A HYBRID FRAMEWORK FOR LIE DETECTION USING DYNAMIC FACIAL FEATURES

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Abstract

Facial Expression recognition is a term which refers to recognizing the mode of the user according to the facial movements and other facial gestures. A lot of previous researches have been already submitted in the same work with different accuracy rate. The reserch work is try to enhance the accuracy rate by improving the feature extraction methods and classification using Neural Network, along with some pre and post processing steps. Finally, in the end proposed work is compare with the previous classifiers to measure the accuracy rate.

Keywords

Facial Recognition System, Verification, Lie detection, Linear Discriminant Analysis.

1. Introduction

The region of human-computer interaction (HCI) will be far effective if a computer is able to recognize the emotional state of human being. Emotional state has a larger effect on face, which expresses about mood of a human. So, if we identify expressions of face, we will come to know something about the human's emotions and their mood. Facial expressions can be detected by various methods of biometrics and is useful for the lie detection purpose that is also known as deception detection. There are various general techniques that are used for deception detection on the basis of responses to the questions, body language or the gestures and postures of the person during answering the questions. Facial expressions techniques are much more useful and proved to be more accurate for deception detection. Automatic facial expression recognition (AFER) Systems are attaining a great interest in a lot of application fields as clinical psychology, intelligent environments, behavioral and cognitive sciences, lie detection, neurology and multimodal human computer interface (HCI). In this a facial signal is used as one of the important modalities. This cause more robust interface between human & computer as well as more flexible and in natural way. Faces are common areas that are used to know our social and emotional lives. Majority of the human being communication near about 70% are through non-verbal area such as facial language and body movements. This technique can operate in two different ways according to our requirement, these are:

Facial Verification (or Authentication): in this, crisis image is matched to only single image in the database (one to one matching), if image features are matched, then authentication is given else not.
Facial Identification (or Recognition): if the aim is to identify the facial, then representation is compared to several descriptions (one to many matching) in the database one by one and scores are given to each matching. The representation that got maximum scores is decided to be the closest to the problem facial.

For the lie detection, various expressions of the human face are used. These are:

- Smiles
- Depth of the eye socket
- Anger
- Gap between words
- Movement of lips
- Movement of eyes

Lie Detection system using facial expressions is suitable and more accepted for the reason that these are not only cost efficient but also works, if the user does not give any kind of cooperation, so it is very simple to use. Image can be taken without disturbing the user. In other words, there is no need to contact the abuser, and representation can be taken from a space. A good quality of image can also be taken from space by using some high-quality cameras. In 2007, US National Institute of Standards and Technology announced that their FRVT (facial Recognition Vendor Test) worked similar or even better than the human for the images that are taken in the changeable brightness situation. But in the newest research, the best automated systems achieve a FRR (False Reject Rate) of 0.01% i.e. 1 in 100. Lie detection using Facial recognition system can help in many ways:

1) Examination for unlawful proceedings.

2) Improvement of protection by using examination cameras in combination with facial detection system.

3) Judgment either person is right or wrong.

4) Knowing the exact criminal.

5) Recognition of a against the law activity at public place.

6) Pattern detection.

The Lie detection using facial recognition technique used as protocol in facial recognition literature is FERET. It uses mainly three different kinds of sets i.e. training, covered passage and investigates set. The first training set is used to create the algorithm able of characterize the whole human facial. In the testing phase the gallery and probe set are used. The recognized identities and probe set contains unidentified identity are mainly contains gallery set. The algorithm identifies the probe descriptions by comparing with gallery descriptions.

2. Working Technology

2.1 What are support vectors?

The singular value decomposition of a matrix A of m x n matrix is given in the form, $A= U \sum V^T$ Where U is an m x m orthogonal matrix; V an n x n orthogonal matrix, and $\sum$ is an m x n matrix containing the singular values of A. $\sigma_1 \geq \sigma_2 \geq$ --------$\geq \sigma_n \geq 0$
along its main diagonal.
A similar technique, known as the eigen value decomposition (EVD), diagonalizes matrix A, but with this case, A must be a square matrix.

3. Methodology

The 25 frames per second are extracted from the video at a time in the sequencing of input records. The frames extracted from the input video are line up in the form of appearance and the characteristics of the expression. For the projected application, the blueprint extended to the constrained local model framework in a number of ways. The projected system is effectively optimize the various methods and allows designing the optimization algorithms by faster parallelization with the use of support vector machines (SVM) [6]. By using such kind of approaches, the performance and the correctness of the design increase. To design the real time dynamic frameworks for the expression detection, the extension in the database and the features are continuously required.

