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A Survey Paper on Eye Detection in a Facial Image under Pose Variation Based on Multi-Scale Iris Shape Feature

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Abstract: *Eyes are the crucial features of a human face, the detection and localization of the eyes are necessary processes in various face and eye related applications. In this paper, it proposes an eye detection method that can locate the eyes in facial image captured at various head poses. Currently used algorithms like Viola and Jones Algorithm, Adaboost classifier, Rapid eye detector (RED) etc. can be use full for the detection of the eye through different poses. The proposed system consists of two stages: eye candidate detection and eye candidate verification for confirming that the size of the iris in face images varies at the different head poses, and the proposed multi-scale iris shape feature method can detect the eyes in such cases. Since it utilizes the integral image, its computational cost is low. It also confirms to reveal the true emotion of a candidate when they try to conceal. Wide range of application in many fields such as physiological diagnosis, investigation, security, blind navigation etc.*

Keywords*–Face detection, Eye detection, Emotion detection*

I. Introduction

Eyes are the primary mind index to identify other members, to detect their personality, to interpret what has been said, and to understand someone's emotional state and intentions on the basis of the shown facial expression. Eyes are the essential process for the face related application like face recognition, age estimation, iris recognition, pose invariant estimation, the localization of the eyes plays a valid step for the alignment of the facial feature points and shape normalization.

Automatic face analysis and facial expression recognition in particular has therefore became an efficient topic in recent years, with the aim of creating machines with interfaces that are better aligned to human communication. Detecting the emotions from the facial image depends upon the individual's internal emotion state and their intensions. The eye detection from the facial image can be use full for detecting the true emotion of an individual if they try to conceal it can be done by using many classifiers like Naïve Bayes classifier, filter classifier etc. Eye detection also refers to the psychological process of enhancing the multiple feature of the detected image to exhibit one's emotion. Face detection algorithms have been done in variety of ways in recent few years but for different head poses the face or eye detection algorithms does not works accurately.

The main aim of the proposed system is to detect the eye candidates from the facial images at various head pose. To study about the role of the eye region in the sense of micro expression. After detecting the eye candidate it tries to exhibits the emotions of the candidates through their facial aspects. It helps to reveal one's true emotions when someone tries to conceal. Many of the algorithms were used to enhance the eye from the detected face but in the proposed system it tries to give more accuracy than the existing method.

II. Methods

A) Measurement of eye characteristics

It uses intuitive visual characteristics, such as shape, the difference in intensity between the iris and the neighbour regions, or reflections of the eye in infrared images, as templates for detection. The advantage of the method is being simple and fast in implementation because they use intuitive algorithms for the detection of the eye region from the facial image.

B) Learning a statistical appearance model

It uses a statistical model of a systematic appearance feature from eye patch images as template for detecting eyes. The statistical appearance model can use eye information, which may be removed or may not be measurable by the intuitive algorithms. This method struggle to detect the position of the eyes in the cases involving variations in head poses because these methods use 2D features and do not consider 3D information. To overcome this viola and jones algorithm has been introduced.

C) Viola and Jones Algorithm

Viola and Jones proposed an object detection framework that uses Haar-like features, integral image with an AdaBoost classifier. This algorithm yielded both a high detection rate and a high frame rate by combining Haar-like features and an integral image. It further improved the eye detection performance of Viola and Jones' method by selecting appropriate Haar-like features for eye detection to get an appropriate detection of the eye region so that by using the classifiers we can have a technique of detecting the emotions of a group people.

D)Feature extraction and classification

In this the features are extracted and classified from the facial region so as to analyse the various micro expression flowing on through their disputes. Image filters are used to apply either on the whole face or from specific region surrounding the mouth or from the eye. Principal component analyses (PCA), Local binary pattern (LBP) are the methods used for extracting the feature from the eye or from the facial region. The expression can be recognized distinctly from the facial image by using the below required methods.

a) Principal Component Analysis (PCA)

It is in a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and the differences. Recognizing the spontaneous emotions using Eigen faces in which PCA is used to extract the features from the input image.

b) Local Binary Pattern (LBP)

It is a feature extraction method used for owing its light invariant property and low computational complexity. It has an advantage of the recognizing the expression with high data rate and with low cost. In this the detection will be provided by extracting the features from the input image by using the threshold values of each portion of the facial image. It gives a high recall performance for recognizing the facial expression in a dynamically efficient for detecting the expressions.

III. Comparison Table

The below table compares the two methods that shows the performance of the detected input image with high quality and with high detection accuracy.

Table 1: Performance Analysis of the two methods PCA & LBP

Reference	Method	Performance
Sukanya, IEEE(2014)	PCA	It provides a better face recognition with low error rate.
Xiaodong Duan , Elsevier(2016)	LBP	It provides high data rate, and high accuracy for recognizing the facial expression with low computational cost.

IV. Related Works

Research over the detection of faces and eyes has been done by many methods within the few decades. Eye and face detection through different head poses has been attracted toward the research over last few years. Detection of the input image follows several disciplines such as image processing, machine learning approach, pattern recognition, computer vision and neural networks. Recent research finds the main problem of detecting the emotions through the eyes. As the eyes are the salient features of the human face in which it express the true inner emotions in non-verbal communication.

The recent approaches for detecting the micro expressions through different head poses from the eye region techniques are discussed below from different reference papers.

