

Claims

1. A method for detecting a face, comprising:
 - preprocessing an image;
 - extracting corners from the preprocessed image, and filtering and combining the
 - 5 corners, to obtain a connected component of the corners;
 - extracting a centroids from the each connected component of the corners; and
 - matching the each centroids with a facial template, calculating a matching probability of the each centroids with the facial template, and identifying regions formed by centroids having a matching probability greater than or equal to a
 - 10 predetermined value as candidate face regions;
 - wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located;
 - wherein matching each centroid with the facial template, calculating the
 - 15 matching probability of each centroid with the facial template, and identifying the region formed by the centroids having a matching probability greater than or equal to the predetermined value as the candidate face region comprises:
 - traversing each centroid; and
 - for each centroid, performing the following steps:
 - 20 searching a second centroid having a distance to the right eye vertex less than or equal to a fourth threshold using a first centroid as a vertex of the facial template;
 - searching a third centroid having a vertical distance less than or equal to the fourth threshold from another line parallel with a line where the left eye vertex and the right eye vertex are located;
 - 25 calculating the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest distance between the third centroid and the third point; and
 - determining whether the matching probability is greater than or equal to the
 - 30 predetermined value, and identifying a region formed by the first centroid, the second

centroid and the third centroid as the candidate face region if the matching probability is greater than or equal to the predetermined value.

2. The method according to claim 1, wherein the preprocessing comprises at least one of image level adjustment, auto white balance, normalization and image mosaic.

5 3. The method according to claim 1, wherein extracting the corners from the preprocessed image comprises:

calculating luminance differences between a current pixel and surrounding pixels based on a predefined 3X3 template; and

10 deriving a pixel having a luminance difference greater than or equal to a first threshold as the corner;

wherein the 3X3 template is a region centered on the current pixel and including pixels to the left, right, upper, lower, top-left, top-right, bottom-left and bottom-right of the current pixel.

4. The method according to claim 1, wherein filtering the corners comprises:

15 identifying skin color points in the preprocessed image, and filtering out the corners which do not include a skin color point in a preset surrounding range; and

extracting the center of the intersection of a YcgCr color space and a YcbCr color space as a skin color center, calculating values of components Cb, Cg and Cr of the corners, calculating distances between the skin color center and the values of the components Cb, Cg and Cr of the corners, and filtering out the corners having a distance greater than a second threshold from the skin color center.

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5. The method according to claim 1, wherein extracting the centroids from the each connected component of the corners comprises:

25 selecting a connected component having an area greater than or equal to a third threshold and/or having an aspect ratio within a preset range;

extracting a center of the selected connected component as a the centroid; and

calculating a direction of the extracted centroid, and removing the centroid when the perpendicularity of the direction is within a set perpendicularity range;

30 wherein the centroid is a vector, and the direction of the centroid represents edge trend information of a region where the centroid is located.

~~6. The method according to claim 1, wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located.~~

5 ~~7. The method according to claim 6, wherein matching the centroids with the facial template, calculating the matching probability of the centroids with the facial template, and identifying the region formed by the centroids having a matching probability greater than or equal to the predetermined value as the candidate face region comprises:~~

10 ~~traversing the centroids; and~~

~~for each of the centroids, performing the following steps:~~

~~searching a second centroid having a distance to the right eye vertex less than or equal to a fourth threshold using a first centroid as a vertex of the facial template;~~

15 ~~searching a third centroid having a vertical distance less than or equal to the fourth threshold from another line parallel with a line where the left eye vertex and the right eye vertex are located;~~

20 ~~calculating the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest distance between the third centroid and the third point; and~~

~~determining whether the matching probability is greater than or equal to the predetermined value, and identifying a region formed by the first centroid, the second centroid and the third centroid as the candidate face region if the matching probability is greater than or equal to the predetermined value.~~

25 ~~86. The method according to claim 1, further comprising:~~

~~after matching the each centroids with the facial template, calculating the matching probability of the each centroids with the facial template, and identifying the region formed by the centroids having a matching probability greater than or equal to the predetermined value as the candidate face region,~~

30 ~~dividing the candidate face region into a set amount of grids, and calculating a skin color proportion of each of the grids; and~~

selecting a candidate face region which has a skin color proportion meeting a preset skin color proportional distribution as a final face region.

