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The Comparison of Face Detection Methods in Angled Mode

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Abstract: The necessity to use the new technologies and carrying out more detailed studies based on identification of best methods in order to detect people's face with respect to modes and position angles in the image, prompted the researchers to further focus on this issue. What issue in the event of face detection is always intended as a question mark of full knowledge and ingenuity is to achieve results in line with targeting of scientific and security agencies. Therefore with increasing the risks of terrorism and the necessity to identify the suspect people in doing such actions, carrying out a comprehensive study in order to collect the most new face detection techniques is inevitable. In this study, we studied and compared five modern methods in face detection that include IWC-F, Eignfaces, Fuzzy-IWO, FLDA-PCA, Fuzzy-Ga, Fisherface. We evaluated these methods on the same terms and with the ORL standard dataset and presented the results in detail. In this study, we find that the Fisherface algorithm has better results than other algorithms in the presented database.

Key words: Posed face detection, image processing, comparing face detection methods, fuzzy logic, ORL database

INTRODUCTION

The face detection is very important for many applications. This issue has caused many algorithms and methods are presented in the field of face detection. A variety of methods have been introduced in face detection that each of them has problems such as system accuracy and calculations. As one of the most important biometric techniques, the face detection has many advantages including natural and passive versus other biometric techniques (Moallem *et al*., 2011) so often it requires combination with other biometric methods such as fingerprint and iris detection. In order to take advantage of face natural features in face detection, the systems have been proposed which are controlled in the environment and a desired position is able to identify and detect the face. Therefore, these systems do not seem very helpful in identification and detection of angled faces. So far, there is little research that specifically discuss the face detection in angled mode (Pentland *et al*., 1994). The study along with generality of facial features in half profile and full profile modes in different environments, puts the idea of focusing on angled face detection in researcher's minds (Keller *et al*., 1985). Although, the generality of environment and conditions, puts the serious challenges against face detection techniques. So many face detection techniques that have reported satisfactory performances, have had limited success to controlled environmental conditions that in real applications is very unrealistic.

MATERIALS AND METHODS

IWC-F method: In this method, the weed classifier, inspired from invasive weed optimization algorithm is used (Deramgozin and Fard, 2016). At first, the feature of input image after conversion to feature extraction GrayScale format is extracted and the same fitness is allocated to each feature. The features that have higher fitness than other features, produce more children in each iteration which these children are the neighbors of algorithm starting point among the features.

Also in each iteration of algorithm, the points which as face candidates have less fitness are removed from the colony (the same set of features close to the face). Finally, points with better continuity as border in the face and extremities are selected and the extracted image is displayed (Deramgozin and Fard, 2016) (Fig. 1).

Eigen face method (Turk and Pentland, 1991a): This method uses main parameters analysis of PCA to reduce size. This research aim is to find subspaces that show data scattering in the best way. These subspaces in the

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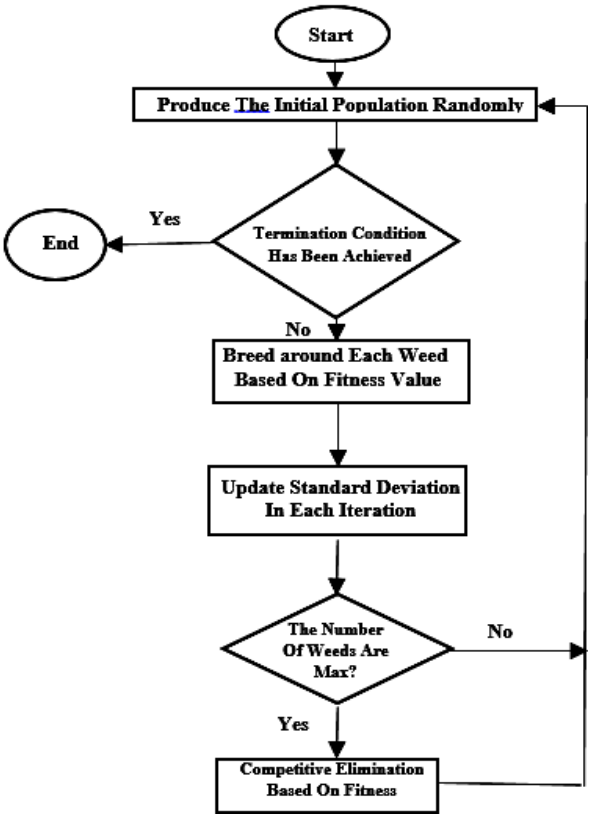

