

Facial Expression Recognition: A Review

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Abstract - Facial expression is one or more motions or positions of the muscles underneath the skin of the face. Facial expressions are a very important part of communication. Though nothing is said verbally, there is much to be understood about the messages we send and receive through the use of nonverbal communication, such as facial expression. Between Verbal and Non-Verbal type of correspondence (contact) outward appearance is type of non-verbal correspondence yet it assumes significant part. The feelings expressed on a person's face; "a sad expression "a look of triumph "an angry face "This paper incorporates presentation of facial feeling acknowledgment framework, Application, relative investigation of well known face look acknowledgment methods and periods of programmed outward appearance acknowledgment framework. Facial expression plays a principal role in human interaction and communication since it contains critical and necessary information regarding emotion. This paper goal is to present needs and utilizations of outward appearance acknowledgment.

Key Words: Emotion recognition, Facial expression, Image processing, Human Machine Interface.

1. Introduction: Facial expression is one of the most powerful, natural and immediate for the human beans to communicate and express their emotion and intention. Automatic facial expression analysis more interesting and challenging problem and it impact important application in many areas such as human computer interaction and data driven animation. Facial expression or motion is plays one of the most important role in human expression to find out his/her mind set. For more than a century expressions have been approached as bidimensional, static, instantaneous, self-contained, well-defined, and universal signals When we can text and message to our friends we use some symbolic diagram to express our filling so facial expressions is most important in our communications. Face recognition is one of the most challenging research areas in the field of computer vision. Even though face exhibits different facial features, which can be instantly recognized by human eyes, it is very difficult for a computer to extract and use the information content from these features. Communication between human been are done by verbal and non-verbal, facial expression is the part of non-verbal communication to communicate human been. Human face consists of main

sensory inputs and sensory outputs. It is used to identify gender, ethnicity, attractiveness, personality, information about age etc.

2. Facial Expression classification and it's features:

Outward appearance presents key system to portray human feeling. From beginning to end of the day human changes a lot of feelings, it might be a direct result of their mental or physical circumstances. In spite of the fact that people are loaded with different feelings, present day brain science characterizes six essential outward appearances: Happiness, Sadness, Surprise, Fear, Disgust, and Anger as widespread feelings. Facial muscles developments recognize human feelings. Essential facial components are eyebrow, mouth, nose and eyes.

Table -1: Universal Emotion Identification

Universal Emotion Identification		
Emotion	Definition	Motion of facial part
Anger	Anger is one of the most dangerous emotions. This emotion may be harmful so, humans are trying to avoid this emotion. Secondary emotions of anger are irritation, annoyance, frustration, hate and dislike.	Eyebrows pulled down, Open eye, teeth shut and lips tightened, upper and lower lids pulled up.
Fear	Fear is the emotion of danger. It may be because of danger of physical or psychological harm. Secondary emotions of fear are Horror, nervousness, panic, worry and dread.	Outer eyebrow down, inner eyebrow up, mouth open, jaw dropped
Happiness	Happiness is most desired expression by human. Secondary emotions are cheerfulness, pride, relief, hope, pleasure, and thrill.	Open Eyes, mouth edge up, open mouth, lip corner pulled up, cheeks raised, and wrinkles around eyes.
Sadness	Sadness is opposite emotion of Happiness. Secondary emotions are suffering, hurt, despair, pity and hopelessness.	Outer eyebrow down, inner corner of eyebrows raised, mouth edge down, closed eye, lip corner pulled down.
Surprise	This emotion comes when unexpected things happens. Secondary emotions of surprise are amazement, astonishment.	Eyebrows up, open eye, mouth open, jaw dropped
Disgust	Disgust is a feeling of dislike. Human may feel disgust from any taste, smell, sound or tough.	Lip corner depressor, nose wrinkle ,lower lip depressor, Eyebrows pulled down

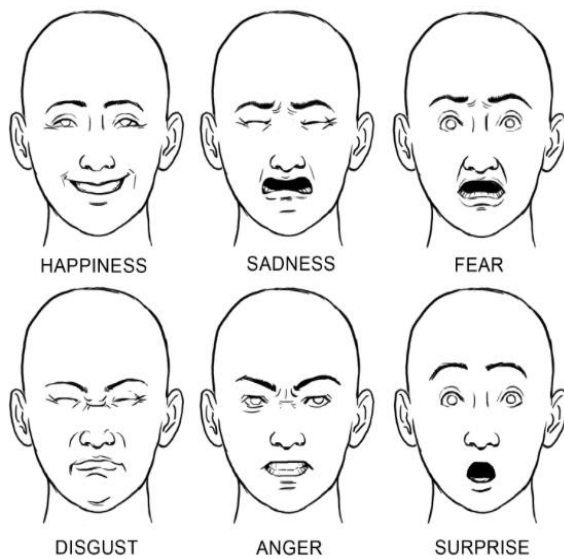


Fig-1: Basic sex facial Expressions

3. Foundation Analysis: Human can perceive feelings immediately and exertion yet acknowledgment of outward appearance by machine is a major test. A portion of the crucial outward appearance acknowledgment methods are:

3.1. Measurable development based: This paper proposed clamor and revolution invariant outward appearance acknowledgment which is based of Statistical development that is Zernike minutes. Removed component structure Zernike minutes are given as contribution to Naive Bayesian classifier for feeling acknowledgment.

