A Survey on Data Mining Classifiers for Face Verification

Amina K, Lekshmy P L

Abstract— Now a days the human face plays an important role in our social interaction, conveying peoples identity. Face recognition is a rapidly growing field today for many uses in the fields of biometric authentication, security and many other areas. An automatic face recognition system will find many applications such as human computer interface, model based video coding and security control systems. Face Recognition System is a computer application for automatically identifying or verifying a person from a digital image or a single frame from a video source. This can be done by comparing selected facial characteristics of the likeness and a facial database. The difficulties of face recognition arising from face characteristics, geometry, image quality and image content. In this paper there are different data mining classifiers are used for face verification. Also we shall see their advantages, disadvantages and solutions to overcome the problems.

Index Terms—Face recognition system, support vector machine (SVM), Discriminative Multi-Projection Vectors (DMPV), Gaussian mixture model (GMM).

I. INTRODUCTION

Face Recognition is a type of biometric software application that can identify a specific individual in a digital image by analyzing and comparing patterns. Face recognition can be categorized into two tasks: face identification and face verification. Face identification is to identify a person based on the image of a face. This image has to be compared with the registered persons (one to one matching). Face verification is concerned with validating a claimed identity based on the image of a face. And either accepting or rejecting the identity claim (one to many matching). [1]

Face verification is an important step in any automatic face recognition system. Given an image of arbitrary size, the task is to detect the presence of any human face appearing in the image. Verification is a challenging task since human face may appear in different scales, orientations and with different head poses. Facial attributes [2] such as make up, wet skin, hairs are also provides the variation of facial appearance. A successful face verification system should be able to handle multiple source of variation. Several face verification methods have been proposed in literature survey.

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Amina K, M.Tech. Scholar, Deparftment of Computer Science and Engineering, LBS Institute of Technology for Women, Poojappura, Trivandrum, India.

Lekshmy P L, Assistant Professor, Deparftment of Computer Science and Engineering, LBS Institute of Technology for Women, Poojappura, Trivandrum, India.

II. LITERATURE SURVEY

In this section we summarises some of data mining classifiers that can be used for better face verification task.

A. Boosted online learning for face recognition.

David masip [3] proposes boosted online learning for face recognition. Here face recognition applications are commonly suffer from three main drawbacks: a reduced training set, information lying in high dimensional subspaces, and the need to incorporate new people to recognize. The most successful approaches of those are the extensions of the principle component analysis or linear discriminant analysis. In which a new online boosting algorithm is introduced. It is a face recognition method that provides a boosting based classifier by adding new classes while avoiding the need of retraining the classifier each time a new person joins to the system.

B. Discriminative Multi-Projection Vectors

Marcos del Pozo-Banos [4] proposes discriminative multi projection vectors. This system is trained using face images databases to determine whether a testing face belongs to a given subject or not. It is composed of three major blocks: an image preprocessing block, a feature extraction block and a pattern classifier block.

Pre-processing: The first block at the systems entrance is the preprocessing block. It collects the face samples, reducing the noise and transforming the original signal in a more readable one. In this case, the preprocessing block tries to reduce lightning variations among pictures. And samples are resized to standard dimensions of 20x20. This ensures that the training time will not increase to unviable levels. Then images grey scale histograms are equalized.

Feature extractor: Once the samples are ready, the feature extractor block transforms them in order to obtain the best suited information for the classification step. In which four types of feature extraction techniques are implemented parallel. First, a pure DCV tool is implemented. As a parameter, eigenvalues containing 90 percentage of the energy were considered as no null eigenvalues, and their corresponding eigenvectors were used to build the projecting matrix. An optimized DCV technique was used to test who this approach increase the performance of a pure DCV tool. In order to find the optimal number of eigenvectors used for the projecting matrix, the performance of the whole system is used to compare different combinations. A third method combining optimized DCV approach and pure DCV theory was implemented. As a result, the classic DCV optimizes the number of eigenvectors. Finally, the DMPV is implemented, and the number of eigenvectors used for building the

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projection matrix is optimized through iterations, based on the systems performance.

