facial recognition method includes processing of extracting features of facial image data including the face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area, processing of preserving the extracted features of the facial image data in a facial feature memory, and processing of performing statistical processing by using the extracted features of the facial image data, in a case where the features of facial image data, which has similarity which is obtained by comparison with the extracted features of the facial image data and is equal to or greater than a predetermined value are preserved in the facial feature memory over a predetermined time from an imaging time point of the camera device.

[0011] According to the disclosure, it is possible to perform statistical processing without performing complicated determination, so as not to repetitively include the same person.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. **1** is a block diagram specifically illustrating an example of an internal configuration of a facial recognition system according to an exemplary embodiment.

[0013] FIG. **2** is a flowchart illustrating an example of operation procedures of face detection processing in a facial recognition server in this exemplary embodiment.

[0014] FIG. **3** is a diagram illustrating an example of a UI screen displayed in a display of a user terminal.

[0015] FIG. **4** is a block diagram specifically illustrating an example of an internal configuration of facial recognition system in a modification example of this exemplary embodiment.

DESCRIPTION OF EMBODIMENT

[0016] Hereinafter, an exemplary embodiment (referred to as "this exemplary embodiment" below) in which a facial recognition system, a facial recognition server, and a facial recognition method in the disclosure are specifically disclosed will be described in detail with reference to the drawings. Detailed descriptions which are unnecessary may be omitted. For example, detailed descriptions of an item which are already known or the repetitive descriptions for the substantially same component may be omitted. This is because it is avoided that the following descriptions become unnecessarily redundant, and the person in the related art is caused to easily understand the following descriptions. The accompanying drawings and the following descriptions are provided in order to cause the person in the related art to sufficiently understand the disclosure and it is not intended that the topics described in claims are not limited thereto.

[0017] FIG. **1** is a block diagram specifically illustrating an example of an internal configuration of facial recognition system **5** in this exemplary embodiment. Facial recognition system **5** illustrated in FIG. **1** has a configuration in which plurality of camera devices **10**, facial recognition server **30**, and user terminal **60** are connected to each other.

[0018] Each of camera devices **10** performs imaging of a predetermined location in a store or the like, which is preset, as an imaging area. Each of camera devices **10** acquires facial image data including the face of a person who passes through the imaging area. The face of the person is shown in the imaged video image. Each of camera devices **10** includes imaging unit **11**, face detector **12**, face clipping unit **13**, and communication unit **14**. The number of camera devices **10** in this exemplary embodiment may be one or plural.

[0019] The imaging unit includes an image pickup device such as a charge coupled device (CCD) image sensor or a complementary metal-oxide semiconductor (CMOS) image sensor. The imaging unit performs imaging of light which is incident from the preset imaging area, on a light receiving surface, and converts the optical image into an electrical signal. Thus, a frame of video image data indicating a video image of the imaging area is obtained.

[0020] Face detector **12** detects a face included in the video image imaged by imaging unit **11**. Face detection processing is processing of detecting a face by using a well-known technology, for example, as follows: a method of detecting a part of the face, such as the eyes, the nose, and the mouse; a method of detecting a skin color; a method of detecting the hair; and a method of detecting a part such as the neck and the shoulders. As the method of the face detection processing, a pattern recognition technology based on statistical learning may be used.

[0021] Face clipping unit **13** clips facial image data including the face which has been detected by the face detector **12**, from the frame of the video image imaged by imaging unit **11**. The clipped facial image data is data which includes a rectangular image having a size as large as includes the imaged face. Face detector **12** and face clipping unit **13** are functions performed, for example, by processor **16** such as a central processing unit (CPU), a micro processing unit (MPU), or a digital signal processor (DSP). Processor **16** executes, for example, an application program stored in an internal memory so as to realize the function of face detector **12** and face clipping unit **13**.