Fig. 1: General view IWC-F algorithm (Deramgozin *et al*., 2016)

Fig. 2: Some results of Eigen Face algorithm (Turk and Pentland, 1991a, b)

face detection are the same as face space. After identifying vectors, all images are transferred into pre-defined spaces and the weights which represent the images in subspaces are obtained. By comparing the weight of each new image with the input images, the face image can be calculated. This method uses Karhumen-Loeve converter (Turk and Pentland, 1991b) (Fig. 2).

Fuzzy-IWO method: In this method, for determining the threshold value for skin of color separation, the invasive weed optimization algorithm is used and the feature extraction is used by classification of characteristics of eye and lip and nose and profile. In fact, an FIS (fuzzy cost function) is defined for each face component which the amount of proximity of provided materials in image to face option is three batches of face, almost face and non-face is investigated and presented (Deramgozin *et al*., 2016) (Fig. 3).

Also for nose, eyes and lips, this part of FIS is defined as a subset. Detecting percentage in this algorithm is 91%. General diagram of this algorithm is shown in Fig. 4.

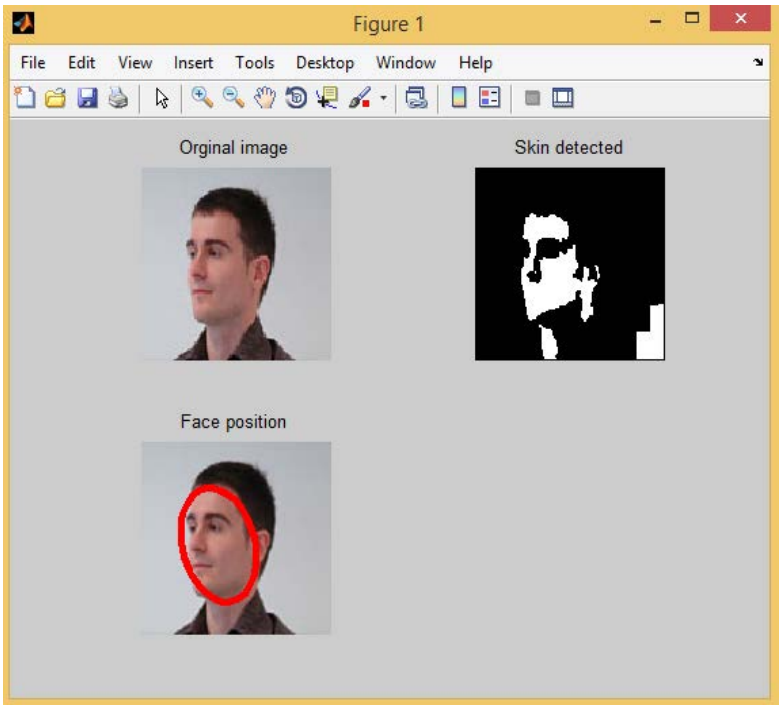

Fig. 3: Detected face skin and image (Deramgozin and Fard, 2016)

