DESCRIPTION

FACE IMAGE CANDIDATE DETERMINATION APPARATUS FOR AUTHENTICATION, FACE IMAGE CANDIDATE DETERMINATION METHOD FOR AUTHENTICATION, PROGRAM, AND RECORDING MEDIUM

TECHNICAL FIELD

[0001] The present invention relates to a face image candidate determination apparatus for authentication, a face image candidate determination method for authentication, a program, and a recording medium.

BACKGROUND ART

[0002] In various fields, personal authentication by face image analysis (hereinafter, referred to as face image authentication) is used. In the face image authentication, a face image of a registered person is stored in advance as a master image, a face image of a person to be authenticated obtained in live as a query image is collated with the master image, and a person to be authenticated is authenticated as the registered person when the face image matches the master image.

SUMMARY

[0003] However, the query image is not always a face image captured in a state in which the modeling of the face of the person to be authenticated can be clearly identified, for example, as in a certification photograph, and may be in various states such as a face with a hat, a face with a mask or sunglasses, a profile, a look-up face, a look-down face, and the like. Similarly, the master image is not always a face image such as the certification photograph. Therefore, depending on the state of the master image and the query image, the accuracy of face image authentication may not be sufficient.

[0004] With the foregoing in mind, it is an object of the present invention to provide a face image candidate determination system for authentication that can improve the accuracy of face image authentication finally performed.

[0005] More specifically, it is an object of the present invention to provide a face image candidate determination apparatus for authentication, a face image candidate determination method for authentication, a program, and a recording medium in the above system.

[0006] In order to achieve the aforementioned object, in a first aspect, the present disclosure provides a face image candidate determination apparatus for authentication, including: a storage unit; an image acquisition unit; an

attribute determination unit; a score calculation unit; and a selection unit, wherein the storage unit includes: a reference storage unit; and a threshold value storage unit, the reference storage unit stores a reference face image in association with an attribute of the reference face image for each registered person, the threshold value storage unit stores a score threshold value for each combination of attributes of face images to be collated, the attribute is an attribute based on a feature of the face image, the score threshold value is a threshold value for determining that face images to be collated are likely to be of the same person, the image acquisition unit acquires a face image of a person to be determined as a face image for determination, the attribute determination unit determines an attribute of the face image for determination, the score calculation unit collates the reference face image with the face image for determination and calculates a score indicating a degree of matching, and the selection unit selects a reference face image satisfying the score threshold value as a face image candidate for authentication and selects the face image candidate and a calculated score thereof as authentication information of the face image for determination.

[0007] In a second aspect, the present disclosure provides a face image candidate determination method for authentication, including the steps of: storing; acquiring an image; determining an attribute; calculating a score; and selecting, wherein the storing includes the steps of: storing a reference; and storing a threshold value, the reference-storing stores a reference face image in association with an attribute of the reference face image for each registered person, the threshold value-storing stores a score threshold value for each combination of attributes of face images to be collated, the attribute is an attribute based on a feature of a face image, the score threshold value is a threshold value for determining that face images to be collated are likely to be of the same person, the image-acquiring acquires a face image of a person to be determined as a face image for determination, the attribute-determining determines an attribute of the face image for determination, the score-calculating collates the reference face image with the face image for determination and calculates a score indicating a degree of matching, and the selecting selects a reference face image satisfying the score threshold value as a face image candidate for authentication and selects the face image candidate and a calculated score thereof as authentication information of the face image for determination.

[0007a] In a third aspect, the present disclosure provides a face image authentication apparatus, comprising: a face image candidate determination unit; and an authentication unit, wherein the face image candidate determination unit comprises: the face image candidate determination apparatus for authentication according to the first aspect, determines a face image satisfying the score threshold value as a face image candidate for authentication for each attribute of the reference face image, and the authentication unit authenticates a face image of a person to be

determined based on the authentication information of the face image candidate.

[0007b] In a fourth aspect, the present disclosure provides a face image authentication method, comprising the steps of: determining a face image candidate; and authenticating, wherein the face image candidate-determining comprises: the face image candidate determination method for authentication according to the second aspect, determines a face image satisfying the score threshold value as a face image candidate for authentication for each attribute of the reference face image, and the authenticating authenticates a face image of a person to be determined based on the authentication information of the face image candidate.

