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Research Article

Challenge and Algorithm of Face Alignment Development

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Abstract: Face alignment is a key step in face recognition. The location of face feature points is located in the face image, and the difference between different faces is reduced by geometric transformation. This is the basic condition of face information processing, such as expression recognition, face tracking, head pose estimation and so on. Due to the interference of expression, illumination, shading and other factors, face alignment has a great challenge and is becoming the developmental direction. Different algorithms can solve different problems at different levels. Deep learning algorithm can solve the shortcomings of traditional algorithm, improve the accuracy of face alignment, and promote the development of face alignment.

Keywords: Face alignment; Development challenges; Algorithms

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In recent years, the cascaded-shape regression model plays an important role in face alignment. This method uses regression model to directly learn the mapping function between face shapes and face appearances, so as to establish the corresponding relationship from appearance to shape. This method is different from the traditional method; it does not need complex appearance modeling and face shape and thereby it appears more efficient and simple. In 2010, the cascaded pose regression method was proposed by Dollar, and the designated initial prediction value was gradually refined by a series of regressors. The iterative operation was performed through the output of one regressor in each regressor, and the system automatically learned from the selection of training samples. The supervised descent method is mainly used to solve the nonlinear least square problem, to learn a series of regressors, and to successfully implement the application in the task of face alignment.

1 Research background of face alignment

1.1 Definition of face alignment

The problem of locating predefined facial feature points on face images is face alignment. It generally uses rough initial shape to achieve convergence by gradually thinning the shape [1]. There are two different information sources in face alignment task: face shape and face appearance. To clearly simulate the location relationship between feature points is a problem that needs to be solved for face shape, so as to ensure that the effective face shape can be constituted by the finally-formed feature points. Some methods use shape information but not explicitly stated. However, these two sources of information are generally combined. The whole process of face alignment can be divided into three steps.

(1) Face detection

The purpose of face detection is to find the location of the face in a picture. Then the face is framed with a rectangle. The first step of face recognition is face detection, and the following steps will be directly affected by the accuracy of the acquired results.

(2) Face feature point detection

There are many features on the face, such as eyes, nose, eyebrows, mouth and the whole face outline. To find out these feature points is the task of face

alignment, and then their positions are determined with giving their coordinates. Face alignment is a key step in face recognition.

(3) Face feature extraction and classification

According to the information of face feature points obtained from face alignment task and image information, we can extract the head posture, facial expression and other related features. Then the obtained data is compared with the existing features, and finally face recognition is carried out.

1.2 Face alignment application

(1)Face recognition

The basic conditions of face recognition are the location of feature points, the extraction of head posture, facial expression and other related features. Then the existing face related features in the data set are compared to achieve the final face recognition.

(2) Expression analysis

The task of face alignment is completed after the location of face feature points. Human expression can be judged according to the combination relation of specific points [2]. For example, whether a person is smiling can be expressed by opening his mouth wide and narrowing his eyes and whether a person's expression is very serious can be expressed by finding that the corner of his mouth inclines downward. In this way, the computer can recognize human's expression and emotion.

(3) Smart makeup

A number of picture beautification software is very popular now. They can realize intelligent beauty only on the basis of face alignment. For example, to find the location of facial contour feature points can realize the function of face thinning, to know the location of feature points around the eyes can realize the function of enlarging the eyes and putting on eye makeup, to know the location of mouth feature points can realize the function of daubing the lipstick on the lip in the picture.

(4) Intelligent monitoring

Now the intelligent monitoring system commonly used in face alignment is the monitoring system of fatigue driving. This kind of monitoring is mainly through the positioning of face feature points and the analysis of the position and relationship of eye feature points, and through this way to judge whether the driver is in the state of fatigue driving, so as to ensure the safety of drivers.

2 Challenge and algorithm of face alignment development

2.1 Challenges of face alignment development

With more and more researches on face alignment at home and abroad, face alignment has made considerable progress. But at the same time, there are many difficulties and challenges for face alignment. These difficulties and challenges are mainly caused by the change of face appearance. This situation is not only a challenge for face alignment, but also a future development direction. If face alignment wants to develop better, it must face these influences and explore the proper development and direction. The influencing factors and development direction are as follows:

(1) Illumination change

With the change of time, weather and environment, the intensity of light will also change. For example, the light intensity will be different in sunny, cloudy and rainy days; there will be some differences of light intensity in different dates, seasons and even the morning and afternoon of the same day; there will also be differences of light intensity in the indoor and outdoor. People's faces may be shaded when the sun is slanting. In terms of light intensity, this causes some parts of the face to be weak and some parts to be strong. Moreover, some features of human face are weakened or enhanced with the change of light intensity.