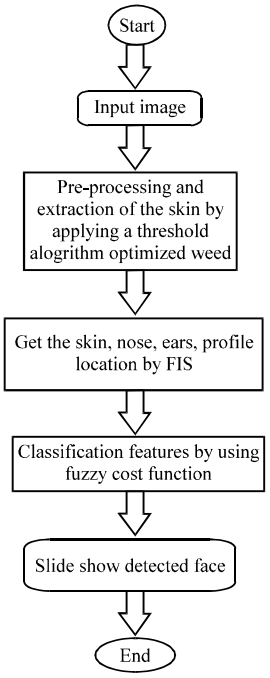

Fig. 4: IWO-fuzzy algorithm flow chart (Deramgozin and Fard, 2016)

FLDA-PCA method: In this model, using a within-class scatter matrix and between class scatter matrix and by applying the reduction of within-class distance and increasing the between class distance, the integration of data distribution in the obtained subspace compared to the EidenFace is achieved. The advantages of this method include the ability to learn the range of variations within a class using the images with the feature changes (Turk and Pentland, 1991).

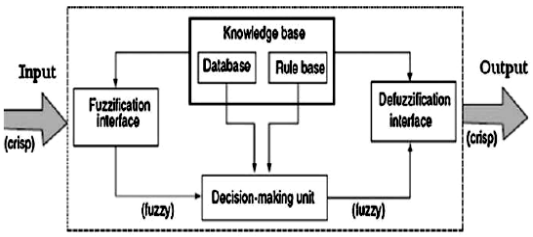

Fig. 5: General view of a fuzzy inference system (Moallem *et al*., 2011)

Fuzzy-Ga method: In this method, the combination of fuzzy cost function and genetic algorithm is used. After entering images into the system and converting their formats, the features are extracted by fuzzy cost function. Features such as face, nose, eyes and ears are achieved. So, when extracting the skin color, the threshold is determined by Genetic algorithm (Zhou *et al*., 2013). Figure 5 shows the general view of the fuzzy inference system (Kwak, and Pedrycz, 2005).

Fisherface method: Using a combination of PCA and FLD, it identifies faces. First FLD conduct the classification of features in a subspace with low dimensions in distinguishable manner. Then, the PCA conducts the dimensional reduction operations using the production of subspaces with maximum variance and results in detecting faces in the shortest time possible. This method utilizes the Fisherface classifier due to lack of sensitivity to noise and change mode. However, in order to integrate the specific level of classes to every feature with considering the degree of their membership after mapping the image, a fuzzy KNN classifier of membership degrees is obtained. Also, fuzzy scattering matrix within and between classes are calculated and divided which this dividing is conducted by Fisherface classifier (Moallem *et al*., 2011; Pentland *et al*., 1994).

RESULTS AND DISCUSSION

Used data base: Used database of faces (formerly "the ORL database of faces"), contains a set of face images taken between April 1992 and 1994 at the lab. 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 (Hashemi *et al*., 2016).

There are ten different images of each of 40 distinct subjects. For some subjects, the images were taken at different times, varying the lighting, facial expressions (open/closed eyes, smiling/not smiling) and facial details (glasses/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). A preview image of the database of Faces is available. 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 92×112 pixels with 256 grey levels per pixel. The images are organized 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 where Y is the image number for that subject (between 1 and 10) (Fig. 6).

The evaluation of algorithms, face detection using ORL standard database: The experiments conducted on ORL database are done in the following six algorithms. The images size used in all experiments was the same and not any pre-processing on the images is applied. Table 1 shows the results of each algorithm using ORL standard database.