3.1 Problem Formulation

From the literature survey the following Research gap find: -

- All the existing techniques as discussed in literature survey are applicable, when pre-defined situations occur but not applicable in other situations such as occlusion, varying illumination and variation in facial appearance. The proposed research will discover and study faces smoothly under almost any situation with a least input amount of information.
- Most of the presented systems for appearance analysis need the face to be in frontal view. For these systems, the presence of a face and its common position in view are predefined. The proposed system will also work at that time when there is small portion of face, like in blur or shake model.
- Most of existing methods are applicable to still images, mean work statically. But the proposed research will mainly focus on dynamic images.
- The existing methods are mainly taking the complete face as an action unit, means work on complete face or either on the lower portion of face. The research indicate that not complete face participates in facial expression. The present work will focus on the key portion of the face (e.g. eyes and mouth) that affect the expressions mainly.

3.2 Research Methodology

As shown in figure there are four steps for lie detection using the facial expression recognition system; facial aqu (localization), facial preprocessing (facial alignment/normalization, light correction and etc.), feature extraction and feature matching. These steps are described in the following sections.

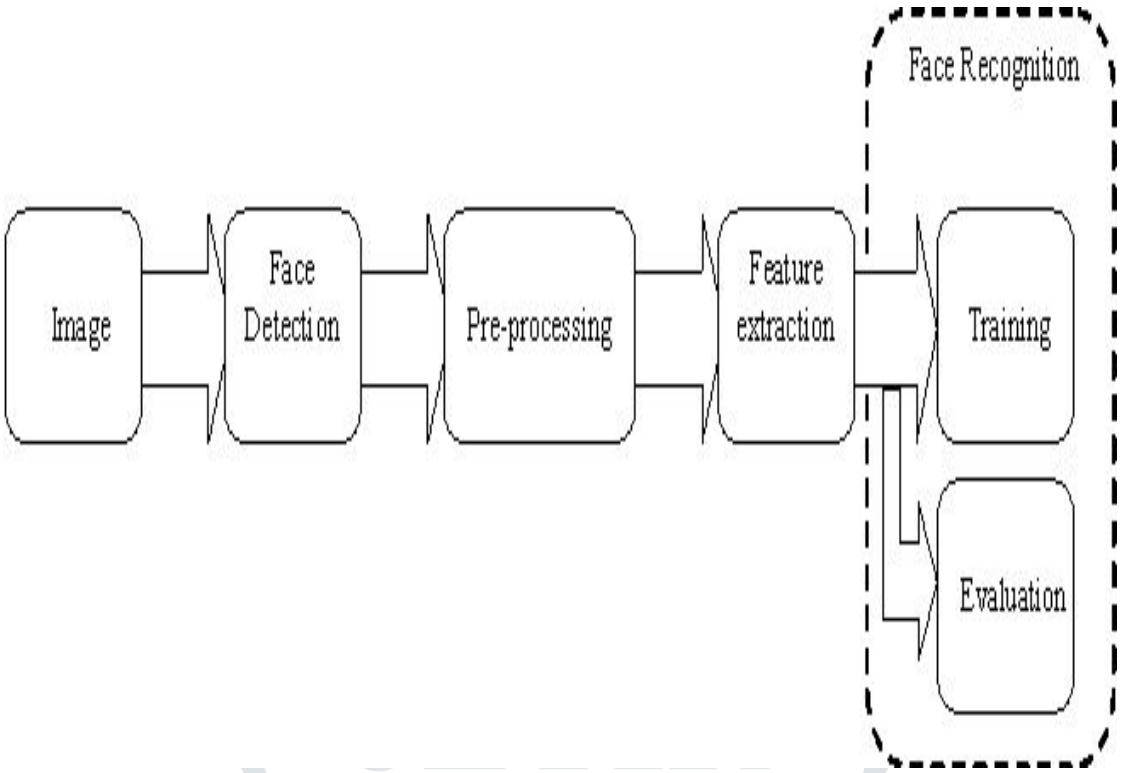

Figure: 3.1 flow chart

3.2.1 Image Acquisition

Images used for facial expression recognition are static images or image sequences. An image sequence contains potentially more information than a still image, because the former also depicts the temporal characteristics of an expression. With respect to the spatial, chromatic and temporal dimensionality of input images, 2-D monochrome facial image sequences are the most popular type of pictures used for automatic expression recognition.

3.2.2 Preprocessing

Image pre-processing often takes the form of signal conditioning such as noise removal and normalization against the variation of pixel position or brightness, together with segmentation, location, or tracking of the face or its parts. Expression representation can be sensitive to translation, scaling and rotation of the head in an image. To combat the effect of these unwanted transformations, the facial image may be geometrically standardized prior to classification.

3.2.3 Feature Extraction

Feature extraction converts pixel data into a higher-level representation of shape, motion, color, texture and spatial configuration of the face or its components. Feature extraction generally reduces the dimensionality of the input space. The reduction procedure should retain essential information possessing high discrimination power and high stability.

