

*A Recent Survey Level-II on Facial Expression Recognition
using Pattern Analysis and Machine Intelligence*

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Abstract: Emotions play an important role in viewer's content selection and consumption. When a user watches video clips or listens to music experience certain feelings and emotions which manifest through bodily and physiological cues, pupil dilation and contraction, facial expressions, frowning, and changes in vocal features, laughter. In order to translate a user's bodily and behavioral reactions to emotions and emotion assessment techniques are required. Emotion assessment is task even users are not always able to express their emotion with words all the time and the self-reporting emotions have a high probability of false emotions. In this research the emotion of the users are used to characterize the image and to arrange them accordingly. The emotion of the user is recognized with the captured image and the features extracted from them. The features extracted from the image will be quantified and will be used as training set for the pattern recognizing neural network. The trained neural network in future will classify the images according to the emotions expressed by the person.

Facial expressions are recognised by the humans, virtually without effort or delay. But automatic expression recognition is still a challenge. There are challenges in capturing and preprocessing the image, in feature extraction or selection, and classification. Attaining successful recognition automatically is very difficult. The objective of this research is to overcome these difficulties and obtain a successful recognition.

This paper gives a review on the mechanisms of human facial behaviour recognition using pattern analysis and machine intelligence, which includes a brief detail on framework, literature survey ,applications and comparative survey in facial behaviour recognition using pattern analysis and machine intelligence.

Keywords: Face detection, Feature extraction, classification, Pattern analysis and machine intelligence, emotion recognition, human-computer interaction.

I. INTRODUCTION

Face plays an important role in social communication. Faces are the primary part of human Communication and a research target in computer vision for long time[6].Facial expression recognition is a type of visual learning process which deals with the classification of facial motion and has been applied in various fields such as image understanding, psychological studies, facial nerve grading in medicine, synthetic face animation and virtual reality[4].Facial recognition systems can be used in multiple present day applications such as surveillance, e-learning and robotic human machine interface[5].Emotional health plays very vital role to improve people's quality of lives, especially for the elderly. Negative emotional states can lead to social

or mental health problems. To cope with emotional health problems caused by negative emotions in daily life, we propose efficient facial expression recognition system to contribute in emotional healthcare system. Thus, facial expressions play a key role in our daily communications, and recent years have witnessed a great amount of research works for reliable facial expressions recognition (FER) systems. Therefore, facial expression evaluation or analysis from video information is very challenging and its accuracy depends on the extraction of robust features. However as new techniques are developed in the field of human computer interface, more research is necessary to find optimal algorithms with respect to find optimal algorithms with respect to automation, speed and accuracy[7]. Facial expression are vital signalling systems of affect, conveying cues about the emotional state of persons. Together with voice, language, hands and posture of the body, they form a fundamental communication system between humans in social context[12]. Emotion recognition system have an important role to play in the human-computer interactive applications. These systems are using facial features of face images and they are verifying or identifying the emotions[14]

A facial expression is one or more motions or positions of the muscles lying beneath the skin of the human face. These muscle movements are used to convey the emotional state of an individual to various observers [16]. The term “facial expression recognition” often refers to the classification of facial features into one of the six so called basic emotions such as happiness, sadness, fear, disgust, surprise and anger [6]. This paper contains the survey on different approaches to facial behavior recognition using pattern analysis and machine intelligence. Section II contains the literature survey on some latest approaches for facial expression recognition. After that in section III the facial expression recognition systems and its applications are given. Section IV summarizes the comparative study of different facial behavior recognition systems on the bases of different techniques and database employs with their pros and cons. Section V gives a key issues that will introduced while developing facial behavior recognition. And last section concludes this survey.

