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Optimising And Recommendations For Collecting Face Databases

KarimovMadjit Malikovich[1], IslomovShahbozZokir ogli[2]
[1]*Professor, Vice-rector of Tashkent state technical university for Academic affairs, Tashkent, Uzbekistan,*
[2]*Assistant teacher, department of Information security, Tashkent university of information technologies, Tashkent,Uzbekistan*

Abstract:- Face recognition is main area of computer vision, it is directed to control peoples everywhere by face. There are very many methods to detect and recognise faces related to situation. These methods work based on 2D, 2,5D and 3D model images. Registration, training, detection and recognition are common parts of the face recognition technologies and for these processes we need to collect face databases. In our paper is given several requirements and recommendations for collecting face database, reviewed popular ORL and YaleB face databases and created new UniverDB. Our face database is tested with PCA, LBP and Fisherface algorithms and published results. This project is directed to control automatic attendance students to lessons. We use created UniverDB face database with our proposed method [9].

Keywords:- *detection, landmarks, training, recognition, Haarlike, face database*.

I. INTRODUCTION

Face recognition technologies and systems are widely used on control peoples, staffs of organisations, airports, railway stations, football stations and other places. Recent times, when face recognition technologies have come on computer systems, at this time these systems were used as a face authentication, so, directed only one person. Automated face recognition is developed in the 1960y. as a new concept and the first semi-automated system for face recognition the administrator required to locate features (such as eyes, ears, nose, and mouth) on the photographs before it calculated distances and ratios to a common reference point, which were then compared to reference data. In the 1970s, Goldstein, Harmon, and Lesk [1] used 21 specific subjective markers such as hair color and lip thickness to automate the recognition. The problem with both of these early solutions was that the measurements and locations were manually computed. Now days is populated using 2D, 2,5D and 3 D face databases and spectrum analysis methods for face recognition systems. Because these systems detect and recognise humans speedily and high accuracy.

II. MAIN CONCEPTS

Following concepts were given in [2], and they are widely used in face recognition and detection systems.

Face detection– applications can locate and return a face (or multiple faces) inside a rectangle or circle. This technology can be used to count how many faces are in the current image and find their general locations.If we need detect faces from video then choose several frames from video and compute as a image.

Landmark or key point detection– this data, comprising 78 key landmark points (Intel uses),is often used to further identify separate features (eyes, mouth, eyebrows, nose, edge of the face) of a detected face. Researchers use these parameters differently, for example, not all landmarks, we take only ends of the eyes, mouth, nose and eyebrows.

Pose detection– this data estimates the head orientation (in degrees) of a face once it is detected. Head orientation is measured three ways as: roll, pitch, and yaw.Pose detection helps us to collect and use 2,5D and 3D face databases.

Face recognition – this feature compares the current face parameters with a set of reference pictures parameters in a face database to determine the user's identification. By the history of the face recognition and detection technologies is used 2D images and calculate only with key points.

2.1. Face databases

In the VeriLook and NEC organisation's face recognition tutorials are given main requirements to collect face database and use face images. So, there are several free face databases, researchers can use or test own face recognition algorithms with these databases and can be used to train statistical models, such as MIT's CBCL face Database [3] which contains 2,429 faces and 4,548 non-faces and was used here to tune the face detection algorithm. Each of the face database collections display different types and degrees of variation which can confound face recognition, such as in lighting or pose, and can include some level of ground truth mark-up, such as the locations of distinctive facial feature points. But AR Face Database [4], Facial Recognition

Technology Database (FERET) database [5], the Yale Face Databases A and B [6] and AT&T Database of Faces [7] are widely used in the face recognition solutions for testing.

We created UniverDB and tested with ORL (AT&T) and YaleB face databases. Therefor we briefly describe these face databases.

YaleB face database: this database is called extended Yale Face Database B. The extended Yale Face Database B includes 16128 images of 28 human subjects under 9 poses and 64 illumination conditions. Database data format is the same as the Yale Face Database A and B. Researchers can free use the extended Yale Face Database B for solution or algorithm testing and research purposes. The extended database as opposed to the original Yale Face Database B with 10 subjects was first reported by [8]. All test image data used in the experiments are manually aligned, cropped, and then re-sized to 168x192 images. In figure 1 is shown different conditions and lights images. With this face databases was tested Proposedalgorithm by Karimov M.M., IslomovSh.Z. and others [9] and was achieved 98% result. In this project half of images are used to training and other half for testing.