[0022] Communication unit **14** is connected to facial recognition server **30** in a wired or wireless manner, and transmits facial image data clipped by face clipping unit **13**, to facial recognition server **30**. For example, in a case where camera device **10** is a network camera, communication unit **14** is capable of transmitting facial image data via an internet protocol (IP) network.

[0023] Facial recognition server **30** performs recognition by collating a face included in facial image data received from each of camera devices **10** with the pre-registered face. Facial recognition server **30** includes communication unit **31**, facial feature extractor **32**, facial feature comparator **33**, imaging time point comparator **34**, preservation unit **35**, pre-passing comparative original facial feature data memory **41**, and facial image data memory **42**.

[0024] Communication unit **31** receives facial image data from camera device **10** and transmits a searching result (that is, statistical data) which corresponds to a request (for example, searching request which will be described later) from user terminal **60** in accordance with the request, to user terminal **60**.

[0025] Facial feature extractor **32** as an example of a feature extractor extracts features (simply referred to as "facial features" below) of a face, from facial image data received by communication unit **31**. Facial feature extraction processing is processing of extracting, for example, features such as a position of the eyeball, a positional relationship between the eyes, the nose, and the mouse, and a direction in which wrinkles are formed, by using a well-known technology.

[0026] Facial feature comparator **33** compares facial features extracted by facial feature extractor **32** to facial features registered in pre-passing comparative original facial feature data memory **41**, and determines whether or not similarity between the extracted facial features and the registered facial features is equal to or higher than a predetermined value. In a case where the similarity is not equal to or higher than the predetermined value (that is, in a case where the similarity is smaller than the predetermined value), facial feature comparator **33** determines the similarity to be low. A predetermined value (second threshold) when the similarity is determined to be low may be equal to a predetermined value (first threshold) when the similarity is determined to be high or may be lower than the first threshold.

[0027] Pre-passing comparative original facial feature data memory **41** as an example of a facial feature memory preserves facial features in a case where the facial features which have been extracted by facial feature extractor **32** from facial image data transmitted from camera device **10** satisfy a predetermined preservation condition. The facial features are preserved as features of facial image data including the face of a person who has passed through the imaging area, for a predetermined period. At this time, information of an imaging time point or the imaging area (position) are preserved as attached information, in addition to the features of the facial image data.

[0028] The predetermined period starts from an imaging time point when image data is obtained by imaging of camera device **10**. The imaging time point is included in a header of the image data, for example. The predetermined period may be randomly set or changed in accordance with an operation of user terminal **60**, so as to match with the environment of the imaging area. For example, in a case where the imaging area is in a store such as a restaurant, the predetermined period is set to be two hours as an example. In a case where the imaging area is in an office building, the predetermined period is set to be 6 to 7 hours as an example. The predetermined period may be previously set in facial recognition server **30**, or may be set in a manner that a user such as a manager operates user terminal **60** so as to transmit the value for the predetermined period to facial recognition server **30**.

[0029] Similar to the facial feature, facial image data memory **42** preserves facial image data of the facial features registered in pre-passing comparative original facial feature data memory **41**, in association with the facial features, for the predetermined period. Here, if the predetermined period elapses and thus the facial features preserved in pre-passing comparative original facial feature data memory **41** are deleted, facial image data which has been preserved in facial image data memory **42** and corresponds to the facial features is also simultaneously deleted. However, the image data may be not deleted but preserved for the longer period (for example, one year). The image data may be not deleted and pieces of image data as many as some amount may be accumulated, and thus may be utilized as big data.

[0030] Imaging time point comparator **34** acquires an imaging time point of facial image data received from camera device **10** in a case where the similarity between the facial features extracted by facial feature extractor **32** and the facial features registered in pre-passing comparative original facial feature data memory **41** is equal to or higher than the predetermined value (first threshold). As described above, the imaging time point is described in header information of the facial image data.

