A Method Based On Face Verification

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Abstract. Recent year, the method based on face verification has been one of the most vibrant study aspect in face verification field. The problem of face verification can be defined: imputing the picture or video, identifying or validating by using face database. “video-video” face verification means inputting video setting, verification by using face video data。It has most useful information, including: a lots of pictures of one person, continuity of face in time and space in video, three dimension face model etc.

1.PCA face verification

Recent year, the method based on face verification has been one of the most vibrant study aspect in face verification field. The problem of face verification can be defined: imputing the picture or video, identifying or validating by using face database. “video-video” face verification means inputing video setting, verification by using face video data。It has most useful information, including: a lots of pictures of one person, continuity of face in time and space in video, three dimension face model etc.

The way that face information be described in video in present literature can be summarized as follows: vector、matrix probability、 dynamic model 、fashion. daopting modes of probability and fashion need mass swatch which reflect distribution of face, can accurately describe face distribution. Dynamic model can better use time and space information , but the method is compicated, calculation is great. The describe way of imputing vector has a big defect, the randomicity of choose swatch.the way of matrix is comparatively simple, can apply the informatin of discontinuous pictures in time,but how to depict relationship between matrix is a worthful contect.

Face character based on PCA (Principal Component Analysis, PCA)is the classic arithmetic in face verification, it is a face face veification and describe technology educe from bases analysis. Face character is a simple 、fast、 useful、 arithmetic based on transform coefficient character.

Face verification: compare the given face portrait with the picture stored in computer, determine the face is whether the appointed guy, it is a one to one matching process, usually one person stored more face portrait in different angle in computer.

A face verification system based on video including face detect model face portrait pretreatment model face character distill model and face verification model.

1.1PCA face verification

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A face verification system [3]based on video including face detect model face portrait pretreatment model face character distill model and face verification model,as picture 1.

1 Picture 2 picture sequence 3 face detect

4 face portrait 5 pretreatment 6charater 7distill face 8 face verification 9 verification result

Picture 1 face verification frame

Adaboost arithmetic[4]is a self-adaptive boosting arithmetic,it can upgrade a weak study arithmetic to a strong arithmetic. The face detect method based on Adaboost arithmetic has a better detect effect, high detect ratio, low wrong detect ratio, fast detect velocity to front face picture and

little deflexion angle picture, but should improve on different expressional face and side face. The result of detection as picture 1:

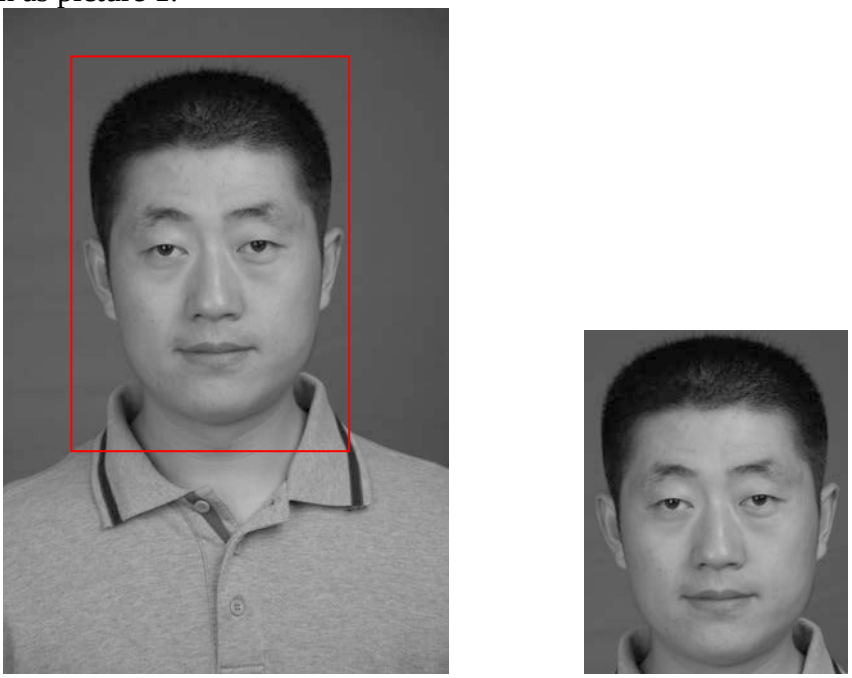


figure 1 adaboost face detection

1.2face detect

Geometry correction:revolve the face portrait on plane, the aim is to keep the line link two eyes in the horizontal location, and zoom to unitive size.Image mask: use ellipse template, extract the main part of face, take out hair、up-half part of forehead、 ears、 profile of cheek, only keep eyes、 nose、mouth such key position. Histogram equalization:boost up the comparative effect of picture.The pixel gray value normalization: elimilate the negative effect caused by imaging condition difference and picture illumination deffrence in certain extent.Face portrait pretreatment process as picture 2.