Xiaodong Duan, Qiguo Dai, Xinhan Wang,Yuangang Wang and Zhichao Hua[1].In this paper it presents a framework to recognize the micro expression within the eye region, namely eye ME. The LBP-TOP feature is extracted from the eye region, and multiple classifiers are trained to recognize the expressions. The proposed Eye ME framework performs better than the methods using the whole face and mouth region when identifying happy and disgust expression.

B. Efraty, M. Papadakis, A. Profitt, S. Shah and I.A. Kakadiaris[2].In this paper it contributes a method for robust component landmark detection that works accurately for all poses varying from side to frontal view .to achieve the robust detection for extreme poses, they uses a set of independent pose and landmark specific detectors. The failure rate the method is lower than that of commercially available software.

Park Kwang Yong Shin, Yeong Gon Kim and Kang Ryoung Park[3].This paper presents a novel iris recognition method based on multi-unit iris images. In order to detect both eyes, they use Adaboost and a RED based on iris shape feature and integral imaging. The proposed system enhances the performance of iris recognition in comparison with the existing methods. The recognition accuracy is enhanced by the score fusion of the left and right irises.

DivyaBhatnaga, DrashtiPathak, GarimaSaini, Amit Kumar and Gautam Vijay Singh[4].This paper presents the various technique used for micro expression recognition. To detect the expressions a high speed camera with a frame rate of 100fps or higher is required.Main objective was to introduce recent methodologies adapted for facial micro expression recognition.Final descriptor vector grows

larger thus taking more time to extract and to train using a given classifier thus it gives a less real time recognition.

S L Happy and Aurobinda Routray[5]. This paper proposes a novel framework for expression recognition by using appearance features of selected facial patches. An automated learning free facial land mark detection techniques has been proposed which achieves a similar performances as that of other state-of –art landmark detection methods yet requires significantly less execution time.

Yujin Jung, Dongik Kim, and Jaihie Kim[6].In this paper it proposes an eye detection method which is robust for eye images of eyeglass wearers is presented. For eye validation 3*3 masks is employed to detect a pupil from eye candidates.It shows that the eye detection rate is higher when a 2*3 mask is employed than when a 3*3 mask is employed in the eye candidate detection for eyeglass wearers.

Yash Arya, Prathamesh Shinde, Sneha Chandwani, Naveena Chandwani and M. Mani Roja[7]. This paper deals with the Macro expression i.e. the expression that we see in our daily interactions. Since they are not suppressed, they last longer. Transform and Euclidean distance algorithm is used here which shows better efficiency for detecting the expression of the face than the other algorithm.The aim of this paper is to develop a system that will help us recognize macro expressions in humans.

Prof.N.A.Nemade and K.M.Attarde[8].This paper presents a biometric system which provides automatic recognition of an individual based on some sort of unique feature or characteristics possessed by the individual.Biometric template provides a normalized, efficient and highly discriminating representation of the feature.

Pengfei Caiand ChongkeWang[9].In this paper an eyelid detection algorithm for the iris recognition is proposed. It is used to reduce the influence of the eyelid for the iris recognition rate. This is to increase the rate of recognition of the iris image

Fernando Alonso-Fernandez, Reuben A. Farrugia and Josef Bigun [10].Paper proposes a super resolution technique to enhance the iris images based on principal component analysis. Here it also presents a method for feature extraction from an iris image based on the concept of textural edgeness. For the authentication purpose they have used two textural features namely: Modified version of grey level, Auto correlation..

Yongqiang LI[11]. This paper presents an iris recognition algorithm based on maximum margin. It helps in revealing accurately the space features of the iris image. Sub patter algorithm does not consider the structure relationship between the same samples in different modes.To accurately reveal the iris image this paper introduces an iris algorithm.

Hanen Jabnoun, Faouzi Benzarti, Hamid Amiri[12].The paper presents a proposed system that restores a central function of the visual system which is the identification of surrounding objects.SFIT algorithm and key points matching showed good accuracy for detecting objects. The contribution is to present the idea of a visual substitution system based on features extractions and matching to recognize and locate objects in images.Proposed system that restores a central function of the visual system which is the identification of surrounding objects.Contributes the idea to present a visual substitution system based on features extractions and matching to recognize and locate objects in images.

D. Jagadiswary, G.Appasami, S. Rajesh [13].Paper presents the eye detection normalization for the biometric identification of the human recognition. Iris recognition has been very crucial for detecting the face recognition. There are many papers that express the systems that operate in the visible wavelength and in less complex environments. These imaging conditions are acquired noisy that lead to severely collapsed images, making iris segmentation a major issue. Following contributions is to consider the sclera the most easily distinguishable part of the eye in degraded images, then a new type of feature that measures the proportion of sclera in each direction and is fundamental in segmenting the iris, and finally to run the entire procedure in dynamically linear time in respect to the size of the image, making the procedure applicable for real-time applications. The proposed system reviews the eye features normalisation and face detection for human identification.

V. Conclusion

The paper proposes a method of detecting the eye candidates from the facial images for revealing the true emotions of the candidate when they try to conceal. When comparing the performance of the method with other eye detection methods on the CAS-PEAL database and the Pointing'04 database, the results showed the superiority of the proposed method when dealing with face pose variations, particularly for pitch- and yaw-varied face poses. In detail, the image of eye regions is first extracted from each frame of original whole face. Then LBP-TOP feature vector is extracted from an image sequence of eye region corresponding to an original micro expression sample. Comparing with the proposed method, the existing method gives low accuracy for detection of eyes and exhibiting the emotion of the candidates.

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