3.2.4 Feature Matching

Expression categorization is performed by a classifier, which often consists of models of pattern distribution, coupled to a decision procedure. A wide range of classifiers, covering parametric as well as non-parametric techniques, has been applied to the automatic expression recognition problem.

3.2.5 Post Processing

Post-processing aims to improve recognition accuracy, by exploiting domain knowledge to correct classification errors, or by coupling together several levels of a classification hierarchy. Although humans recognize facial expressions virtually without effort or delay, reliable expression recognition by machine is still a challenge.

Conclusion

In research work we proposed the algorithm for the lie detection of human being. For image acquisition researcher use the web camera. The whole implementation done on the MATLAB and the results are also comparing the existing methods and algorithms which indicate that the proposed algorithm produced more accurate results.

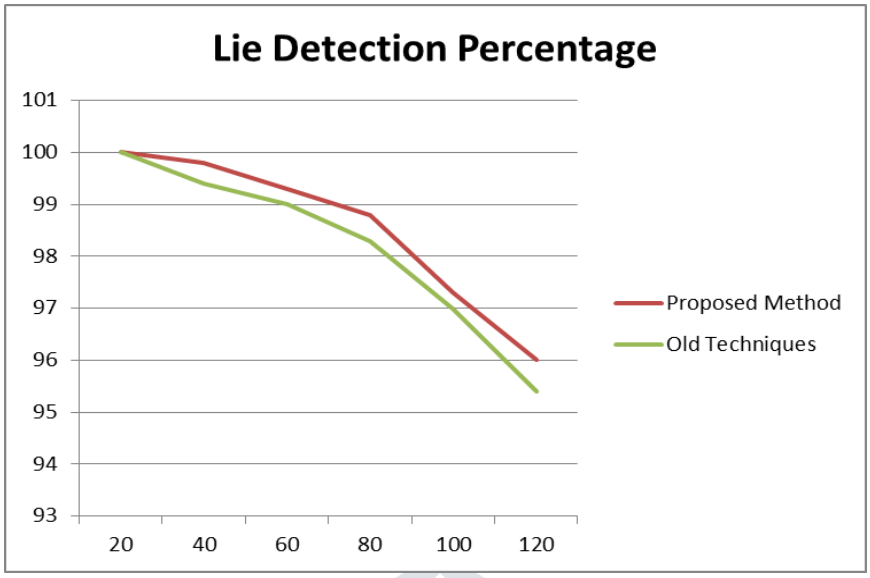

Fig 4.18: Comparison of new technique with old technique

Refrences

[1] Caifeng Shan, Shaogang Gong b, Peter W. Mc Owan, "Facial expression recognition based on Local Binary Patterns: A comprehensive study", Image and Vision Computing, pp-803–816, 2017.

[2] S.P.Khandait, Dr. R.C.Thool, P.D.Khandait, "Automatic Facial Feature Extraction and Expression Recognition based on Neural Network", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, pp. 113-118, January 2017.

[3] Moore, S.; Bowden R, "Local binary patterns for multi-view facial expression recognition", Comput. Vision Image Underst., pp.541–558, 2018.

[4] Xiaoming Zhao and Shiqing Zhang**,** "Facial expression recognition using local binary patterns and discriminant kernel locally linear embedding ", Springer, 27 January 2018.

[5] Zhang, S.; Zhao, X.; Lei, B, "Robust facial expression recognition via compressive sensing" Sensors, Vol.12, pp. 3748–3761, 2017.

[6] Sandbach, G.; Zafeiriou, S.; Pantic, M.; Rueckert, D, "Recognition of 3D facial expressions dynamics", Image Vision Comput, pp.762–773, 2018.

[7] Nooshin NabiZadeh, Nigel John, "Automatic Facial Expression Recognition Using Modified Wavelet-Based Salient Points and Gabor-Wavelet Filters, Communications in Computer and Information Science , Volume 373, pp 362-366, 2018.

[8] Deepak Ghimire and Joonwhoan Lee , "Geometric Feature-Based Facial Expression Recognition in Image Sequences Using Multi-Class AdaBoost and Support Vector Machines", Sensors, pp. 7714-7734 14 June 2016.

[9] BhosaleSwapnali B, Kayastha Vijay S, HarpaleVarsha K." *FEATURE EXTRACTION USING SURF ALGORITHM FOR OBJECT RECOGNITION";* International Journal of Technical Research and Applications Volume 2, Issue 4 (July-Aug 2014).

[10] Swapnali B.,Vijay K.,Varsha H., ―Feature *based object detection scheme.*‖, Technovision International Conf.,2014 .