Human Face Detection Based on Skin Color Using Support Vector Machine

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***Abstract*— Here we present the paper, which detects the number of faces from image using support vector machine. In general for detecting face is not an easy task. Support vector machine learning may be a comparatively recent methodology that gives a decent generalization performance. As there is more number of classifier used for face detection.**

SVM is the method which gives best result which is developed by the Vapnik, Boser, and Guyon (1992).In this paper, we propose a methodological improvement to raise face detection rate by clustering the image as skin and non-skin region. An experimental result on image databases gives promising results.

***Index Terms*— SVM, face detection, SVM classifiers.**

I. INTRODUCTION

Computer vision is to the present day a extremely active field of analysis, driving additionally a major quantity of innovation within the closely related fields of image process and machine learning.Face detection and recognition may be a specific instance of the object recognition problem that deals with finding and characteristic appearances of human faces in digital pictures or video frames.

Traditionally, face detection and recognition has been the main target of the leading beholding analysis thanks to its wide pertinence. Biometric systems will like characteristic the user's face, security applications will find intruders, digital cameras will mechanically target the faces within the frame, interactive systems will be controlled by head movement, users will search their photography archives for all pictures of a selected person—all these use eventualities square measure already potential nowadays with the assistance of face detection and recognition algorithms.

Classifiers work as call functions that area unit supported rules or models that area unit fashioned throughout the method of learning. The foremost outstanding machine learning ways historically embrace neural networks, applied math modeling ways like principal elements analysis, and a lot of recently, support vector machines.

After its introduction within the early Nineteen Nineties, the support vector machine learning technique was fast to achieve an oversized following. Offering a simple to grasp geometric interpretation of the educational method, in distinction to usually additional 'black-box' neural networks whose inner state is mostly arduous to interpret, for a short time SVMs were a favoured technique and got adopted in an exceedingly variety of research areas. In more recent years, important enhancements are created to deal with the problems of the support vector machine learning. The analysis given during this paper joins in to defend the position that the support vector machine learning technique is extended in ways in which build it an adequate approach for prime needs issues like face detection.

II. LITRATURE REVIEW

The task of face detection is to search out all instances of human faces in a picture, within the general case while not assumptions regarding the quantity of faces, their sizes or positions. A wider survey of face detection approaches; this reviews the 2 most typical approaches—model-based and pattern-based detection [1].

A method to expeditiously represent human faces victimization this idea: eigenvectors extracted from a covariance matrix of a given distribution of face pictures [2]. Illustration of faces to recommend a recognition system wherever a candidate image is projected onto the face area outlined by the chosen eigenfaces [3]. This 'distance-from-face-space' will be used for face/non-face classification. As an example that Independent Component Analysis (ICA), which may be thought of as a generalization of the PCA approach, outperforms the latter during a face recognition state of affairs [4].Independent component analysis (ICA) is a method for finding underlying components from multidimensional statistical data. There is need to implement face recognition system using ICA for facial images having face orientations and different illumination conditions,What distinguishes ICA from other methods is that, it looks for component that are both statistically independent and non Gaussian. Linear Discriminate Analysis (LDA) may be a spatiality reduction technique just like PCA, however geared toward discrimination, face recognition and additional improved by [5,6]. Common problems in PCA method is overcome by Linear Discriminate Analysis (LDA).Linear discriminant analysis (LDA) has been used as a dimensionality reduction technique to many classification problems, such as speech recognition, face recognition, and multimedia information retrieval.

Neural networks uses some organizational principles (such as learning, adaptability, fault tolerance, generalization, and distributed representation, and

computation) in a network of weighted directed graphs, where the nodes are artificial neurons and directed edges (with weights) are connections between neuron outputs and neuron inputs. One of the most important characteristics of neural networks are that they have the ability to learn complex nonlinear input-output relationships, use sequential training procedures, and adapt themselves to the data. Neural networks are used in many pattern recognition problems, like character recognition, object recognition, and autonomous robot driving. The feasibility of training a system to capture the complex class of face patterns is the main advantage of the NN in the face recognition.

The NN is non linear in the network hence it is widely used. NN approaches encounter problems when the number of classes increases.Neural Networks (NN) are wide applied for numerous pattern classification tasks, as well as face detection and recognition. The Multi-layer Perceptron (MLP) model was used for the primary applications, like the face detection systems [7].A neural network classifier supported the Constrained Generative Model (CGM)Another learning design, referred to as SNoW (Sparse Network of Winnows)[8], came from the domain of natural language processing and was initial applied to face detection [9].

AdaBoost is an adaptive Boosting machine learning technique is taken into account one amongst the foremost successful object detection strategies in computer vision.AdaBoost has been successfully used toboost different classifiers, including perceptrons, PCA and LDA based classifiers, linear support vector machines andothers.

Initial introduced support vector machines (SVM) quickly became a wide used machine learning technique [10]. It's the pioneering and arguably the foremost well-liked of the kernel strategies, the category of algorithms that map data points into terribly high-dimensional feature areas, [11, 12] initial to use the SVM technique to face detection. They used nineteen × nineteen pixel image patches containing faces and non-faces. A lot of recently SVMs saw more enhancements in tries to enhance their efficiency. Approximation methodology to create efficient SVM classifier cascades victimization 20×20 pixel pictures and also the Gaussian Radial Basis Function (RBF) kernel [13]. Within the lightweight of the terribly efficientAdaBoost face detection system to more improve the SVM cascaded classifier [14,15].

State of the art face detection systems like the one developed to create variety of problem-specific novel approaches like classifier cascades, boosting, efficient rectangular Haar-like options and integral pictures, to be combined with the standard and universally applicable machine learning ways so as to attain smart performance in terms of each accuracy and speed [15].

