

CLAIMS

1. A face unlocking method, comprising:
 - performing face detection on one or more images;
 - performing face feature extraction on an image in which a face is detected;
 - performing authentication on extracted face features based on stored face features, wherein the stored face features at least comprise face features of face images of at least two different angles corresponding to a same identity (ID);
 - performing living body detection on the image; and
 - performing an unlocking operation in response to the extracted face features passing the authentication and the image passing the living body detection, wherein the performing living body detection on the image comprises:
 - performing image feature extraction on the image by using a neural network;
 - detecting whether the extracted image features comprise at least one type of counterfeited clue information; and
 - determining, based on a detection result of the at least one type of counterfeited clue information, whether the image is a counterfeited face image to determine whether the image passes the living body detection, wherein whether the image is the counterfeited face image is detected from multiple dimensions.
2. The method according to claim 1, wherein the face images of at least two different angles corresponding to the same ID comprise face images of the following two or more angles corresponding to the same ID: a frontal face image, a head-up face image, a head-down face image, a head-turned-left face image, or a head-turned-right face image.
3. The method according to claim 1 or 2, wherein before performing face detection on the one or more images, the method further comprises: performing light equalization adjustment processing on each image; and
 - the performing face detection on the image comprises: performing face detection on the image subjected to the light equalization adjustment processing.
4. The method according to claim 3, wherein the performing light equalization adjustment processing on each image comprises:
 - obtaining a grey-scale image of the image; and
 - performing histogram equalization processing on the grey-scale image of the image.
5. The method according to claim 3, wherein the performing light equalization adjustment processing on each image comprises:
 - performing image illumination conversion on the image to convert the image into an image that satisfies a predetermined illumination condition.

6. The method according to any one of claims 3 to 5, wherein before performing light equalization adjustment processing on each image, the method further comprises:

determining that a quality of the image does not satisfy a predetermined face detection condition,

wherein the predetermined face detection condition comprises any one or more of the following: pixel value distribution of the image does not conform to a predetermined distribution range, or an attribute value of the image is not within a predetermined value range.

7. The method according to any one of claims 1 to 6, wherein the performing authentication on extracted face features based on stored face features comprises:

obtaining a similarity between the extracted face features and at least one stored face feature, and in response to the similarity between the extracted face features and any stored face feature being greater than a set threshold, determining that the extracted face features pass the authentication; or

obtaining similarities between the extracted face features and multiple stored face features, respectively, and in response to a maximum value among values of the similarities between the extracted face features and the multiple stored face features being greater than a set threshold, determining that the extracted face features pass the authentication.

8. The method according to any one of claims 1 to 7, wherein before performing authentication on the extracted face features based on the stored face features, the method further comprises:

obtaining the stored face features of face images of at least two different angles corresponding to the same ID through a face unlocking information registration process.

9. The method according to claim 8, wherein the face unlocking information registration process comprises:

outputting prompt information that indicates obtaining the face images of at least two different angles corresponding to the same ID;

performing face detection on the obtained images;

performing face feature extraction on the images in which the face at each angle of the at least two different angles is detected; and

storing the extracted face features of the face image of each angle, and a corresponding relationship between the same ID and the face features of the face image of each angle.

10. The method according to claim 9, wherein before performing face detection on the obtained image, the method further comprises: performing light equalization adjustment processing on the obtained image; and

the performing face detection on the obtained images comprises: performing face detection on an image subjected to the light equalization adjustment processing,

wherein before performing light equalization adjustment processing on the obtained image, the method further comprises: determining that the quality of the image does not satisfy the predetermined face detection condition.

11. The method according to claim 9 or 10, wherein before storing the extracted face features of the face image of each angle, the method further comprises:

- detecting an angle of the face included in the image; and
- determining that the detected angle matches an angle corresponding to the prompt information.

12. The method according to claim 11, wherein the detecting an angle of the face included in the image comprises:

- performing face key point detection on the image; and
- calculating the angle of the face in the image according to the detected face key points.

13. The method according to any one of claims 9 to 12, further comprising:

- in response to the image passing the living body detection, storing the extracted face features of the face image of each angle, and the corresponding relationship between the same ID and the face features of the face image of each angle.

14. The method according to claim 9, wherein after storing the extracted face features of the face image of each angle, the method further comprises:

- identifying whether storing the face features of the face images of at least two different angles corresponding to the same ID is completed; and

- in response to the storing the face images of at least two different angles corresponding to the same ID being not completed, outputting the prompt information that indicates obtaining of face images of at least two different angles corresponding to the same ID.

15. The method according to claim 14, further comprising: in response to the storing the face images of at least two different angles corresponding to the same ID being completed, outputting prompt information for prompting a user to input the same ID, wherein

- the storing the extracted face features of the face image of each angle, and a corresponding relationship between the face features of the face image of each angle and the same ID comprises: storing the extracted face features of the face images of at least two angles and the same ID input by the user, and establishing a corresponding relationship between the same ID and the face features of the face images of at least two angles.

16. A face unlocking apparatus, comprising:

- a face detection module, configured to perform face detection on one or more images;

- a feature extraction module, configured to perform face feature extraction on an image in which a face is detected;

- an authentication module, configured to perform authentication on extracted face features based on stored face features, wherein the stored face features at least comprise face features of face images of at least two different angles corresponding to a same identity (ID);

- a living body detection module, configured to perform living body detection on the image; and

- a control module, configured to perform an unlocking operation in response to the extracted face features passing the authentication and the image passing the living body detection,

- wherein the living body detection module comprises a neural network, configured to:

- perform image feature extraction on the image;

- detect whether the extracted image features comprise at least one type of counterfeited clue information; and

- determine, based on a detection result of the at least one type of counterfeited clue information, whether the image is a counterfeited face image to determine whether the image passes the living body detection, wherein whether the image is the counterfeited face image is detected from multiple dimensions.

17. An electronic device, comprising:

- a memory for storing executable instructions; and

- one or more processors, which communicate with the memory to execute the executable instructions to perform a face unlocking method, comprising:

- performing face detection on one or more images;

- performing face feature extraction on an image in which a face is detected;

- performing authentication on extracted face features based on stored face features, wherein the stored face features at least comprise face features of face images of at least two different angles corresponding to a same identity (ID);

- performing living body detection on the image; and

- performing an unlocking operation at least in response to the extracted face features passing the authentication and the image passing the living body detection,

- wherein the performing living body detection on the image comprises:

- performing image feature extraction on the image by using a neural network;

- detecting whether the extracted image features comprise at least one type of counterfeited clue information; and

- determining, based on a detection result of the at least one type of counterfeited clue information, whether the image is a counterfeited face image to determine whether the image passes the living body detection, wherein whether the image is the counterfeited face image is detected from multiple dimensions.

18. A computer-readable medium having stored thereon computer-readable instructions that, when being executed, implements operations of the method according to any one of claims 1 to 15.