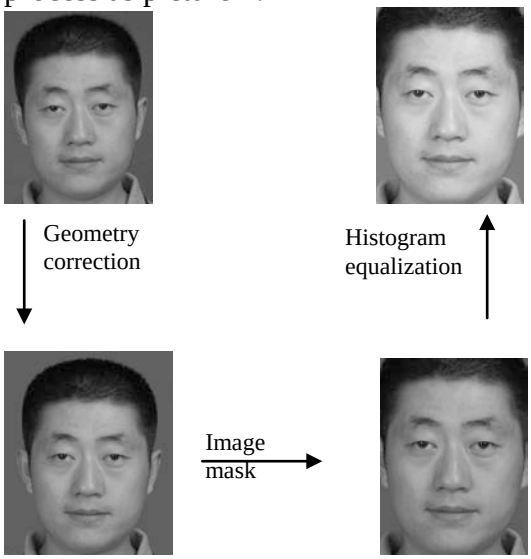
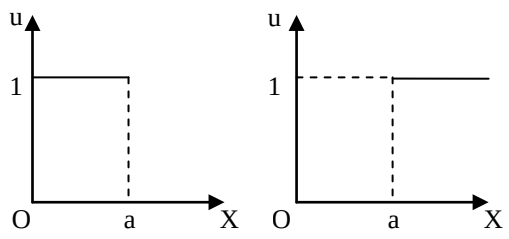


Figure2 face portrait pretreatment



Figrue 3 rectangle distribution

1.3 face Verification

Preject the undiscriminating face portait to feature face space:

$$\Omega_i^K = w^T(\Gamma - \Psi)$$

Adopting Euclidean distance calculate the distance between undiscriminating face and every pair face:

$$\varepsilon_k^2 = \left\| \Omega - \Omega_i^K \right\|^2$$

Threshold comfirm:calculate the projected face portrait distance in face sample library and choose the max as threshold T, the threshold express signify most permission distance belong to one person.

According to nearest Neighbor classifier,minimal distance d is the recognise result. If d<T，verification result is right, or d>T, the result is wrong.

2.Training sample membership degree

The discussed model is given as follow:

In fuzzy mathmatics, the membership function which universe in the real number field be fuzzy distribution, the familiar fuzzy distribution is rectangle distribution、 terraced distribution、 parabola distribution、 normal distribution etc.

2.1 Single frame recognition membership degree

Factors weighted summation method: In practical problems, sometimes encountered such a fuzzy set, it has a number of interacting factors, and each factor can be signigied by fuzzy set, the universal can be described as n factor sets Descartes product .

each face sample has its training sample membership degree in video library, Each face samples to verify the results of the importance of different, we according to the distance increasing sequence,taking the first 10 training samples, the face image of the minimum distance endow with the max weight. according to the distance from the rehearsal sequence, weight descending, make good use of information of video library.

2.2 Face verification based on traditional PCA

Detect 11 frame face image of the input video, find to meet certain rules of face image, then make use of face recognition method based on the static .

same person video verification

Validation input video and face video image database belong to same person.We take the video of No. 1 face length of 30 frames as training samples, make the 10 pairs ofvideo of No. 1 face length of 11 frames to verificated test. In order to better and improved algorithm to compared, We take the verificated results of 10 tested segment of the video in a simulation design.