97. A system for detecting a face, comprising:

a preprocessing module, used to preprocess an image;

5 a corner extracting module, used to extract corners from the preprocessed image;

a corner filtering and combining module, used to filter and combine the corners to obtain a connected component for the corners;

a centroid extracting module, used to extract a centroid from ~~the each~~ connected component of the corners; and

10 a candidate face region determining module, used to match ~~the each~~ centroids with a facial template, calculate a matching probability of ~~the each~~ centroids with the facial template, and identify regions formed by ~~the~~ centroids having a matching probability greater than or equal to a predetermined value as candidate face regions;

15 wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located;

wherein the candidate face region determining module comprises:

20 a searching unit, used to, for each centroid, search a second centroid having a distance less than or equal to a fourth threshold from the right eye vertex using a first centroid to act as a vertex of the facial template, and search a third centroid having a vertical distance less than or equal to the fourth threshold from another line parallel with a line of the left eye vertex and the right eye vertex;

25 a matching probability calculating unit, used to calculate the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest distance between the third centroid and the third point; and

30 a region locating unit, used to determine whether the matching probability is greater than or equal to the predetermined value, and locate regions formed by the first centroid, the second centroid and the third centroid as the candidate face regions if the matching probability is greater than or equal to the predetermined value.

108. The system according to claim 97, wherein the preprocessing comprises at least one of image level adjustment, auto white balance, normalization and image mosaicing.

119. The system according to claim 97, wherein the corner extracting module is used to calculate a luminance difference between a current pixel and surrounding pixels based on a predefined 3X3 template, and extract the pixel having the luminance difference greater than or equal to a first threshold as the corner;

wherein the 3X3 template is a region having the current pixel as a center and including pixels to the left, right, upper, lower, top-left, top-right, bottom-left and bottom-right of the current pixel.

1210. The system according to claim 97, wherein the corner filtering and combining module is used to identify skin color points in the preprocessed image, and filter out the corners which do not include a skin color point in a preset surrounding range; and

the corner filtering and combining module is further used to extract the center of the intersection of a YcgCr color space and a YcbCr color space as a skin color center, calculate values of components Cb, Cg and Cr of the corners, calculate distances between the values of the components Cb, Cg and Cr of the corners and the skin color center, and filter out corners having a distance from the skin color center greater than a second threshold.

1311. The system according to claim 97, wherein the centroid extracting module comprises:

a connected component selecting unit, used to select a connected component having an area greater than or equal to a third threshold and/or having an aspect ratio within a preset range;

a centroid extracting unit, used to extract a center of the selected connected component as a centroid;

a centroid removing unit, used to calculate a direction of the extracted centroid, and remove the centroid when the direction has a perpendicularity within a set perpendicularity range, wherein the centroid is a vector, and the direction of the centroid represents edge trend information of a region where the centroid is located.

~~14. The system according to claim 9, wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located.~~

5 ~~15. The system according to claim 14, wherein the candidate face region determining module comprises:~~

~~a searching unit, used to, for each centroid, search a second centroid having a distance less than or equal to a fourth threshold from the right eye vertex using a first centroid to act as a vertex of the facial template, and search a third centroid having a~~
10 ~~vertical distance less than or equal to the fourth threshold from another line parallel with a line of the left eye vertex and the right eye vertex;~~

~~a matching probability calculating unit, used to calculate the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest~~
15 ~~distance between the third centroid and the third point; and~~

~~a region locating unit, used to determine whether the matching probability is greater than or equal to the predetermined value, and locate regions formed by the first centroid, the second centroid and the third centroid as the candidate face regions if the matching probability is greater than or equal to the predetermined value.~~

20 ~~16~~12. The system according to claim ~~9~~7, further comprising:

 a region selecting module, used to divide the candidate face regions into a set amount of grids, calculate a skin color proportion of each of the grids, and select a candidate face region which has a skin color proportion meeting a skin color proportional distribution as a final face region.