II. FACIAL EXPRESSION RECOGNITION AND ITS APPLICATIONS

Automatic detection of facial behavior is a process of identifying human mental status from the expression and cognition has human on his face. Face and facial feature extraction is one of the most challenging problems because of various pose, facial expression, orientation, light condition, color of images. But it is necessary to detect facial expression because information extracted from the face is the input for expression classifier. Feature extraction refers to determining a set of features or attributes, preferably they are independent, which together represents a given emotional facial expression. While classification does mapping of emotional features into one of several emotion classes such as happy, anger, surprise, sad, disgust, etc. The set of features that are considered for extraction and the classifier that is used for the task of classification are both equally important to determine the performance of a facial expression recognition system.

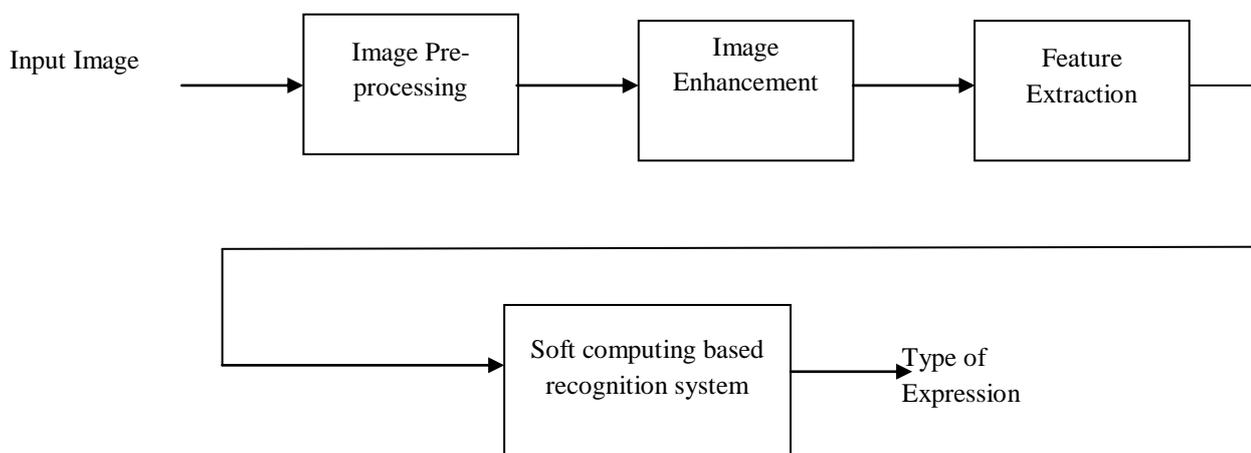


Fig 1. overall diagram of facial expression detection system

Face detection is the process of highlighting the face region from the input image. There are so many methods that successful to detect face from the image, but Face detection suffers from the conditions such as Pose variation, Feature

occlusion, Facial expression, imaging conditions. Face detection methods can be divided into four types: Knowledge-Based Method, Appearance-Based Methods, Feature-Invariant Methods, Template Matching Methods,

Feature extraction is the process of extracting relevant information from a face image and Expression classification can be taken as the problem of pattern recognition. Information extracted from the feature extraction process is given to classifier as input vector. Classifier processed that input and gives the best suited output. Neural networks, support vector machines, rule based classifiers, geometric based methods, are the classifiers that are used to classify the expressions.

III. APPLICATIONS

Face expression detection is an attractive field of research nowadays because it has wide application areas such as Human Machine Intelligent Interaction, Smart rooms, Advance Driver Assistance Systems, Intelligent Robotics, Monitoring and Surveillance, Gaming, Research on pain and depression, Health support appliances, Deception Detection, Advance Computing Technologies, disease detection in medical field, human emotion analysis, awareness systems, surveillance and security, medical diagnosis, law enforcement, automated tutoring systems, pain assessment, clinical psychology, e-learning, computer graphic animation and fatigue driving detection.

IV. COMPARATIVE SURVEY

The comparative analysis of human facial behaviour recognition systems using pattern analysis and machine intelligence is given in the table. The table shows the technique they use in each phase, image database used advantage and disadvantage of that system.