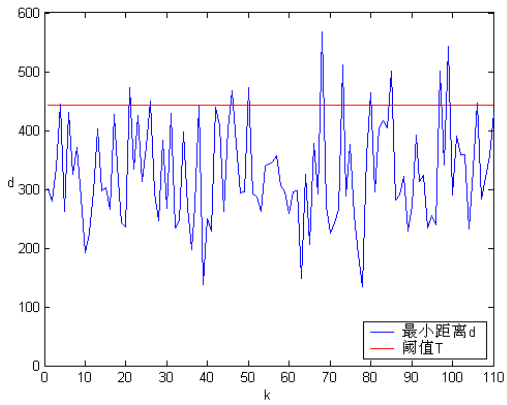


figure 3 discriminant results of same person

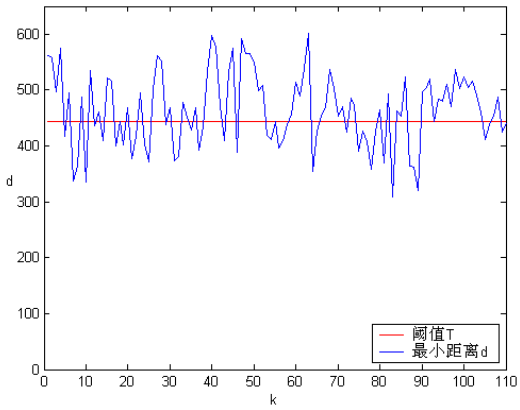


Figure4 Video verification of different person

Figure 3 is the 10 segments of tested video sequences of No. 1 face ,each segment has 11 frames, A total of 110 frames of image verification results. The red line denote threshold; the blue line denote minimal distance of nearest neighbor classifier. The maximum distance of face image in the training base is the threshold T, equal 443.34748， if d<T, the validated result is right.

Video verification of different person

validated input video and image of face image database do not belong to same person. We take the video length of 30 frames of No. 1 face as training samples, seperately selected each 10 segment of video length of 11 frame namber from 2 to 11 as input video to validate.

Figure 4 denote training sample of namber 1 face, the tested video is each 10 segment of video length of 11 frame namber from 2 to 11, each segment video sequence is 11 frame, a total of 110 frames of image verification results. The red line denote threshold; the blue line denote minimal distance of nearest neighbor classifier. The maximum distance of face image in the training base is the threshold T, equal 443.34748， if d<T, the validated result is right.

From figure 3 and figure4 can be seen, training sample are both 30 face images of No. 1 face, the minimal distance d of different person in figure 5 wholly greater than figure 4. in the validation results of 110 frame unrecognised image, the correct result is greater than the error result, but these two kind of situations appear alternately, the validated result is unstable.

If we find the best image satisfied certain rules in each segment video sequence of face image to validate, the rule is hard to define, and it is not furthest make use of time and space Continuous information of face video, the robustness is not strong.

2.3 face verification based on Membership classification

Calculate according to formula 1、2、3 , construct membership classification, get A(u), if A(u) >0.5, then the validate result is right.

the value of A(u) as table 1:

Table 1 membership degree A(u) of 10 segment video(same person)

Test	video1	video2	video3	video4	video5
A(u)	0.7636	0.7745	0.8145	0.8418	0 0.7000
Test	video6	video7	video8	video9	video10
A(u)	0.8363	0.7090	0.7018	0.7090	0.8036

It can be seen from table 1 that the validated result of each segment video A(u)>0.5，means validated result is right.

the value of A(u) as table 2:

Table 2 membership degree A(u) of 10 segment video(different person)

Test	video1	video2	video3	video4	video5
A(u)	0.3090	0.3636	0.3836	0.3018	0.2272
Test	video6	video7	video8	video9	video10
A(u)	0.3727	0.3000	0.4454	0.0727	0.2909

It can be seen that the validated result of each segment video A(u)<0.5，means validated result is right.

2.4 Algorithm performance evaluation

Using the false acceptance rate and false rejection rate to evaluate the performance of algorithms. False acceptance[8] Is making the impostor as user acceptance; false rejiction is making the user accpetance as impostor.

Make the 20 person's video each has 1 segment length of 30 frames as a video image library, the remaining each has 10 segment length of 11 video frames, to test. A total of 200 test samples. The false acceptance rate and false rejection rate shown in table 3

Table 3 test result

The video segment number	False acceptance number	False acceptance rate
200	24	0.12
The video segment number	False rejection number	False rejection rate
200	1	0.005

Accordint to table 3, We get the actual correct rate of face verification is 93.75%. the experiment validate, This article proposed the face verification method based on membership function, Reasonable use of spatial information of video, it has a good effect on face verification.

Conclusion and discussion

This paper bring forward PCA face verification method based on the fuzzy degree of membership, adopt video as input and database form, Construct membership function. Follow the principle of fuzzy pattern recognition threshold to validate face. The experiment indicate, the false rejection rate of method is very low, It has high accuracy and seldom make the use acceptance as impostor; and it should furthur improve on the case of making the impostor as use acceptance.

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