

Face Identification Using Histogram based Approach With a Probabilistic Classifier In Spatial Domain

Pankaj Prusty¹, Bibhu Prasad Mohanty²

¹ Faculty of Engg., Electronics and Communication Engg., Siksha 'O' Anusandhan University,
Bhubaneswar
pankajprusty@soa.ac.in

² Faculty of Engg., Electronics and Communication Engg., Siksha 'O' Anusandhan University,
Bhubaneswar
bibhumohanty@soa.ac.in

Article Info
Volume 83
Page Number: 7623 – 7625
Publication Issue:
May-June 2020

Article History
Article Received: 19 November 2019
Revised: 27 January 2020
Accepted: 24 February 2020
Publication: 18 May 2020

Abstract:

Face identification is a well known and widely used method in computer vision and also in many security related biometric applications. The major problem that the face detection algorithm encounters is the variation in position, illumination due to different conditions and many more. In this paper we have focused on the fact that the test input image must correspond to a predefined image in the database. The major feature used here is Histogram of oriented Gradients. The feature vector is used to train the probabilistic classifier, so that the classifier can easily distinguish the data set image and non data set image. The method also verifies the correct image from a data set on which it was found to belong to the data set. At the end the performance of the algorithm is verified with the help of correct and miss classification.

Keywords: Histogram of oriented gradients, probabilistic classifier, miss classification

1 Introduction

Human perception plays an important role in recognizing faces under different situations. It may be bad lighting condition or poor weather condition. But when it comes to the case of machine it becomes very difficult to identify the face. To identify the faces in a machine we may require different computer vision algorithms, thresholding operations etc with high accuracy. The performance of the face detection algorithm using a probabilistic classifier completely depends upon the training accuracy of a classifier. This indicates how correctly your classifier has been trained using the faces in the data base.

The orientation of some of the facial components such as eyes, nose, mouth etc plays an important role in identifying face in an image. But the detection algorithm seems to be difficult when variations in pose and expres-

sions are there. Few common issues encountered during the recognition of face are poor or variation of lighting conditions, spectacles, more cut mark or hairs in face etc. Many techniques like matching of template, geometrical approaches etc were adopted in past for face detection by various researchers. Facial Identification is the first and important step in verifying the face in an image. Next step is to match the face available in the data base to ensure that whether the data base contains that face or not. The accuracy of detection depends upon the features that are chosen in such a way that it can clearly discriminate one face from the other. Better is the training, better is the output. Majority of face recognition algorithms contain feature extraction and machine learning algorithms. Face identification applications are required in many computer vision algorithms and security based applica-

tions. Also it is required in matching of data sets in criminal activities.

In this paper we have proposed a novel approach of detecting faces. We have taken histogram oriented gradients and a probabilistic classifier that is naïve bayes classifier for face identification process. The organization of the paper is as follows: the following section that is section II gives the works carried out in past by researchers in this field that is face identification feature extraction. Section III provides our proposed method of face identification followed by result analysis, conclusion and future scope of the work.

2 Literature Survey:

In 2004[1] Viola and Jones proposed an algorithm proposed an algorithm where the facial features extracted are not variant to position variations. Such type of features which are invariant in nature are based on Active Shape Model [2]. Different features may include texture, edge, color details and many more. Principal component analysis method [3], where feature space is reduced only by considering the dominant feature like distance measurement. Many face detection algorithm also uses Gabor filter approach, local binary feature approach, linear discriminant analysis approach etc. Generally pixel information are not capable of discriminating position varying image pattern. So it is required to find information from larger areas with more

pixels based on applications. Many features requires the type of data based on which the the identification is based on.

The histogram oriented gradient descriptor[4] is a feature vector which is independent of illumination conditions. This is used by extracting magnitude of edge information even when variation in pose and lightening conditions are there. Histogram oriented gradient features are based on direction. The combination of histogram oriented features and SVM [4] gives a better accuracy in terms of correct matching. Machine learning based approach is adopted when an algorithm is trained and then is capable of taking decisions on the data set. So the final result depends on the better training that is better feature selection and quality of data available.

3 Proposed Work

This section represents our work on histogram oriented gradient based approach with a probabilistic classifier. Here naïve bayes classifier is used for detecting the image belongs to data set or not. Then matching algorithm is applied for decision making.

3.1 Data Base Creation:

MIT-CBCL data base is used for data base creation. 200 images are taken from the data base for the simulation process. Few images are taken to be training image and few images are considered as testing image in cross validation approach. Few images from the data base is shown in figure1.