(2) Face posture and expression

Because of the shooting angle and some other reasons, the faces in the pictures are often not frontal. It's very likely to show the posture of looking up, looking down, and turning left, turning right and so on. Especially in face alignment, some people's face deflections are more than 50 degrees, and even the face is completely sideways. In this way, the difficulty of face alignment will be greatly increased. The expression of human face is very rich. Compared with the posture, the expression of human face is more complex and diverse. Obviously, it can be divided into surprise, fear, sadness, happiness, anger and many other expressions. Moreover, the corresponding expressions of each kind of expression are different. Just saying happy can be divided into laughing, smiling, etc. At this time, the position of the mouth, the size of opening and closing degree for the mouth, and the position of other parts of the face may be different.

(3)Face shading

In face shooting, there are often a variety of shadings

to block face alignment, such as myopia glasses worn by nearsighted people, sunglasses worn by some people in summer, beards left by some men, bangs left by women, and hats of various sizes. Some people will wear masks in winter, and even make-up is too much to recognition. All of these conditions will produce more or less shading to face alignment, so it will affect the accuracy of face alignment algorithm.

(4)Time change

The face will change over time. For example, the skin may wrinkle after a long time; men may change from having no beard to having a thick beard and their hair styles will also change; muscle texture will also change after a long time. In these changes of face appearance, face feature information will change accordingly.

2.2 Face alignment algorithm

(1) Feature method of geometric configuration

After the set feature analysis of the face is obtained, the matching is carried out. It has been used in face recognition for a long time. To calculate the vector distance of different eigenvalues, we need to extract the related face geometric eigenvectors. The geometric structure feature method judges the distance of each vector, the target vector takes the shortest distance, and the final result is obtained by comparing the distance. The face recognition rate is between 46% and 76%, which is also the feedback that can be obtained by using geometric features. For face recognition method, simple and small amount of computation is the advantage of geometric structure features. Because the selected features are typical, the speed is the fastest. The recognition result of this method is also more ideal. However, this method still has many disadvantages, such as the recognition is not precise enough; the external environment is easy to affect; the unclear light will cause a large probability of image recognition failure. This kind of problem cannot be solved, so the existing face recognition algorithms rarely continue to use the geometry feature method, and the method based on deep learning is often used in more situations.

(2) Learning method based on profundity

The features of human face are never immutable. It will lead to more complex face recognition algorithm with the change of light and age. Compared with the traditional face recognition algorithm, the algorithm based on deep learning mainly obtains face features from a large number of data through neural network. It's no longer necessary to depict artificially and intentionally. Deep learning algorithm makes face feature extraction simplified from the complex situation, and some laws that cannot be found by human can be discovered automatically when obtaining data. A large number of experiments have proved that this recognition method is very effective for improving the accuracy and precision of face recognition.

(3) SDM algorithm

This is the supervised descent method, which is improved according to the Newton method. Although Newton method has a history of hundreds of years, it is still considered as a main optimization method of smoothing function with second derivative [3]. SDM algorithm is widely concerned and researched in the existing face alignment algorithm, and it is also one of the most stable and accurate algorithms in the existing face alignment algorithms. While ensuring its accuracy, this algorithm also has the advantage of high efficiency. The real-time video face alignment task can also be satisfied, and the tracking face alignment can be carried out in the video stream. This algorithm is efficient and stable, which makes it perform well in the head attitude estimation. The calibration task of five basic points is the treatment limit of some traditional face alignment methods, and SDM has made great improvement in this respect. According to different data sets, SDM can process a large number of feature points at the same time. The built shape model is more stable. Even in the face of shading, head offset and other extreme cases, we can get better alignment effect.

3 Conclusion

As the application of face recognition in modern society is in gradual popularization, face alignment, as the basic guarantee of face recognition, must keep up with the pace of the times as soon as possible. In this way, we can meet the challenges in the development process, make breakthroughs, promote the development of face alignment, and lay a solid foundation for face recognition.

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