[0031] Imaging time point comparator **34** determines whether or not the registered facial features are preserved in pre-passing comparative original facial feature data memory **41** from an imaging time point of facial image data having facial features extracted by facial feature extractor **32** until the predetermined time. When statistical processing which will be described later is performed, the predetermined time is a time which is set not to repetitively count (double-count) the same person. The predetermined time is set to be an adequate value in accordance with the environment of the imaging area. For example, in a case where the predetermined period when facial features are allowed to be preserved in pre-passing comparative original facial feature data memory **41** is 24 hours, the predetermined time is set to be, for example, two hours which are shorter than 24 hours. The predetermined period and the predetermined time may be the same period. In this case, facial features before a predetermined time are not provided in pre-passing comparative original facial feature data memory **41**. Thus, imaging time point comparator **34** may be omitted.

[0032] Preservation unit **35** is connected to pre-passing comparative original facial feature data memory **41** and facial image data memory **42**. Preservation unit **35** preserves features of facial image data in pre-passing comparative original facial feature data memory **41** and preserves facial image data corresponding to the features, in facial image data memory **42**. As will be described later, even in a case where statistical processing is not performed on facial features, the facial features are preserved in a case where facial image data corresponding to the facial features satisfies the preservation condition.

[0033] Facial recognition server **30** further includes age-and-gender determiner **36**, statistics unit **37**, preservation unit **38**, statistical data searching unit **39**, and age-and-gender statistical data memory **43**.

[0034] Age-and-gender determiner **36** estimates the age and the gender based on the facial features extracted by facial feature extractor **32**, by using a well-known technology. The estimated age may be expressed by an age range of a certain degree or may be expressed by a representative value.

[0035] Statistics unit **37** as an example of the statistical processing unit performs statistical processing for the age and the gender as a target of statistics. In the statistical processing, for example, the number of faces included in a video image imaged by camera device **10** is counted for each age and each gender, and is registered as age-and-gender statistical data. The statistical processing may include processing of calculating a ratio of each age group occupying in the population, a ratio between men and women, and the like, simply in addition to processing of counting up the number of people (number of faces) for each age and each gender. In addition, in the statistical processing, counting is performed so as to allow searching in accordance with the AND condition or the OR condition of searching conditions (year/month/day, period, location, age, gender, camera ID, and the like) which will be described later, and the resultant obtained by the counting may be set as the age-and-gender statistical data. The age-and-gender statistical data is statistical data which is classified by at least the age and the gender, and may be sub-classified by other factors. Preservation unit **38** is connected to age-and-gender statistical data memory **43**, and thus preserves the age-and-gender statistical data which has been subjected to statistical processing by statistics unit **37**, in age-and-gender statistical data memory **43**. Age-and-gender statistical data memory **43** preserves the age-and-gender statistical data for a long term and is used when statistical data is used.

[0036] Statistical data searching unit **39** searches for age-and-gender statistical data memory **43** in a predetermined searching condition, in accordance with a request from user terminal **60**, and transmits a searching result to user terminal **60** as a response.

[0037] User terminal **60** is a general-purpose computer device that performs various settings or requests for facial recognition server **30**. User terminal **60** includes communication unit **61**, controller **62**, display **63**, and operation unit **64**. Communication unit **61** is connected to facial recognition server **30** in a wired or wireless manner, and thus is capable of communicating with facial recognition server **30**. For example, communication unit **61** is connected to facial recognition server **30** via an IP network.

[0038] Controller **62** collectively controls an operation of user terminal **60**, executes an application, and requires facial recognition server **30** to perform searching processing in accordance with an input operation of a user. Display **63** displays various types of information and displays the searching condition, the searching result, and the like which will be described later, on a UI screen. Operation unit **64** is a keyboard, a mouse, or the like, and receives an input operation from a user, such as the searching condition.

[0039] In a case where user terminal **60** is configured by a portable tablet terminal, operation unit **64** is integrated with display **63** as a touch panel. Thus, an input operation may be directly performed on the screen of display **63**.

