

CLAIMS

1. A gaze point determination method, comprising:

obtaining two-dimensional coordinates of eye feature points of at least one eye
5 of a face in an image, wherein the eye feature points comprise an eyeball center area
feature point;

obtaining, in a preset three-dimensional coordinate system, a three-
dimensional coordinate of a corresponding eyeball center area feature point in a three-
dimensional face model corresponding to the face in the image based on the obtained
10 two-dimensional coordinate of the eyeball center area feature point; and

obtaining a determination result for a position of a gaze point of an eye of the
face in the image according to two-dimensional coordinates of feature points other
than the eyeball center area feature point in the eye feature points and the three-
dimensional coordinate of the eyeball center area feature point in the preset three-
15 dimensional coordinate system.

2. The method according to claim 1, wherein the eye feature points further comprise:
an eyelid line feature point and an eyeball contour feature point.

20 3. The method according to claim 1 or 2, wherein the obtaining two-dimensional
coordinates of eye feature points of at least one eye of a face in an image comprises:

extracting features from the image, and obtaining two-dimensional coordinates
of face feature points in the image; and

obtaining the two-dimensional coordinates of the eye feature points of at least
25 one eye of the face in the image based on the two-dimensional coordinates of the face
feature points in the image.

4. The method according to claim 3, wherein the obtaining the two-dimensional
coordinates of the eye feature points of at least one eye of the face in the image based
30 on the two-dimensional coordinates of the face feature points in the image comprises:

intercepting one or more rectangular images comprising an eye area
corresponding to the at least one eye from the image according to two-dimensional
coordinates of feature points of eye area of the face in the image; and

extracting features from the rectangular image, and obtaining the two-dimensional coordinates of the eye feature points of at least one eye of the face in the image.

- 5 5. The method according to claim 4, wherein the intercepting rectangular images comprising an eye area corresponding to the at least one eye from the image according to two-dimensional coordinates of feature points of the eye area of the face in the image comprises:

10 intercepting a rectangular image comprising an eye area corresponding to one eye from the image according to two-dimensional coordinates of feature points of the eye area of one eye of the face in the image; and

the extracting features from the rectangular image, and obtaining the two-dimensional coordinates of the eye feature points of at least one eye of the face in the image comprises:

15 extracting features from the rectangular image, and obtaining the two-dimensional coordinates of the eye feature points of one eye of the face in the image;

or,

20 mirroring the rectangular image, extracting features from the rectangular image and the mirrored rectangular image, and obtaining the two-dimensional coordinates of the eye feature points of two eyes of the face in the image.

6. The method according to any one of claims 1 to 5, wherein the obtaining, in the preset three-dimensional coordinate system, the three-dimensional coordinate of a corresponding eyeball center area feature point in a three-dimensional face model corresponding to the face in the image based on the obtained two-dimensional coordinate of the eyeball center area feature point comprises:
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generating the three-dimensional face model corresponding to the face in the image according to the face in the image; and

30 obtaining, in the preset three-dimensional coordinate system, the three-dimensional coordinate of the corresponding eyeball center area feature point in the three-dimensional face model based on the obtained two-dimensional coordinate of the eyeball center area feature point.

7. The method according to claim 6, wherein the generating the three-dimensional face model corresponding to the face in the image according to the face in the image comprises:

generating the three-dimensional face model corresponding to the face
5 according to a correspondence between keypoints of the face in the image and keypoints of a prior three-dimensional face model.

8. The method according to any one of claims 1 to 7, wherein the obtaining a determination result for the position of a gaze point of the eye of the face in the image
10 according to two-dimensional coordinates of feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system comprises:

according to the two-dimensional coordinates of the feature points other than
15 the eyeball center area feature point in the eye feature points; and

the false positive rate comprises: a rate of incorrect determination when the gaze point of the eye of the face in the image is out of the preset area.

9. The method according to claim 8, wherein the comparing the gaze fraction with a
20 preset threshold to obtain the determination result for the position of the gaze point of the eye of the face in the image comprises:

responsive to that the gaze fraction is greater than the preset threshold,
determining that the gaze point of the eye of the face in the image is within a preset
area; or,

25 responsive to that the gaze fraction is less than or equal to the preset threshold,
obtaining that the gaze point of the eye of the face in the image is out of the preset
area.

10. The method according to claim 9, wherein the preset threshold comprises: a
30 difference between a true positive rate and a false positive rate, wherein the true positive rate comprises: a rate of correct determination when the gaze point of the eye of the face in the image is within the preset area, and the false positive rate comprises: the eye of the face in the image is out of the preset area;

performing processing on the image according to the determination result.

11. The method according to claim 9 or 10, wherein the preset area comprises: part or all of a screen area.

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12. The method according to any one of claims 9 to 11, wherein after the comparing the gaze fraction with a preset threshold to obtain the determination result for the position of the gaze point of the eye of the face in the image, the method further comprises:

10 obtaining a gaze fraction of the eye of the face in the image according to the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system;
 comparing the gaze fraction with a preset threshold to obtain the determination
15 result for the position of the gaze point of the eye of the face in the image.

13. The method according to claim 12, wherein the performing processing on the image according to the determination result comprises:

 displaying the image according to a first preset display mode in response to
20 that the gaze point of the eye of the face in the image is within the preset area; and
 displaying the image according to a second preset display mode in response to
 that the gaze point of the eye of the face in the image is out of the preset area.

14. The method according to any one of claims 8 to 13, wherein the obtaining a gaze
25 fraction of the eye of the face in the image according to the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system comprises:

 obtaining, through a neural network, the gaze fraction of the eye of the face in
30 the image according to the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system.

15. The method according to claim 14, wherein after the obtaining, in the preset three-dimensional coordinate system, the three-dimensional coordinate of an eyeball center area feature point in a three-dimensional face model corresponding to the face in the image based on the obtained two-dimensional coordinate of the eyeball center area feature point, the method further comprises:

adjusting, according to a preset format, formats of the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system; and

the obtaining, through a neural network, the gaze fraction of the eye of the face in the image according to the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system comprises:

obtaining, through the neural network, the gaze fraction of the eye of the face in the image according to the two-dimensional coordinates of the feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system which are subjected to format adjustment.

16. The method according to any one of claims 1 to 15, wherein the method is applied to at least one of the following: facial expression recognition, terminal payment, terminal locking, or terminal unlocking.

17. A gaze point determination apparatus, comprising:

an obtaining unit, configured to: obtain two-dimensional coordinates of eye feature points of at least one eye of a face in an image, wherein the eye feature points comprise an eyeball center area feature point; and obtain, in the preset three-dimensional coordinate system, a three-dimensional coordinate of a corresponding eyeball center area feature point in a three-dimensional face model corresponding to the face in the image based on the obtained two-dimensional coordinate of the eyeball center area feature point; and

a determination unit configured to obtain a determination result for a position of a gaze point of an eye of the face in the image according to two-dimensional coordinates of feature points other than the eyeball center area feature point in the eye feature points and the three-dimensional coordinate of the eyeball center area feature point in the preset three-dimensional coordinate system.

18. An electronic device, comprising the apparatus according to claim 17.

19. An electronic device, comprising:

a memory for storing executable instructions; and
a processor configured to communicate with the memory to execute the executable instructions to implement the method according to any one of claims 1 to 16.

20. A computer storage medium, having computer readable instructions stored therein, wherein the instructions, when being executed, implement the method according to any one of claims 1 to 16.