III. SUPPORT VECTOR MACHINES

Support Vector Machine could be a sensible learning technique supported applied math Learning Theory. An easy SVM may beat a complicated neural network with elaborate options in a very handwriting recognition task. SVM have the aim of crucial the situation of call boundaries that turn out the best separation of categories. Within the case of a two-class pattern recognition drawback during which the categories are linearly severable the SVM selects from among the infinite range of linear call boundaries the one that minimizes the generalization error. The greatest margin between the two classes, where margin is defined as the sum of the distances to the hyper plane from the closest points of the two classes [1]. This drawback of maximizing the margin is often solved victimization commonplace Quadratic Programming (QP) optimization techniques. The data points that are closest to the hyper plane are used to measure the margin; hence these data points are termed 'support vectors'.

SVM also can be extended to handle non-linear call surfaces. If the 2 categories don't seem to be linearly severable, the SVM tries to seek out the hyper plane that maximizes the margin whereas, at identical time, minimizing a amount proportional to the quantity of misclassification errors. The trade-off between margin and misclassification error is controlled by a user-defined constant. Away of protruding the computer file onto a high-dimensional feature house victimization kernel functions and formulating a linear classification drawback in this feature house.

The support vector machine learning technique could be a comparatively new approach that pioneered the adoption of kernel-based ways and through the last twenty years caused a major impact within the analysis community. Praised for the universal applicability and wonderful generalization performance also as resistance to overtraining, SVMs were applied to just about each machine learning problem, together with that of face detection.

SVMs area unit capable of learning the complicated and correct classifiers needed for face detection also as applicable to the cascade ways required to attain quick detection speeds [13, 14]. Analysis that specializes in accuracy found that competitive performance is feasible however training on adequately giant datasets is difficult. Others tackled the speed issue and whereas varied approximation ways created interactive response times potential, those usually came at a worth of reduced accuracy.

IV. PROPOSED WORK AND METHODOLOGY

The Proposed Method Consist of following steps

1. Select Input Face Image from your database.
This is the very first step of our project where it takes an input in the form of image. Input image can be of any form which are generally used in day today life such as .JPEG, .PNG, etc.

2. Applying Filter on Input Image (Denoise using

Gabor filter.,Haar Wavelet, Wavelet db, Gaussian filter.)

3. SVM Pixel Classification

SVM,where it classifies the image into two regions i.e. skin pixel region and another one is non-skin pixel region.

4. Detecting Faces From an Input Image Using SVM

As in the previous step we classify an input image by skin pixel and non-skin pixel region. It finding the face features only in skin pixel region which in turn reduces the cost of time and improves the accuracy. Hence face/s is/are detected from input image.

5. Crop Faces which is detected in previous step

If we want to save detected faces into our database hence need to crop them and this can be done in this step.

6. Labeling to the detected faces and save the faces to the database.

By labeling or specifying the name we can save it into the existing database.

7. Select Input Face Image from your computer

This is the very first step of our project where it takes an input in the form of image. Input image can be of any form which are generally used in day today life such as .JPEG, .PNG, etc.

V. RESULT ANALYSIS

In present paper we compare the performance of the implemented system by computing face detection rate and the number of false detection**.** Here the ratio between the number of successful detection and the number of faces which is tested, called as detection rate of an image.

Table 1 shows the detection rate of our methods and the results of different detection methods.

Table 2 shows our experimental results on 20 images. From both tables, show that our method have a good detection performance than that of other methods, yet with fewer false detections.

TABLE 1

Experimental Results on (125 Images with 483 Faces) in [16][17]

Method	Detection rate	False detection
Mixture of factor analyzers	92.3%	82
Fisher's linear discriminant	93.6%	74
Neural network [17]	92.5%	862
Naive Bayes classifier [18]	93.0%	88
Kullback relative information [6]	98.0%	12758
Proposed System(20 Images with 100 faces)	98.611%	4

TABLE 2

Experimental Results on (20 Images with 136 Faces) in [16][20]

Method	Detection rate	False detection
Mixture of factor analyzers	89.4%	3
Fisher's linear discriminant	91.5%	1
Distribution-based [20]	81.9%	13
Neural network [17]	90.3%	42
Naive Bayes classifier [18]	91.2%	12
Proposed System(20 Images with 100 faces)	98.885%	6

Here in Table 3.a shows the results of existing system proposed by [21] and Table 3.b gives the results of our proposed method. The results are tested with the five cases, in first case the face images are tested as they are. In second and third cases the illumination conditions of images change. In fourth and fifth cases some ratio of noise is added to images.

Table 3.a

The face detection rate and the number of false negative (Existing System)[21]

The Case Number	Number of Images	False Negative	Detection Rate
First Case	255	14	94.4
Second Case	255	6	97.6
Third Case	255	15	94
Fourth Case	255	10	96
Fifth Case	255	17	93.2

Table 3.b

The face detection rate and the number of false negative (Proposed System)

The Case Number	Number of Images	False Negative	Detection Rate
First Case	20	4	98.611
Second Case	20	4	98.611
Third Case	20	6	98.885
Fourth Case	20	6	98.611
Fifth Case	20	4	95.278

VI. CONCLUSION

This paper has attempted to review a significant number of papers to cover the recent development in the field of face detection. Present study reveals that for enhanced face detection. As now the research area of face detection technology is much advanced. Face recognition is that it can be used in the different fields like identity authentication, access control and so on. Hence in this paper we has attempted to survey on human face detection using support vector machine.SVM is the more efficient technique compared to others for human face detection.

This summary holds the position that SVM learning are often extended in ways in which create it Associate in Nursing adequate approach to high-requirements issues like face detection. From Above results, shows that our method have a good detection performance than that of other methods, yet with fewer false detections.

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