[0040] An operation of facial recognition system **5** having the above-described configuration will be described.

[0041] FIG. **2** is a flowchart illustrating an example of operation procedures of face detection processing in facial recognition server **30** in this exemplary embodiment. Communication unit **31** in facial recognition server **30** receives facial image data transmitted from camera device **10** (S1).

[0042] Facial feature extractor **32** extracts facial features from the received facial image data (S2). Features such as a position of the eyeball, a positional relationship between the eyes, the nose, and the mouse, and a direction in which wrinkles are formed are extracted as the facial features. Facial feature comparator **33** compares the facial features extracted by facial feature extractor **32** to facial features registered in pre-passing comparative original facial feature data memory **41** (S3), and determines whether or not similarity between the extracted facial features and the registered facial features is equal to or higher than a predetermined value (first threshold) (S4).

[0043] In a case where the similarity is not equal to or higher than the predetermined value (that is, in a case where the similarity is determined to be low), preservation unit **35** preserves the facial features extracted by facial feature extractor **32**, in pre-passing comparative original facial feature data memory **41** (S7). Age-and-gender determiner **36** estimates the age and the gender based on the facial features extracted by facial feature extractor **32**, by using a well-known technology. Statistics unit **37** performs statistical processing for the age and the gender as a target of statistics (S8). In the statistical processing, the number of pieces of age-and-gender statistical data which are estimated from the extracted facial features and are classified for each age and each gender of a person is counted so as to increment (count up).

[0044] Preservation unit **38** preserves age-and-gender statistical data which has been subjected to statistical processing by statistics unit **37**, in age-and-gender statistical data memory **43** (S9).

[0045] In a case where it is determined, in Step S**4**, that the similarity is equal to or higher than the predetermined value (first threshold), imaging time point comparator **34** compares an imaging time point of facial image data having facial features which have been extracted by facial feature extractor **32**, to an imaging time point of facial features registered in pre-passing comparative original facial feature data memory **41** (S5). Imaging time point comparator **34** determines whether or not features which are preserved in pre-passing comparative original facial feature data memory **41** and has high similarity are preserved until a predetermined time (in a range of a predetermined time) from the imaging time point of the facial image data having the facial features which have been extracted by facial feature extractor **32** (S6).

[0046] In a case where the imaging time point thereof is out of the range of the predetermined time (NO in S6), the facial features are set as facial features of new facial image data. Statistics unit **37** performs the above-described statistical processing in Step S**8**. In a case where it is determined that the imaging time point thereof is in the range of the predetermined time in Step S6 (YES in S6), statistics unit **37** determines that the extracted facial features are already preserved. Thus, statistics unit **37** determines whether or not facial image data having the facial features satisfies the preservation condition (S10). In a case where the facial image data does not satisfy the preservation condition (NO in S10), facial recognition server **30** discards the facial features without being preserved in pre-passing comparative original facial feature data memory **41** (S11). In a case where the facial image data satisfies the preservation condition (YES in S10), preservation unit **35** preserves the facial features in pre-passing comparative original facial feature data memory **41** (S12).

[0047] Here, for example, in a case where preserving only the first image is set as the preservation condition, since the facial image data determined in Step S10 is not the first image, the facial features corresponding to the facial image data are not preserved and are discarded. In a case where a preservation condition in which an orientation of a face included in the facial image data is directed to the front and the face is largely shown is provided, if the facial image data does not satisfy the preservation condition, the facial feature corresponding to the facial image data are discarded. In a case where preserving all pieces of facial image data is set as the preservation condition, facial features are preserved regardless of image data. The preservation condition may be previously set in preservation unit **35** and may be changed by setting information from user terminal **60** in the middle of the operation.

[0048] In the processes of Steps S1 to S12, if the age-and-gender statistical data and the facial features are completely preserved, statistical data searching unit **39** receives a request from user terminal **60**, searches for age-and-gender statistical data registered in age-and-gender statistical data memory **43**, in accordance with the request, and transmits the corresponding age-and-gender statistical data to user terminal **60** as a response (S13). Then, facial recognition server **30** ends the main operation.