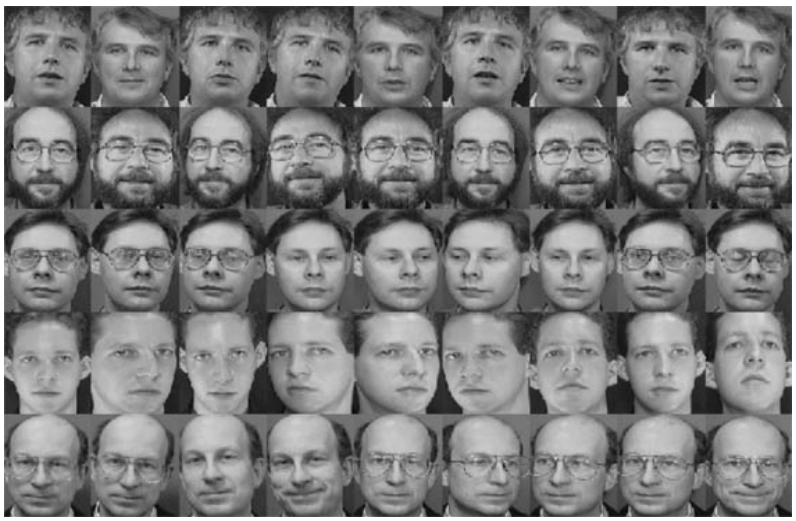

Fig. 6: Example of orl bank images

Table 1: Comparing of pose face detections methods

Parameters	Fisher (%)	Fuzzy-Ga (%)	FLDA-PCA (%)	Fuzzy-IWO (%)	Eignfaces (%)	IWC-F
Recognition rate	94.5	90.7	91.8	92.02	92.1	94.2
Correct recognition rate	93	90	89	91	89.5	91.2
Error rate	1	6.7	4	9	10.5	8.8

CONCLUSION

In recent research on face detection techniques, angle and position change is recognized as one of the major unsolved problems in the investigation of faces and it has attracted special attention in the field of machine vision and research community of pattern detection.

In this study, the comparing of classical and modern techniques in the field of face detection at the angled corner is presented so that the gaps available in the design of systems identifying the people's faces are reduced. In this study, we evaluated the six approach presented in the same terms and with the orl standard dataset and presented the results in details.

REFERENCES

Deramgozin, M.M. and A.B. Fard, 2016. Face recognition across pose using invasive weed optimization classification F-IWC. Proceedings of the 21th International Conference on Engineering of Complex Computer Systems, November 6-8, 2016, Dubai -.

Deramgozin, M.M., S.M.R. Hashemi and A.B. Fard, 2016. Face recognition improvement in angled status using invasive weed optimization algorithm and fuzzy system. Proceedings of the 1st International Conference on New Research Achievements in Electrical and Computer Engineering, May 12, 2016, Tehran, Iran -.

Hashemi, S.M.R., M. Hajighorbani, M.M. Deramgozin and B. Minaei-Bidgoli, 2016. Evaluation of the algorithms of face identification. Int. J. Mech. Electr. Comput. Technol., 6: 2767-2772.

Keller, J., M.R. Gray and J.A. Givens, 1985. A fuzzy k-nearest neighbor algorithm. IEEE Trans. Syst. Man Cybernet., 15: 580-585.

Kwak, K.C. and W. Pedrycz, 2005. Face recognition using a fuzzy fisherface classifier. Pattern Recognit., 38: 1717-1732.

Moallem, P., B.S. Mousavi and S.A. Monadjemi, 2011. A novel fuzzy rule base system for pose independent faces detection. Applied Soft Comput., 11: 1801-1810.

Pentland, A., B. Moghaddam and T. Starner, 1994. Viewbased and modular eigenspaces for face recognition. Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, June 21-23, 1994, Seattle, WA., USA., pp: 84-91.

Turk, M. and A. Pentland, 1991a. Eigenfaces for recognition. J. Cognit. Neurosci., 3: 71-86.

Turk, M.A. and A.P. Pentland, 1991b. Face recognition using eigenfaces. Proceedings of the Computer Society Conference on Computer Vision and Pattern Recognition, June 3-6, 1991, Maui, HI., USA., pp: 586-591.

Zhou, C., L. Wang, Q. Zhang and X. Wei, 2013. Face recognition based on PCA image reconstruction and LDA. Optik-Int. J. Light Electr. Opt., 124: 5599-5603.