

CLAIMS

1. A face image processing method, comprising:

- obtaining face key points and a face deflection angle in a face image;
- determining a submalar triangle center in the face image according to the face key points and the face deflection angle;
- determining a submalar triangle region in the face image according to the face key points and the submalar triangle center; and
- performing color filling on the submalar triangle region.

2. The method according to claim 1, wherein the determining a submalar triangle center in the face image according to the face key points and the face deflection angle comprises:

- determining an estimated location of the submalar triangle center in the face image by performing interpolation on the face key points; and
- adjusting the estimated location of the submalar triangle center according to the face deflection angle to obtain the submalar triangle center in the face image.

3. The method according to claim 1 or 2, wherein the determining a submalar triangle region in the face image according to the face key points and the submalar triangle center comprises:

- connecting the face key points to obtain a polygon corresponding to the face key points;
- determining a maximum circle centered on the submalar triangle center in the polygon as a submalar triangle outer contour circle in the face image; and
- determining the submalar triangle region in the face image according to the submalar triangle outer contour circle.

4. The method according to claim 3, wherein the determining the submalar triangle region in the face image according to the submalar triangle outer contour circle comprises:

- adjusting the submalar triangle outer contour circle by using a facial contour line in the face image to obtain the submalar triangle region in the face image.

5. The method according to claim 4, wherein the adjusting the submalar triangle outer contour circle by using a facial contour line in the face image to obtain the submalar triangle region in the face image comprises:

sampling the facial contour line in the face image to obtain a sample point on the facial contour line;

sampling the submalar triangle outer contour circle to obtain a sample point on the submalar triangle outer contour circle; and

performing curve fitting on the sample point on the facial contour line and the sample point on the submalar triangle outer contour circle to obtain the submalar triangle region in the face image.

6. The method according to any one of claims 1 to 5, wherein the performing color filling on the submalar triangle region comprises:

determining a first target pixel corresponding to each pixel in the submalar triangle region, wherein the first target pixel corresponding to the pixel is positioned on a line connecting the submalar triangle center and the pixel; and

updating a pixel value of each pixel to a pixel value of the first target pixel corresponding to the pixel.

7. The method according to claim 6, wherein the determining a first target pixel corresponding to each pixel in the submalar triangle region comprises:

determining the first target pixel corresponding to each pixel in the submalar triangle region according to a submalar triangle filling strength coefficient.

8. The method according to claim 6 or 7, wherein the determining a first target pixel corresponding to each pixel in the submalar triangle region comprises:

determining the first target pixel corresponding to each pixel in the submalar triangle region by using a convex downward function with a second derivative constantly greater than 0.

9. The method according to any one of claims 1 to 8, wherein the performing color filling on the submalar triangle region comprises:

determining a first reference point in the face image;

determining a vector that points from the submalar triangle center to the first

reference point as a first reference vector;

determining a second target pixel corresponding to each pixel in the submalar triangle region according to the first reference vector, wherein direction of a vector that points from the second target pixel to its corresponding pixel is the same as that of the first reference vector; and

updating a pixel value of each pixel to a pixel value of the second target pixel corresponding to the pixel.

10. The method according to claim 9, wherein a distance between the first reference point and a nose tip key point is greater than a distance between the submalar triangle center and the nose tip key point.

11. The method according to claim 9 or 10, wherein the determining a second target pixel corresponding to each pixel in the submalar triangle region according to the first reference vector comprises:

determining a first distance between the submalar triangle center and a first pixel in the submalar triangle region;

determining a first coefficient according to a radius of a submalar triangle outer contour circle, the first distance, and a modulus of the first reference vector; and

determining a second target pixel corresponding to the first pixel according to the first pixel, the first coefficient, and the first reference vector.

12. The method according to claim 11, wherein the determining a first coefficient according to the radius of the submalar triangle outer contour circle, the first distance, and a modulus of the reference vector comprises:

calculating a first difference between a square of the radius of the submalar triangle outer contour circle and a square of the first distance;

adding the first difference and a square of the modulus of the first reference vector to obtain a first sum; and

calculating a ratio of the first difference to the first sum to obtain the first coefficient.

13. The method according to claim 11 or 12, wherein the determining a second target pixel corresponding to the first pixel according to the first pixel, the first coefficient,

and the first reference vector comprises:

- determining a vector that points from a first reference pixel to the first pixel as a first pixel vector;

- calculating a first product of the first coefficient and the first reference vector;

- calculating a difference between the first pixel vector and the first product to obtain a second target pixel vector corresponding to the first pixel; and

- determining the second target pixel corresponding to the first pixel according to a location of the first reference pixel and the second target pixel vector corresponding to the first pixel.