Figure 1.Examples of the Extended Yale Face Database B

ORL (AT&T) face database: this face database was created at the Cambridge AT&T laboratories and it is called formerly "The ORL Database of Faces". This laboratory collected faces between April 1992 and April 1994. In fist the database was used in the context of a face recognition project carried out in collaboration with the "Speech, Vision and Robotics Group" of the Cambridge University Engineering Department. There are 10 different images of each of 40 distinct subjects. For some subjects, the images were taken at different times, varying the lighting, facial expressions (open and closed eyes, smiling and not smiling) and facial details (glasses and no glasses). All the images were taken against a dark homogeneous background with the subjects in an upright, frontal position (with tolerance for some side movement). The files are in .pgm format, and can conveniently be viewed on UNIX (TM) systems using the 'xv' program. The size of each image is 92x112 pixels, with 256 grey levels per pixel. If you want to collect your own face databases like ORL, and your images are RGM colour model, you need to change to grey levels. So, you need to change size of images to the 92x112. The images are organised in 40 directories (one for each subject), which have names of the form sX, where X indicates the subject number (between 1 and 40). In each of these directories, there are ten different images of that subject, which have names of the form Y.pgm (for example: 1.pgm, 2.pgm), where Y is the image number for that subject (between 1 and 10). In figure 2 is presented ORL face database examples with above given requirements. Our UniverDB was created based on this face database.

Figure 2.Examples of the ORL face databases

These face databases help us to generate 2,5D images from 2D images. Following are given 2D, 2,5D and 3D model concepts.

2D faces: Many researchers investigated the large positions face recognition problem in recent years, and the popular 2D image based method achieved significant improvement. There are several face recognition algorithm which work based on this type of images. But all face must be only frontal position. This is main problem of the 2D images. Face recognition technologies detect and recognize faces by spectrum analyse, colour (pixel) based, key (edge) points, continuity based and matching face database. Zhu, Luo, Wang and Tang learned face identity preserving features by using a deep neural network to transform a non-frontal face to frontal [10]. Researchers solve this problem by generating 2,5D image model by 2D images.

2,5D faces: 2,5D image is a simplified three-dimensional (x, y, z) surface representation that contains at most one depth (z) value for every point in the (x, y) plane. These images help to create 3D images. In the

solutions are used 2D images to generate 2,5D models, but there are scanners which work based on 2,5D images. In this case 3D methods solve with different view image positions.

3D faces: For detection and recognition 3D faces are used special 3D scanners or cameras. 3D scanner returns a set of points approximating the facial surface or by capturing range images representing the face depth [11].The main advantage of the 3D based approaches is that the 3D model retains all the information about the face geometry.

So, researchers can generate 2,5D and 3D facesbased on 2D face images. For this, we take photo and save pose variation up to ±45 in yaw and ±30 in pitch angles [9]. This is the one way and calls passive 3D images. Other method using and creating 3D images is active 3D sensing technique that possible to capture 3D face models without considering the 2D templates. There are two types of active 3D technologies; one is using 3D cameras like Microsoft Kinect, acceptable and fast, but it has low resolution, low precision, and low reliability. Second type of 3D scanners look like Minolta, performance high quality 3D image but usually slow and expensive [12].

2.2. Main requirements to creating face databases

Face quality is the important concept in the enrolment, detection and creation face databases. There are some basic recommendations and constraints when using face recognition technologies:

Camera and images:

- If your system work based on 2D images, then you need to use 2D based cameras, for 3D images 3D cameras. Similar quality cameras are used for registration and recognition.
- More face recognition systems try to choose quality images, therefor, minimal distance between eyes is 50px, 75px and more is better.
- Minimal camera resolution 640x480 is recommended. You can abridge image size to 92x112 For creating face base like ORL. But lower resolution webcams are not recommended as optical distortions will appear and affect facial template quality because users will have to be too close to the cameras for successful face detection and recognition.
- For improving recognition rate is recommended using several images.

Lighting:

- Detect lighting direction, if your image is frontal than illumination will be in the centre, not form left to right or from top to bottom.
- Glasses or sunglasses may be create some types of illumination.

Face position:

- ± 45 degrees is to left.
- ± 45 degrees is to right.
- ± 15 degrees is to top.
- ± 15 degrees is to bottom.

These positions may be change, so, you can create face database by these requirements and choose degree parts more. For example: 0^0, 15^0, 30^0 and 45^0 for right and for left. It supports accuracy of face recognition.

Facial Expression:

- Smiling and frown.
- Open and close eyes.
- Raised eyebrows.

Obstacles:

- Eyeglasses decrease accuracy rate for face detection and recognition. Contact lens do not affect the recognition quality too.
- Hair style may cover the face parts and this style decrease accuracy too.
- Beard or moustache is grown or shaved off.

2.3. Face recognition algorithms

PCA: Principal Component Analysis examines relationships between variables. It can be used to reduce the number of variables in regression and clustering. Each component in PCA is the linear combination of the variables and gives a maximized variance. Let X be a matrix for n observations by p variables, and the covariance matrix is z. Then for a linear combination of the variables:

$$z_1 = \sum_{i=1}^{p} a_{1i} x_i$$

Where, x_i is the ith variable, a_{1i} and p are linear combination coefficients forz_1. They can be denoted by a column vector a_1, and normalized.