Pattern classification: The last block of the system is the pattern classification block. It has the task of decide whether a sample picture correspond to a given subject or not. For the experiments, two well-known classifiers were used: the K-Nearest Neighbour method (K-NN) and a Support Vector Machine (SVM). The K-NN is a very simple method based on a metric distance between the training and the test sample. For this work the Euclidean distance was used, the result was based on a majority rule, and the number of neighbours (K) was optimized through iterations to achieve the lowest error rate possible maximizing the distance between classes. The SVM projects the problem into a higher dimensional space where it can be solved linearly. This transformation is done using an operator called kernel, in this case a Radial Basis Function kernel (RBF-kernel). In the new space, the positive and negatives classes are divided using a linear function, which gives rise to a boundary and a margin between both classes [2]

C. A probabilistic elastic matching for pose variant face verification

Haoxiang Li,Gang Hua and Zhe Lin, Jonathan Brandt, Jianchao Yang [5] introduce a probabilistic elastic matching for pose variant face verification method. Pose variation is a major challenge for real world face recognition. This problem can be solved by a probabilistic elastic matching method. Normally face recognition can be categorized into two tasks: face identification and face verification. A face is represented as a bag of spacial appearance features. To enable matching for pose variant face verification, given a set of training images and build a Gaussian mixture model (GMM)on the spatial appearance feature from all the training images. In speech recognition, GMM is also called universal background model (UBM). When matching two face images for face verification, each component of GMM model identifies a pair of spacial appearance features (corresponding to a pair of image patches) from the two face images to be matched.

The absolute difference vector of all these feature pairs from all spherical Gaussian components together to form a long difference vector. An SVM classifier is trained on such difference vectors given a set of training matching/non matching face pairs. Which is use to verify any new face pairs. The advantage of this matching framework is that it can be used for both image to image and video to video face verification without any modification. In which the proposed robust matching scheme bridged by UBM-GMM, namely probabilistic elastic matching (PEM) performs the current state of the art on both LFW and you tube video face dataset. To make PEM to be adaptive to each pair of faces, propose a joint bayesian adaptation scheme to adapt the UBMGMM to better the features of the pair of faces. The Gaussian mixture model has been widely used for various visual recognition tasks including face recognition and scene recognition [5].

D. Learning Prototype Hyperplanes

Meina Kan, Dong Xu, Shiguang Shan, Wen Li [6] proposes learning prototype hyperplanes for face verification. In which faces are generally captured in unconstrained conditions. Face verification in wild is a more challenging task due to the extremely large class appearance variations in terms of pose, illumination, expression, and occlusion. New methods are recently proposed to improve face verification performance in unconstrained conditions after the release of the Labelled Faces in Wild(LFW) data set. These methods can be divided into feature based approaches and distance metric based approaches. The feature based approach aim to develop a better feature representation. The distance metric based attempt to develop new distance metrics to effectively measure the similarity between two face images.

In this work, learn a few classification hyperplanes of binary SVM models by using the weakly labelled data set. In which sparse set of support vectors are automatically selected from the unlabelled generic data set. Each sample in the weakly labelled data set is represented as a mid level feature with each entry corresponding decision value from one learned SVM model. Then propose FLD-like objective function to learn the optimal prototype hyperplanes by maximizing the discriminability on the weakly labelled data set.

E. Facial Expression Recognition using Anatomy Based Facial Graph

Sina Mohseni, Niloofar Zarei, Saba Ramazani [7] introduces a facial expression recognition using anatomy based facial graph. Automatic analysis of human facial emotions is one of the challenging problems in intelligent systems and social signal processing. Face expression recognition plays a significant role in human computer interaction systems, robotics, machine vision, virtual reality, broadcasting, web services, ect. Facial activity analysis are studying in two levels. First level is facial feature tracking, which detects and tracks salient facial feature and extract face shape information. In second level, facial expression analysis attempts to recognize facial gestures that represent human emotion.

Two main methods of feature extraction in the current research are appearance based analysis (eg: pixel intensity) and geometry based analysis (eg: location of facial points). The most frequently used texture based feature extraction method gives more explicit information to analyse the human facial features.

III. CONCLUSION

In this paper, a survey of data mining classifiers for face verification has been presented. Face verification or recognition is one of the challenging tasks in data mining applications. Each of the above techniques has its own advantages as well as disadvantages. The key conclusion drawn from this study could be for facial verification, which causes various problems. And it will have to improve the existing system. There for this Survey has been presented for an overview of data mining classifiers for face recognition.

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