14. The method according to any one of claims 1 to 13, wherein the performing color filling on the submalar triangle region comprises:

- determining a second reference point in the face image;

- determining a vector that points from the submalar triangle center to the second reference point as a second reference vector;

- determining a third target pixel corresponding to each pixel in the submalar triangle region according to the second reference vector, wherein direction of a vector that points from the third target pixel to its corresponding pixel is the same as that of the second reference vector; and

- updating a pixel value of each pixel to a pixel value of the third target pixel corresponding to the pixel.

15. The method according to claim 14, wherein the second reference point is positioned on a line that connects the submalar triangle center and a key point of lower eyelid.

16. The method according to claim 14 or 15, wherein the determining a third target pixel corresponding to each pixel in the submalar triangle region according to the second reference vector comprises:

- determining a second distance between the submalar triangle center and a second pixel in the submalar triangle region;

- determining a second coefficient according to a radius of a submalar triangle outer contour circle, the second distance, and a modulus of the second reference vector; and

determining a third target pixel corresponding to the second pixel according to the second pixel, the second coefficient, and the second reference vector.

17. The method according to claim 16, wherein the determining a second coefficient according to the radius of the submalar triangle outer contour circle, the second distance, and a modulus of the second reference vector comprises:

calculating a second difference between a square of the radius of the submalar triangle outer contour circle and a square of the second distance;

adding the second difference and a square of the modulus of the second reference vector to obtain a second sum; and

calculating a ratio of the second difference to the second sum to obtain the second coefficient.

18. The method according to claim 16 or 17, wherein the determining a third target pixel corresponding to the second pixel according to the second pixel, the second coefficient, and the second reference vector comprises:

determining a vector that points from a second reference pixel to the second pixel as a second pixel vector;

calculating a second product of the second coefficient and the second reference vector;

calculating the difference between the second pixel vector and the second product to obtain a third target pixel vector corresponding to the second pixel; and

determining the third target pixel corresponding to the second pixel according to a location of the second reference pixel and the third target pixel vector corresponding to the second pixel.

19. The method according to any one of claims 1 to 5, wherein the performing color filling on the submalar triangle region comprises:

determining a first target pixel corresponding to each pixel in the submalar triangle region, wherein the first target pixel corresponding to the pixel is positioned on a line that connects the submalar triangle center and the pixel;

updating a pixel value of each pixel to a pixel value of the corresponding first target pixel corresponding to the pixel;

determining a first reference point in the face image, wherein a distance

between the first reference point and a nose tip key point is greater than a distance between the submalar triangle center and the nose tip key point;

determining a vector that points from the submalar triangle center to the first reference point as a first reference vector;

determining a second target pixel corresponding to each pixel in the submalar triangle region according to the first reference vector, wherein direction of a vector that points from the second target pixel to its corresponding pixel is the same as that of the first reference vector;

updating a pixel value of each pixel to a pixel value of the corresponding second target pixel;

determining a second reference point in the face image, wherein the second reference point is positioned on a line that connects the submalar triangle center and a key point of lower eyelid;

determining a vector that points from the submalar triangle center to the second reference point as a second reference vector;

determining a third target pixel corresponding to each pixel in the submalar triangle region according to the second reference vector, wherein a direction of a vector that points from the third target pixel to its corresponding pixel is the same as that of the second reference vector; and

updating a pixel value of each pixel to a pixel value of the third target pixel corresponding to the pixel .

20. A face image processing apparatus, comprising:

an obtaining module, configured to obtain face key points and a face deflection angle in a face image;

a first determining module, configured to determine a submalar triangle center in the face image according to the face key points and the face deflection angle;

a second determining module, configured to determine a submalar triangle region in the face image according to the face key points and the submalar triangle center; and

a filling module, configured to perform color filling on the submalar triangle region.

21 An electronic device, comprising: a processor, and a memory for storing

instructions executable by a processor;

wherein the processor is configured to execute the instructions to implement the method according to any one of claims 1 to 19.

22. A computer-readable storage medium, having computer program instructions stored thereon, wherein the computer program instructions, when being executed by a processor, causes to implement the method according to any one of claims 1 to 19.