Face Detection System

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Abstract— Face Detection System are used for the identification of person from digital images. Face detection system can extract the different facial features from digital image. A set of facial features extracted from a digital image includes eyes, nose, mouth and face region. Face recognition is a difficult task due to the different facial expressions. With the help of a face detection system presence of human face can be detected easily. For the detection of different facial features Viola-Jones algorithm is used in the proposed work. To make task more manageable, Viola-Jones requires full view frontal upright faces [1].

Keywords—Face Detection, Multiple Face Detection, Viola-Jones Algorithm, Facial Features Detection, Face Identification.

I. INTRODUCTION

Face recognition system are used for security purposes mainly for the identification, verification and authentication purposes. Before recognition process, the face and different facial features from the digital image should be detected. For the detection of different facial features from digital images the Face Detection System is purposed. Face detection system can detect the different facial features like Eyes, Nose, Mouth and Face reason. For the detection of facial features Viola-Jones algorithm is used. Detection is fast in viola-jones algorithm as compare to training. Multiple faces can also be detected from a digital image like group photos. For the detection of multiple faces from any digital image Viola-Jones algorithm is used. After feature extraction from image the input image is verified with the output image if images matched than person is verified else not.

Fig.1: An Example of face detection from digital image.

Feature extraction is important process in face recognition. With the help of extracted facial features from digital image the person can be easily recognized by comparing the extracted facial features with the input images. Facial features play an important role in the verification of person.

II. RELATED WORK

Dinesh Kumar. D.S. and P. V. Rao, purposed a model for face recognition. In this model, Principal Component Analysis (PCA) is used for facial recognition from digital images as well as from moving video. Their purposed model also includes, Hidden Markov Model (HMM) technique and Gaussian mixture model (GMM) and Artificial Neural Network (ANN). According to author, face recognition technique uses different parameters like eyes moments, lips position, lighting and background noise [2]. The experimental results are obtained from this proposed work has been achieved the performance parameters 99.83% of false rejection rate (FRR) and0.62% of false acceptance rate (FAR) and an accuracy of 96% is implemented using MatLab2012A. Dayong Wang and Charles Otto, purposed a model face search system on gallery containing 80 million web-downloaded internet images. In this model author used LFW database with 98.20% accuracy under the standard protocol. Additionally, in a face search experiment involving photos of Tsarnaev brothers, convicted of the Boston Marathon bombing, the proposed cascade face search system could find the younger brother's (Dzhokhar Tsarnaev) photo at rank 1 in 1 second on a 5M gallery and at rank 8 in 7 second on an 80M gallery [3].

III. PROBLEM STATEMENT

Different models are available for the face recognition. These models can detect face, eyes and nose. But the detection process is very slow. To solve this problem, viola-jones algorithm is applied to detect the different facial features. Viola-jones algorithm is face and provide accurate results from the input digital image.

A. Searching a large collection of faces remains a difficult problem.

B. In the any recognition system, the selection of feature extraction plays a vital role. There are a lot of feature extraction techniques proposed efficiency of proposed system is not acceptable due to lack of appropriate feature selection.

C. In exiting work, the detection of face from the data remains a difficult task so the recognition accuracy of proposed work is not good.

IV. METHODOLOGY

A framework for the purposed face detection system is designed. First upload the test image from the database for feature detection. Than viola-jones algorithm is applied on the input image for the detection of different facial features. Figure 2 shows the overall block diagram of purposed face detection system. Image database is created by downloading images from the internet. Data flow diagrams are also shown in the figures of face detection system.
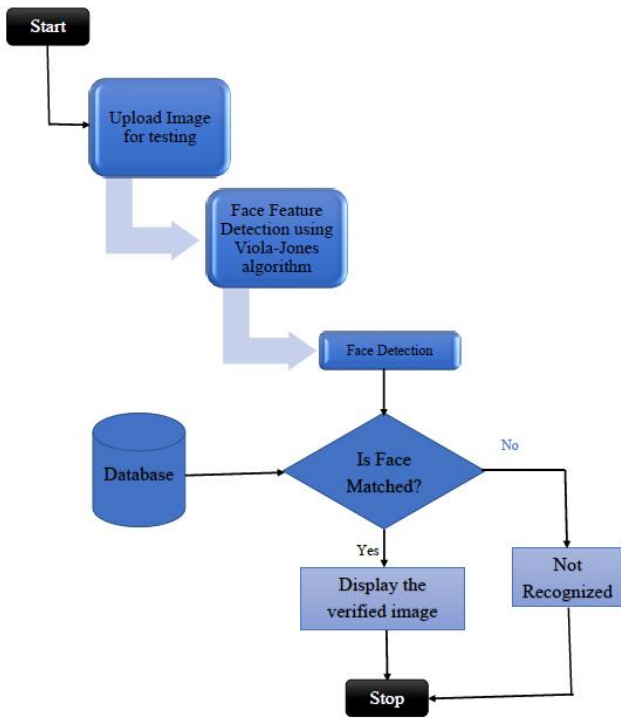
Fig.2: Flow diagram of purposed work for face detection.