[0049] User terminal **60** requires facial recognition server **30** to search for age-and-gender statistical data and receives a searching result from facial recognition server **30**. FIG. **3** is a diagram illustrating a UI (user interface) screen displayed in display **63** of user terminal **60**. The searching condition used for searching for age-and-gender statistical data registered in age-and-gender statistical data memory **43** by a user is displayed on the left side of the screen in display **63**.

[0050] Here, keywords such as year/month/day, a time zone (period), a location, the age, the gender, a camera ID when imaging is performed may be selected as the searching condition. A user inputs a check mark into an input box of each searching item, and thus searching items may be searched in the AND condition or the OR condition which is preset.

[0051] If user terminal **60** transmits the searching condition set by the user, to the facial recognition server **30**, statistical data searching unit **39** searches for age-and-gender statistical data registered in age-and-gender statistical data memory **43**, in accordance with the searching condition. Facial recognition server **30** extracts facial features of a person, which satisfy the searching condition, from age-and-gender statistical data memory **43**. Facial recognition server **30** extracts facial image data which is registered in facial image data memory **42** and is associated with the facial features, from facial image data memory **42**. Facial recognition server **30** transmits the facial features and the facial image data which have been extracted, to user terminal **60**.

[0052] As a result, the facial features and the facial image data of a person which satisfy the searching condition are displayed on the right side of the screen in display **63** of user terminal **60**. Here, as the searching result, facial features TK**1**, TK**2**, and TK**3**, and pieces of facial image data G**1**, G**2**, and G**3** of three persons are displayed.

[0053] As described above, in facial recognition system **5** in this exemplary embodiment, facial feature extractor **32** in facial recognition server **30** extracts facial features of facial image data including a face which is shown in a video image obtained by camera device **10** imaging the imaging area. Preservation unit **35** preserves facial features of facial image data including a face which has passed through the imaging area, in pre-passing comparative original facial feature data memory **41**. In a case where facial features which has high similarity (equal to or higher than the predetermined value) to the facial features (extracted by facial feature extractor **32**) of the facial image data imaged by camera device **10** are not preserved in pre-passing comparative original facial feature data memory **41** until the predetermined time from an imaging time point by camera device **10**, statistics unit **37** performs the statistical processing on the facial features of the facial image data, which have been extracted by facial feature extractor **32**.

[0054] Thus, facial recognition server **30** determines that the facial features which are preserved at a time point close to the imaging time point and has high similarity are facial features of the same person. Since the facial features obtained at this imaging time point are not subjected to the statistical processing, it is possible to efficiently perform statistical processing without performing complicated determination, so as not to repetitively include the same person. In facial recognition system **5**, since facial image data clipped from a video image frame in camera device **10** is transmitted to facial recognition server **30**, it is possible to reduce the volume of transmitted data, in comparison to a case where video image data is transmitted.

[0055] In a case where the facial features having high similarity are preserved in pre-passing comparative original facial feature data memory **41** until the predetermined time, if facial image data imaged by camera device **10** does not satisfy the predetermined preservation condition, preservation unit **35** discards the facial features of the facial image data, which have been extracted by facial feature extractor **32**. Thus, it is possible to omit the unnecessary facial features and reduce the data volume to be preserved.

[0056] If the facial image data imaged by camera device **10** satisfies the predetermined preservation condition, the facial features of the facial image data, which have been extracted by facial feature extractor **32** are preserved in pre-passing comparative original facial feature data memory **41**. Thus, the volume of data of effective facial features is increased and determination accuracy for the similarity of the facial features is improved.