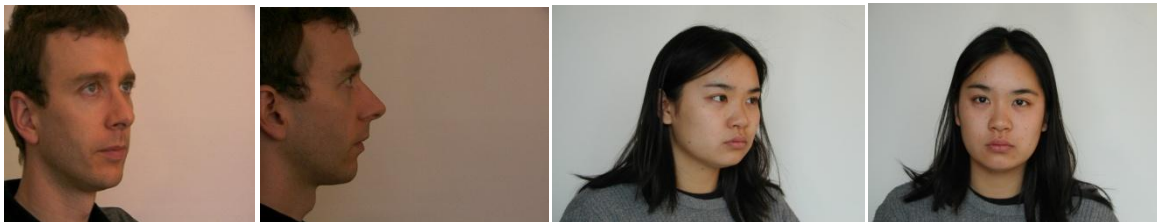


Fig.1 Sample images used for simulation

3.2 Pre Processing Techniques:

At first the images are converted to gray scale image. All the images in the data base are converted into 112 x 112 in the pre processing stage. Here importance is given on those images where face appearance is more with different orientations. So that the result will be more accurate using histogram of gradient and naïve bayes classifier approach.

3.3 Feature Extraction and Classification

All the features are based on histogram oriented gradient based features. Feature vectors are generated using on this. Then a probabilistic classifier (naïve Bayes) is trained to classify the image. The rule used in classification purpose for decision making of a classifier is the V_{MAP} decision rule[5].

The Algorithm:

Step-1: The data base is created by taking 200 images.

Step-2: All the images are converted to gray scale and resized.

Step-3: Some images are selected to train the classifier using histogram oriented features.

Step-4: Decision rule is applied by the naïve Bayes classifier to predict the test image as data set image or not.

Step-5: Feature matching is done for the accepted image for correct output prediction.

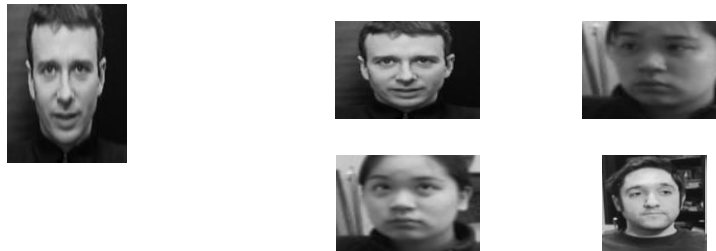


Fig.2 (a) test image

(b) Output of classifier

In order to measure the performance of the algorithm two parameters are used : percentage of positive fraction and percentage of false detection. Where percentage of positive fraction gives the total number of correctly classified faces divided by total number of faces multiplied with 100 and percentage of false detection gives total number of falsely classified faces detected as correct classified multiplied with 100. We found that out of 40 test images 37 images classified correctly which gives a positive fraction of 92.5 %. Two images are classified as false detection which is of 5%.

5 Conclusion

This paper mainly focused on a probabilistic classifier based approach which distinguishes first the data set image and non data set image. As a result of which the false detection rate reduces drastically. We have used MIT-CBCL data base images with the help of histogram oriented gradient based approach which improves the accuracy of positive fraction. The algorithm is not capable of detecting 3D images and also the images where the face is full of hairs or spectacles are there in the face. To detect 3D face and to overcome all the limitations of the current algorithm with the help of machine learning algorithms are the future scope of the work.

4 Experimental Results

Our training data base has 160 images and 40 images are for testing purpose. Feature HOG is used for training data set. Totally 160 feature vectors are obtained. These feature vectors contain all possible edge information. Figure 2 (a) shows the classifier input for one of the test image which is in data base. Figure 2 (b) shows the classifier output.

References

1. Paul Viola, Michael J. Jones, "Robust Real-Time Face Detection" in Int. J. of Computer Vision, vol. 57, no. 2, pp. 137 - 154, 2004
2. Leonardo A. Camet, Francisco J. Galdames, Kevin W. Bowyer, Claudio A. Perez, "Face recognition under pose variation with Gabor-features enhanced by Active Shape and Statistical Models" in Pattern Recognition, vol. 48, pp. 3371-3384, 2015
3. M. Turk, A. Pentland, "Eigenfaces for Recognition" in Journal of Cognitive Neuroscience, vol. 3, no. 1, pp. 71-86, Win. 1991
4. J. Kulandai Josephine Julina, T. Sree Sharmila " Facial Recognition using Histogram of Gradients and Support Vector Machines" IEEE International Conference on Computer, Communication, and Signal Processing 2017
5. Tom M Mitchell, machine learning, McGraw-Hill Science, 1997.
6. Wen yao Lu, Ming Yang " Face Detection Based on Viola –Jones Algorithm Applying Composite Features" International Conference on Robots & Intelligent System (ICRIS) 2019