Different steps involved in the methodology of the face detection system are given below:

Step 1. Design a purposed framework for the face detection system.
Step 2. Upload the dataset for the training of the system.
Step 3. Upload a test image from the database.
Step 4. Apply viola-jones algorithm for the different facial features extraction.
Step 5. After uploading the input image extract the different facial features like eyes, nose and mouth.
Step 6. Verification or identification of input image with output image.
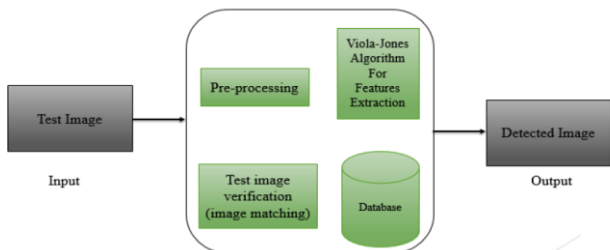Step 7. If the output image matched with the input image than person is verified else not.

Fig.3: Level 3 Data Flow Diagram of face detection system

A. Viola-Jones Algorithm

Viola-Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection [2]. Viola-jones is widely used algorithm for the real-time object detection. Viola-jones algorithm uses haar basis feature filter. The efficiency of viola-jones algorithm can be significantly increased by first generating the integral image. [3].

$$\| (y, x) = \sum_{P=0}^{y} \quad \sum_{q=0}^{x} \quad y(p,q)$$

Vision.CascadeObjectDetector system object is used for the detection of object by using viola-jones algorithm. The cascade object detector uses the viola-jones algorithm to detect people faces, nose, eyes, mouth or upper body [4]. The ClassificationModel property in viola-jones control the type of the object to detect. There are few examples of detector used in this work.

FaceDetector=vision.CascadeObjectDetector('FrontalFaceCART');

FaceDetector=vision.CascadeObjectDetector('EyePairBig);

FaceDetector=vision.CascadeObjectDetector('Mouth);

A. To detect a feature

1. Define and set up your cascade object detector using the constructor.

2. Call the step-up method with input image, I, the cascade object detector object, detector, points PTS, and optional property [4].

3. BBOX = step (detector, I) return BBOX, an M-by-4 matrix defining M bounding boxes containing the detected object [4].

Properties of viola-jones algorithm for the detection of different features. ClassificationModel (trained cascade classification model), Man-size (size of smallest detectable object), Max-size (size of largest detectable object), ScaleFactor (scaling for multiscale object detection), Merge threshold(detection threshold), USE ROI(use region of interest).

V. Implementation and Result

The implementation of face detection system is done using MatLab 2016a. The graphical user interface is created and images from different resources are used as shown in figure 4.1. Multiple face detection from digital done is also done by using viola-jones algorithm. Facial features detection from colored images as well as black and white images can be done easily. The images database is created by downloading different images from the internet for face detection purpose.
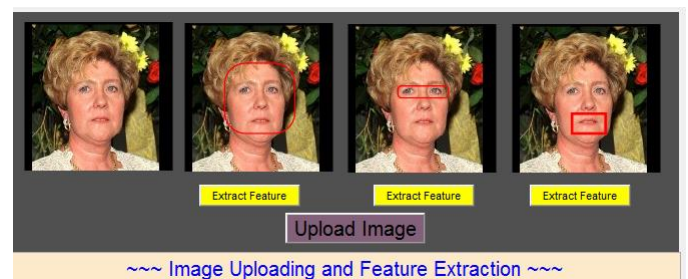

Fig.4: Extraction of different facial features from digital image.

Different facial features from single digital image is shown in the figure 5 and figure 4.
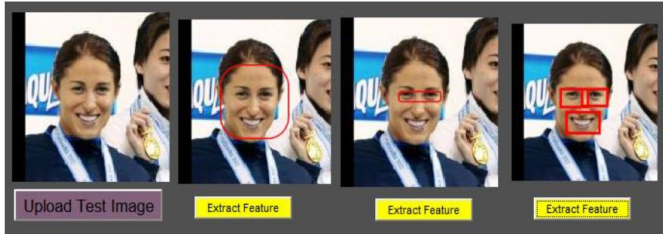

Fig.5: Facial feature detection by using viola-jones algorithm.