LBP: Local binary patterns is a type of visual descriptor used for classification in computer vision. In this case it is used for extracting the most useful features from face images to perform face recognition.LBP features have performed very well in different applications, including texture classification and segmentation, image retrieval and surface inspection. The original LBP operator labels the pixels of an image by thresholding the three by three neighborhood of each 9 pixels with the center pixel value and considering the result as a binary number. For example we choose 9 pixels like 3x3 matrix, every matrix boxes consists of color bytes, all 9 colors (Figure 3.a).

a

12	15	18
5	8	3
8	1	2

b

1	1	1
0		0
1	0	0

Figure 3. Calculating LBP points

We make stipulation: if a(i,j)>=8 =>1, else a(i,j)<8 =>0, so we can express as a Figure 3.b. Result, read from a[0][0], 11100010, 8 bits, it means one color. We must determine edges of landmarks at the face from color base on LBP. Figure 3.b is shown with bold line these edges where covered with zero.

Fisherfaces:PCA algorithm takes more principal components and at this time is appeared one problem, how does program classified these components. Fisherfaces is implemented. Fisherfaces and eigenfacesis used classification images in the face recognition algorithms. So, Principal Component Analysis is used eigenfaces, Linear Discriminate Analysis, Elastic Bunch Graph Matching are used the Fisherface algorithm, the Hidden Markov model, the Multilinear Subspace Learning are used tensor representation, and the neuronal motivated dynamic link matching [13].

III. UniverDBFACE DATABASE

Our solution directed to the create face database. Face databases are collected by face recognition area. We developed proposed method by changing to Euclid norm in [12]. This method is used automated controlling attendance students to lessons. Classroom illumination is not almost changed. But there are different condition students, smiling, eyeglasses and others like ORL face database. UniverDB face database was collected at the TUIT University in Uzbekistan, and it consists of 64 students faces, each student 11 different positions. In figure 4 is given examples.

Figure 4.UniverDB examples

We tested UniverDB with PCA, LBP and Fisherfaces by video data. Half of images are used for testing and other half for testing. This solution works online, but we choose video file for testing. In this case we use rotation IP camera because from one place camera can't take all students at the auditorium.

HaarLike properties are used for detection face from video stream. It helps us easily detecting faces and saving as a file (.pgm file). HaarLike properties are directed to detect rotation rate of face position until ± 45 degrees.

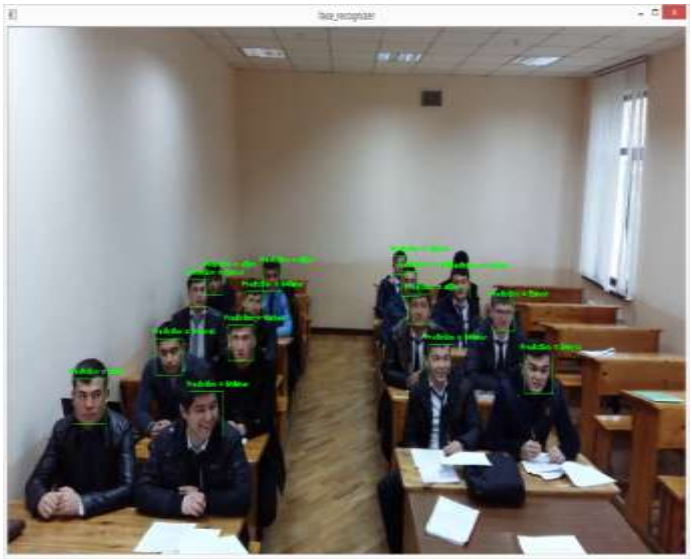

Figure 5. Face recognition results from video file

IV. EXPERIMENT RESULTS

In table 1 is shown comparing results with face recognition algorithms PCA, LBP and Fisherface. As a face databases, we choose ORL and YaleB.

Table 1. Experiment results

Face database / algorithm	PCA	LBP	Fisherface
ORL	84 %	88 %	81 %
YaleB	20 %	99 %	100 %
UniverDB	65 %	64 %	71 %

In the table 2 is given results from video file and compared on the face recognition algorithms.

Table 2. Experiments with video files

Face database / algorithm	PCA	LBP	Fisherface
UniverDB/ video_1	50 %	53 %	50 %
UniverDB/ video_2	40 %	49 %	45 %

Above results of face recognition by video files are not good, because all offline face recognition by video or image is not given effective result. Therefor we recommend using online systems, so, web camera. Web camera helps or tries to detect and find none faces on the area.

V. CONCLUSION

We used mobile phone camera for testing and experimenting. PCA algorithm is based on principal components and if we test with ORL face database it uses for one face with eleven properties, PCA easily detect and recognise effectively. But YaleB face database uses more properties for one face and PCA result is not good (20%).UniverDB is built similar ORL, therefor its result is satisfactory. LBP algorithm recognises mainly based on colours, illuminations, edges. In UniverDBwas not used illumination properties and others, used only eleven face conditions for one human. We tested only Fisherface based on PCA, there are very many landmarks on the face properties and Fisherface sorts by value and it helps to take good result. We recommend for collecting face database using real time face images, approval to algorithm or choosing algorithm by ambience. For acquiring best results for real time face recognition systems need to tune illumination, attention to camera direction, choosing best quality camera and using high speed computers for testing.

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