[0008] In a fifth aspect, the present disclosure provides a program for a computer to execute the steps of the face image candidate determination method according to the second aspect, or the steps of the face image authentication method according to the fourth aspect.

[0009] In a sixth aspect, the present disclosure provides a computer readable recording medium with the program according to the fifth aspect.

Claims

1. A face image candidate determination apparatus for authentication, comprising:

a storage unit;

an image acquisition unit;

an attribute determination unit;

a score calculation unit; and

a selection unit, wherein

the storage unit comprises:

a reference storage unit; and

a threshold value storage unit,

the reference storage unit stores a reference face image in association with an attribute of the reference face image for each registered person,

the threshold value storage unit stores a score threshold value for each combination of attributes of face images to be collated,

the attribute is an attribute based on a feature of the face image,

the score threshold value is a threshold value for determining that face images to be collated are likely to be of the same person,

the image acquisition unit acquires a face image of a person to be determined as a face image for determination,

the attribute determination unit determines an attribute of the face image for determination,

the score calculation unit collates the reference face image with the face image for determination and calculates a score indicating a degree of matching, and

the selection unit selects a reference face image satisfying the score threshold value as a face image candidate for authentication and selects the face image candidate and a calculated score thereof as authentication information of the face image for determination.

2. The face image candidate determination apparatus according to claim 1, wherein

the attribute of the face image is at least one selected from the group consisting of a face orientation, a facial expression, and a wearing object on the face.

3. The face image candidate determination apparatus according to claim 2, wherein

the attribute of the face image is at least one selected from the group consisting of a front face, a profile, a look-down face, a look-up face, an obliquely right profile, an obliquely left profile, a smiling face, a face with a hat, a face with a mask, and a face with sunglasses.

4. The face image candidate determination apparatus according to any one of claims 1 to 3, further comprising:

an extraction unit; and

an output unit, wherein

the extraction unit extracts a face image candidate having a highest score for each of the attributes based on the authentication information of the face image for determination, and

the output unit outputs, for each of the attributes, that the registered person associated with the extracted face image candidate is highly likely to be the person to be determined.

5. The face image candidate determination apparatus according to any one of claims 1 to 4 further comprising:

an extraction unit; and

an output unit, wherein

the extraction unit extracts face image candidates in an order of scores for each of the attributes based on the authentication information of the face image for determination, and

the output unit outputs, for each of the attributes, that the registered persons in an order of scores associated with the extracted face image candidates are in an order of high possibility of being the person to be determined.

6. A face image candidate determination method for authentication, comprising the steps of:

storing;

acquiring an image;

determining an attribute;

calculating a score; and

selecting, wherein

the storing comprises the steps of:

storing a reference; and

storing a threshold value,

the reference-storing stores a reference face image in association with an attribute of the reference face image for each registered person,

the threshold value-storing stores a score threshold value for each combination of attributes of face images to be collated,

the attribute is an attribute based on a feature of a face image,

the score threshold value is a threshold value for determining that face images to be collated are likely to be of the same person,

the image-acquiring acquires a face image of a person to be determined as a face image for determination,

the attribute-determining determines an attribute of the face image for determination,

the score-calculating collates the reference face image with the face image for determination and calculates a score indicating a degree of matching, and

the selecting selects a reference face image satisfying the score threshold value as a face image candidate for authentication and selects the face image candidate and a calculated score thereof as authentication information of the face image for determination.

7. A face image authentication apparatus, comprising:

a face image candidate determination unit; and

an authentication unit, wherein

the face image candidate determination unit comprises:

the face image candidate determination apparatus for authentication according to any one of claims 1 to 5,

determines a face image satisfying the score threshold value as a face image candidate for authentication for each attribute of the reference face image, and

the authentication unit authenticates a face image of a person to be determined based on the authentication information of the face image candidate.

8. A face image authentication method, comprising the steps of:

determining a face image candidate; and

authenticating, wherein

the face image candidate-determining comprises:

the face image candidate determination method for authentication according to claim 6,

determines a face image satisfying the score threshold value as a face image candidate for authentication for each attribute of the reference face image, and

the authenticating authenticates a face image of a person to be determined based on the authentication information of the face image candidate.

9. A program for a computer to execute:

the steps of the face image candidate determination method according to claim 6; or

the steps of the face image authentication method according to claim 8.

10. A computer readable recording medium with the program according to claim 9.