Multiple face detection from digital image is also performed in the face detection system. Multiple faces from digital image can be detect by using viola jones algorithm. The result of more than one face detection are show in figure 6.
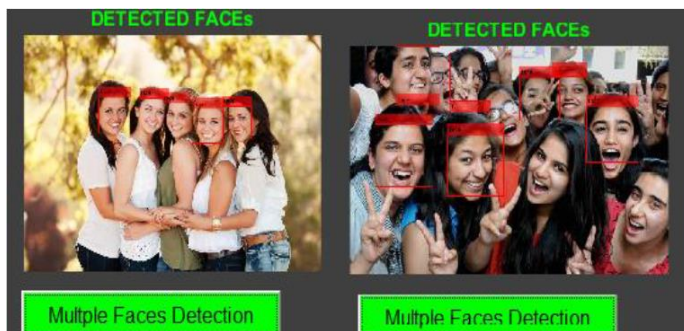

Fig.6: Multiple face detection from digital images.

Digital image verification is the last step which is used to check weather the person is verified or not. If the input image matched with the output image than the person is verified else not. The example of image verification is given in the figure 6. For the verification of digital images different facial features are extracted from multiple images. During verification of image the different facial features are compared with the input image. If features matched with the input image than output image is verified.
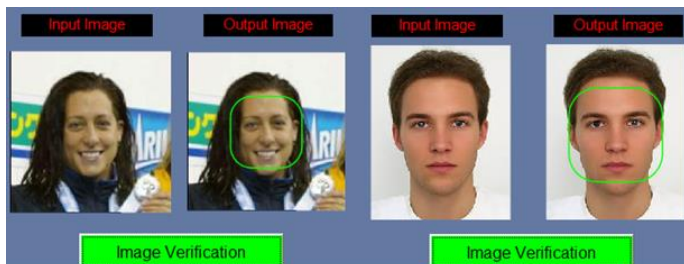

Fig.7: Image verification after feature extraction from digital image

Different methods used by viola jones algorithm for the detection of different features and objects are given below in table 1.

TABLE I.

Sr. No	Methods	
	Method Name	Description
1	Step	Detect objects using viola-jones algorithm
2	Clone	Create system object with same property
3	Relese	Allow system object property value changes
4	isLocked	Check locked state of system object

VI. References

[1] Wikipedia contributors. "Viola–Jones object detection framework." Wikipedia, The Free Encyclopedia. Wikipedia, The Free Encyclopedia, 4 Nov. 2017. Web. 27 Dec. 2017.

[2] Dinesh Kumar. D. S. and P. V. Rao, "Analysis and principal component analysis and hidden markov model for face recognition," CNT 2014.

[3] Vocal techonologies "Face detection using viola-jones algorithm".

[4] MathWorks "vision.CascadeObjectDetector system object" R2017 documentation.

[5] P. Viola and M. Jones, "Robust real-time face detection," *Proceedings Eighth IEEE International Conference on Computer Vision. ICCV 2001*, 2001, pp. 747-747.

[6] V. Kazemi and J. Sullivan, "One millisecond face alignment with an ensemble of regression trees," *2014 IEEE Conference on Computer Vision and Pattern Recognition*, Columbus, OH, 2014, pp. 1867-1874.

[7] Dong Yi, Zhen Lei, Shengcai Liao and Stan Z. Li, "Learning Face Representation from Scratch Dong Yi," 2014, arXiv:1411.7923.

[8] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[9] H. Wang, B. Kang and D. Kim, "PFW: A Face Database in the Wild for Studying Face Identification and Verification in Uncontrolled Environment," *2013 2nd IAPR Asian Conference on Pattern Recognition*, Naha, 2013, pp. 356-360.

[10] Vidit Jain and Erik Learned-Miller, "FDDB: Benchmark for Face Detection in Unconstrained Settings," 2010.

[11] D. Wang and A. K. Jain, "Face retriever: Pre-filtering the gallery via deep neural net," *2015 International Conference on Biometrics (ICB)*, Phuket, 2015, pp. 473-480.

[12] C. Otto, d. wang and A. Jain, "Clustering Millions of Faces by Identity," in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. PP, no. 99, pp. 1-1.

[13] N. Kumar, A. C. Berg, P. N. Belhumeur and S. K. Nayar, "Attribute and simile classifiers for face verification," *2009 IEEE 12th International Conference on Computer Vision*, Kyoto, 2009, pp. 365-372.

[14] S. Liao, Zhen Lei, Dong Yi and S. Z. Li, "A benchmark study of large-scale unconstrained face recognition," *IEEE International Joint Conference on Biometrics*, Clearwater, FL, 2014, pp. 1-8.

[15] Karen Simonyan_ & Andrew Zisserman, "VERY DEEP CONVOLUTIONAL NETWORKS FOR LARGE-SCALE IMAGE RECOGNITION" Published as a conference paper at ICLR 2015, arXiv:1409.1556v6.