[0057] In a case where facial features which have low similarity (which does not reach the predetermined value (second threshold)) to the facial features (extracted by facial feature extractor **32**) of the facial image data imaged by camera device **10** are preserved in pre-passing comparative original facial feature data memory **41**, statistics unit **37** performs the statistical processing on the facial features of the facial image data, which have been extracted by facial feature extractor **32**. Thus, it is possible to perform the statistical processing without losing the face of the first person.

[0058] The predetermined time may be set in accordance with the environment of the imaging area in a restaurant, a building, or the like. Thus, it is possible to perform the statistical processing so as not to repetitively include the same person, regardless of the environment of the imaging area.

[0059] Facial recognition server **30** searches for age-and-gender statistical data (features of facial image data, which are subjected to the statistical processing) registered in age-and-gender statistical data memory **43**, in accordance with a request from user terminal (terminal device) **60**, and transmits a searching result to user terminal **60** as a response. Thus, it is possible to contribute to using of a user and various types of utilization are expected.

Modification Example of this Exemplary Embodiment

[0060] FIG. **4** is a block diagram specifically illustrating an example of an internal configuration of facial recognition system **5**A in a modification example of this exemplary embodiment. Constituent components which are the same as those in this exemplary embodiment are denoted by the same reference marks and descriptions thereof will not be repeated. Facial recognition system **5**A in the modification example in this exemplary embodiment is different from the above-described exemplary embodiment in that camera device **10**A includes only imaging unit **11** and communication unit **14**, and only transmits image data itself imaged by imaging unit **11**, to facial recognition server **30**A by communication unit **14**.

[0061] Facial recognition server **30**A includes face detector **52** and face clipping unit **53** in processor **40**, differently from that in this exemplary embodiment. Face detector **52** detects a face included in an image regarding image data (image) transmitted from camera device **10**A, similar to face detector **12** in this exemplary embodiment. Face clipping unit **53** clips facial image data including a face which has been detected by face detector **52**, from a frame of a video image, similar to face clipping unit **13** in this exemplary embodiment.

[0062] As described above, in facial recognition system **5**A in the modification example in this exemplary embodiment, processing of applying a load to facial recognition server **30**A is efficiently concentrated. Thus, it is possible to reduce the load of camera device **10**A. As described above, since camera device **10**A only transmits the captured image data (video image) to facial recognition server **30**, camera device **10**A is made with the simple configuration. In addition, camera device **10**A may be used even if camera device **10**A is already provided in the imaging area. In facial recognition system **5**A in the modification example in this exemplary embodiment, a general-purpose network camera may be also used as camera device **10**A.

[0063] Hitherto, various exemplary embodiments are described with reference to the drawings, but the disclosure is not limited to the above-described examples. It is apparent that the person in the related art may suppose various changes or modifications in the range described in claims and it is understood that those belong to the technical scope of the disclosure.

INDUSTRIAL APPLICABILITY

[0064] The disclosure is useful because it is possible to efficiently perform statistical processing without performing complicated determination, so as not to repetitively include the same person when an image imaged by a camera device is used.

REFERENCE MARKS IN THE DRAWINGS

[0065] **5**, **5**A FACIAL RECOGNITION SYSTEM
[0066] **10**, **10**A CAMERA DEVICE
[0067] **11** IMAGING UNIT
[0068] **12**, **52** FACE DETECTOR
[0069] **13**, **53** FACE CLIPPING UNIT
[0070] **14** COMMUNICATION UNIT
[0071] **16**, **40**, **66** PROCESSOR
[0072] **30**, **30**A FACIAL RECOGNITION SERVER
[0073] **31** COMMUNICATION UNIT
[0074] **32** FACIAL FEATURE EXTRACTOR
[0075] **33** FACIAL FEATURE COMPARATOR
[0076] **34** IMAGING TIME POINT COMPARATOR
[0077] **35**, **38** PRESERVATION UNIT
[0078] **36** AGE-AND-GENDER DETERMINER
[0079] **37** STATISTICS UNIT
[0080] **39** STATISTICAL DATA SEARCHING UNIT
[0081] **41** PRE-PASSING COMPARATIVE ORIGINAL FACIAL FEATURE DATA MEMORY
[0082] **42** FACIAL IMAGE DATA MEMORY
[0083] **43** AGE-AND-GENDER STATISTICAL DATA MEMORY
[0084] **60** USER TERMINAL
[0085] **61** COMMUNICATION UNIT
[0086] **62** CONTROLLER
[0087] **63** DISPLAY
[0088] **64** OPERATION UNIT
[0089] TK**1**, TK**2**, TK**3** FACIAL FEATURE
[0090] G**1**, G**2**, G**3** FACIAL IMAGE DATA