25 ~~17~~13. A computer storage medium comprising computer executable instructions for performing a method for detecting a face, wherein the method comprises:

 preprocessing an image;

 extracting corners from the preprocessed image, and filtering and combining the corners, to obtain a connected component of the corners;

30 extracting a centroids from ~~the each~~ connected component of the corners; and

matching ~~the each~~ centroids with a facial template, calculating a matching probability of ~~the each~~ centroids with the facial template, and identifying regions formed by centroids having a matching probability greater than or equal to a predetermined value as candidate face regions;

- 5 wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located;

- 10 wherein matching each centroid with the facial template, calculating the matching probability of each centroid with the facial template, and identifying the region formed by the centroids having a matching probability greater than or equal to the predetermined value as the candidate face region comprises:

traversing each centroid; and

for each centroid, performing the following steps:

- 15 searching a second centroid having a distance to the right eye vertex less than or equal to a fourth threshold using a first centroid as a vertex of the facial template;

searching a third centroid having a vertical distance less than or equal to the fourth threshold from another line parallel with a line where the left eye vertex and the right eye vertex are located;

- 20 calculating the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest distance between the third centroid and the third point; and

- 25 determining whether the matching probability is greater than or equal to the predetermined value, and identifying a region formed by the first centroid, the second centroid and the third centroid as the candidate face region if the matching probability is greater than or equal to the predetermined value.

~~14~~14. The computer storage medium according to claim ~~47~~13, wherein the preprocessing comprises at least one of image level adjustment, auto white balance, normalization and image mosaicing.

- 30 ~~15~~15. The computer storage medium according to claim ~~47~~13, wherein extracting the corners from the preprocessed image comprises:

calculating luminance differences between a current pixel and surrounding pixels based on a predefined 3X3 template; and

deriving a pixel having a luminance difference greater than or equal to a first threshold as the corner;

- 5 wherein the 3X3 template is a region centered on the current pixel and including pixels to the left, right, upper, lower, top-left, top-right, bottom-left and bottom-right of the current pixel.

2016. The computer storage medium according to claim 1713, wherein filtering the corners comprises:

- 10 identifying skin color points in the preprocessed image, and filtering out the corners which do not include a skin color point in a preset surrounding range; and

extracting the center of the intersection of a YcgCr color space and a YcbCr color space as a skin color center, calculating values of components Cb, Cg and Cr of the corners, calculating distances between the skin color center and the values of the
15 components Cb, Cg and Cr of the corners, and filtering out the corners having a distance greater than a second threshold from the skin color center.

2117. The computer storage medium according to claim 1713, wherein extracting the centroids from ~~the each~~ connected component of the corners comprises:

- 20 selecting a connected component having an area greater than or equal to a third threshold and/or having an aspect ratio within a preset range;

extracting a center of the selected connected component as ~~a the~~ centroid; and

calculating a direction of the extracted centroid, and removing the centroid when the perpendicularity of the direction is within a set perpendicularity range;

- 25 wherein the centroid is a vector, and the direction of the centroid represents edge trend information of a region where the centroid is located.

~~22. The computer storage medium according to claim 17, wherein the facial template is a rectangular template including a left eye vertex, a right eye vertex, and at least one third point located on another line parallel with a line where the left eye vertex and the right eye vertex are located.~~

~~23. The computer storage medium according to claim 22, wherein matching the centroids with the facial template, calculating the matching probability of the centroids with the facial template, and identifying the region formed by the centroids having a matching probability greater than or equal to the predetermined value as the~~
5 ~~candidate face region comprises:~~

~~traversing the centroids; and~~

~~for each of the centroids, performing the following steps:~~

~~searching a second centroid having a distance to the right eye vertex less than or equal to a fourth threshold using a first centroid as a vertex of the facial template;~~

10 ~~searching a third centroid having a vertical distance less than or equal to the fourth threshold from another line parallel with a line where the left eye vertex and the right eye vertex are located;~~

~~calculating the matching probability based on the distance between the second centroid and the right eye vertex, the vertical distance between the third centroid and the another line, and the shortest distance between the third centroid and the third point; and~~
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~~determining whether the matching probability is greater than or equal to the predetermined value, and identifying a region formed by the first centroid, the second centroid and the third centroid as the candidate face region if the matching probability~~
20 ~~is greater than or equal to the predetermined value.~~

2418. The computer storage medium according to claim 1713, further comprising:

~~after matching the each centroids with the facial template, calculating the matching probability of the each centroids with the facial template, and identifying the~~
25 ~~region formed by the centroids having a matching probability greater than or equal to the predetermined value as the candidate face region,~~

~~dividing the candidate face region into a set amount of grids, and calculating a skin color proportion of each of the grids; and~~

~~selecting a candidate face region which has a skin color proportion meeting a~~
30 ~~preset skin color proportional distribution as a final face region.~~