Publication/Year	Title	Database	Methods and Techniques	Key points +Pros and -Cons
Springer/2012	Face Detection and facial Expression Recognition Using a Novel Variational Statistical Framework	JAFFE	Bayesian model	+It is a powerful approach for dealing with the problems of face detection and facial expression recognition -more complexity
Springer/2012	Human Emotion and Cognition Recognition from Body Language Of The Head Using Soft Computing Techniques	JAFFE And Microsoft Web Cam	Corner Detection	+Fuzzy rules are clear -Leads incorrect recognition while training data is insufficient
IEEE/2013	Emotion and Gesture recognition with soft computing tool for drivers assistance system in human centered transportation	Image	Skin classifier, fuzzy inference systems	+recognize facial gesture and emotion with more than 90% accuracy -different sample system got optimized fuzzy rules
IEEE/2014	Face detection and facial expression recognition system	Image	Active appearance model	+It achieved 95% accuracy -it require the extraction and training of additional facial points
IEEE/2015	Assessment of pain using facial pictures taken with a smartphone	Usable images	Eigenfaces,SVM	+it performs better for automatic pain assessment -The problem in appropriate training set for target application
IEEE/2015	Facial expression recognition using two-tier classification and its applications to smart home automation system	Extended Yale B face,Extended cohn-kanade database	PCA,SVM	+it applied for automated system with vareity of emotions for multiple users -The system accuracy can vary if used with different orientation of faces
IEEE/2015	Driver gaze tracking and eyes off the road detection system	Image	Supervised descent method,non-rigid facial deformations	+It achieved 90% accuracy +validate the performance of the system in a real car environment -need to improve the gaze estimation
IEEE/2016	Lip shape based emotion identification	Cohn-kanade	Fourier descriptors	+results are obtained as 93.9% accuracy rate for

				scalar FDS -it only suitable for lip region
IEEE/2016	Pain recognition and intensity classification using facial expressions	UNBC	Gabor features and SVM	+It produce higher accuracies -computationally expensive -recognition rate was low
IEEE/2016	A comparative analysis of different facial action tracking models and techniques	3D pose image	Online appearance methods	+It is more flexible,accurate,more feasibility -it does not completely suitable for multi-person face recognition
IEEE/2016	Facial expression recognition system on a face statistical model and support vector machines	MUG	Constrained local models and SVM	+It achieved better recognition rates -It required more processing power
IEEE/2016	Real time intention recognition	MPEG	Active shape model and SVM	+It recognized seven expressions -accuracy very low
IEEE/2017	Nasal patches and curves for expressions-robust 3D face recognition	FRGC dataset	Land marking algorithm	+it have a better performance than many 3Dholistic and multi-modal approaches +highly consistent And accurate algorithm -it applied only for low dimensional face recognition and pateren recognition
IEEE/2017	Research on factigue driving assessment based on multi-source information fusion	PERCLOS Value	FUZZY neural network semantic learning	+to improve the accuracy and reliability of driving fatigue detection -lack of verification of actual driving under the actual highway environment
Springer/2017	Sensorimotor simulation and emotion processing: Impairing facial action increases semantic retrieval demands	Nimstim	Facial motor interference	+it measuring neural correlates associated with semantic processing -very complex operation

V. CONCLUSION

Emotion recognition through facial expression detection is a challenging task in the area of image processing and human computer interaction. Extensive research have already been conducted in this field for around past two decades and last few years it received a great amount of attention due of its various applications and implementations in many domains. In this paper we have presented a comparative study on various approaches of real-time emotion recognition through detection of facial expression from a live image and video using approaches such as land marking algorithm, Bayesian model, corner detection, skin classifier, Fourier descriptors, Principle of component analysis and Support vector machines. This paper shows a survey of recent trends to automatic recognition of human facial behavior using pattern analysis and machine intelligence .Pattern analysis and machine intelligence proves effective techniques to the problem of classification, prediction, optimization, pattern recognition, image processing, etc. There are a lot of effective methods are there to detect face expression, but no method performs best in all types of situation. Each method has their limitations. The future of human facial behavior recognition system is to make a robust system that will perform efficiently in any circumstances.

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