1. A facial recognition system comprising:
a camera device; and
a facial recognition server, which is connected to the camera device,
wherein the facial recognition server comprising:
a feature extractor, in operation, extracts features of facial image data including a face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area,
a preservation unit, in operation, preserves the features of the facial image data, which are extracted by the feature extractor, in a facial feature memory, and
a statistical processing unit, in operation, performs statistical processing by using the features of the facial image data, which are extracted by the feature extractor, in a case where the features of facial image data, which has similarity to the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than a predetermined value are preserved in the facial feature memory until a predetermined time elapses from an imaging time point of the camera device.

2. The facial recognition system of claim **1**,
wherein the facial recognition server, in operation, discards the features of the facial image data, which are extracted by the feature extractor, if the facial image data corresponding to the video image data which has been imaged by the camera device does not satisfy a predetermined preservation condition in a case where the features of the facial image data, which has similarity which is obtained by comparison with the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than the predetermined value are preserved in the facial feature memory for a period without exceeding the predetermined time from the imaging time point of the camera device.

3. The facial recognition system of claim **2**,
wherein the facial recognition server, in operation, preserves the features of the facial image data, which are extracted by the feature extractor, in the facial feature memory in a case where the facial image data corresponding to the video image data which has been imaged by the camera device satisfies the predetermined preservation condition.

4. The facial recognition system of claim **1**,
wherein the facial recognition server, in operation, performs the statistical processing by using the features of the facial image data, which are extracted by the feature extractor, in a case where the features of the facial image data, which has similarity which is obtained by comparison with the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than the predetermined value are not preserved in the facial feature memory.

5. The facial recognition system of claim **1**,
wherein the predetermined time is allowed to be randomly set in accordance with an environment around the imaging area.

6. The facial recognition system of claim **1**,
wherein the facial recognition server, in operation, searches for the features of the facial image data, which are subjected to the statistical processing by the statistical processing unit, in accordance with a searching request from a terminal device, and transmits a searching result which corresponds to the searching request, to the terminal device.

7. A facial recognition server which is connected to a camera device, the server comprising:
a feature extractor, in operation, extracts features of facial image data including a face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area;
a preservation unit, in operation, preserves the features of the facial image data, which are extracted by the feature extractor, in a facial feature memory; and
a statistical processing unit, in operation, performs statistical processing by using the features of the facial image data, which are extracted by the feature extractor, in a case where the features of facial image data, which has similarity which is obtained by comparison with the features of the facial image data, which are extracted by the feature extractor and is equal to or greater than a predetermined value are preserved in the facial feature memory over a predetermined time from an imaging time point of the camera device.

8. A facial recognition method in a facial recognition system in which a camera device and a facial recognition server are connected to each other, the method comprising:

processing of extracting features of facial image data including the face of a person shown in video image data, based on the video image data obtained by the camera device imaging an imaging area;

processing of preserving the extracted features of the facial image data in a facial feature memory; and

processing of performing statistical processing by using the extracted features of the facial image data, in a case where the features of facial image data, which has similarity which is obtained by comparison with the extracted features of the facial image data and is equal to or greater than a predetermined value are preserved in the facial feature memory over a predetermined time from an imaging time point of the camera device.

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