Star:

i) The turn invariance is accomplished with the assistance of Zernike minutes.

ii) Recognition time under 2 seconds for frontal face picture.

Con:

i) Emotion acknowledgment framework got influenced in light of revolution of facial pictures.

3.2. Auto-Illumination remedy based: In this paper, outward appearances are resolved utilizing confinement of focuses called Action Unit (AU's) without marking them. Face is perceived by utilizing the skin and Chrominance of the extricated picture. By utilizing mapping system separated eyes and mouth are mapped together. Skin and non-skin pixels are isolated to discrete face from the foundation by utilizing Haar-Cascaded technique. This paper depends on various face picture acknowledgment.

Star:

i) Single and different face location framework.

ii) Limitation of light is evacuated and consequently revised utilizing shading consistency calculation.

Cons:

i) 60% acknowledgment rate accomplished while identifying different face pictures. In this way, it is required to accomplish more exactness.

ii) This framework endures under extremely poor lighting framework.

3.3. Distinguishing proof driven Emotion acknowledgment framework for a Social Robot:

Keeping in mind the end goal to give customized feeling acknowledgment, this paper incorporates ID venture preceding feeling characterization. For discovering facial arrangement half breed approach utilized which incorporates Active Space models and Active appearance models. Face tracker is utilized for face discovery. Composition data comprises of as set of vectors to portray the substance of 3D model.

Star:

i) Identification of subject and earlier learning about the subject improve the execution acknowledgment in term of value and speed of grouping.

ii) 82% acknowledgment rate when facial picture taken in a social robot working environment that incorporates different lighting conditions and distinctive positions and introductions of subject face.

Cons:

i) Required preparing before utilizing it as utilization of social robot feeling acknowledgment framework.

ii) Required suitable layout in the following information to cover the entire elements space for feeling acknowledgment.

3.4. E-learning based feeling acknowledgment framework:

This paper proposed E-learning based feeling acknowledgment system.SVM (Support Vector Machine) classifier based Adoost calculation used to find human face. Advertisement help calculation contrasts the classifier by removing components and week classifier to solid classifier. This is iterative weight redesigning process.

Star:

i) This paper presents application for the feeling in system instructing framework.

ii) Wearing glasses on the face range has no impact on feeling acknowledgment.

Cons:

i) Distance between the Camera and face will affect a range of face acknowledgment.

ii) Regional effect of the human face impact the execution of feeling acknowledgment like-Hear, Sitting stances, Light quality.

3.5. Psychological Face Analysis System for Interactive TV System:

This paper proposed, feeling discovery of individuals staring at the TV Program. Face look acknowledgment are utilized to distinguish particular TV viewer and perceive their interior enthusiastic state. Ada-LDA technique utilized based acknowledgment. Every second more than 15 casings can worked.

Star:

i)This paper presented a novel engineering without bounds intelligent TV.

ii) Proposed strategy depends on ongoing feeling acknowledgment framework.

iii) It can work at more than 15 outlines for every second.

Cons:

- i) Recognition rate vary with sort of facial database utilized.
- ii) Need to enhance execution of acknowledgment and timing for continuous application.

3.6. Movement identification based outward appearance utilizing Optical stream:

So as to confine facial components around dynamic Infra-Red (IR) brightening utilized. Source Vector (SV) utilized for vector accumulation which indicates movement and misshapening because of feeling representation. Feelings are characterized by evaluated comparability between the source vector and execution movement vector and most elevated level of likeness could be distinguished as identified feeling.

Star:

- i) Few number of picture casings (three edges) are adequate to recognize outward appearance.
- ii) Not important to decide accurate facial component areas, just the estimated qualities are adequate.

Cons:

- i) Recognition rate of feeling "Trepidation" is not exactly different feelings.

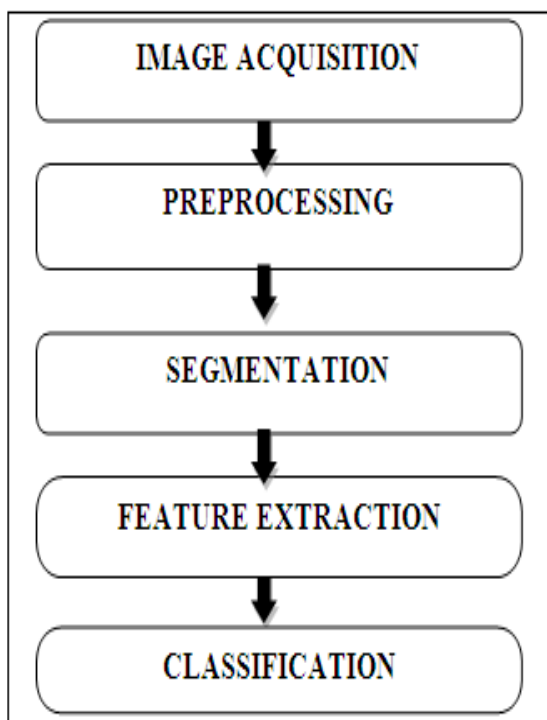
Table -1: Comparative Study

Comparative Study					
S.N o.	Title	Technique	Database	Performance (%)	Remarks
1	Statistical Moments based Facial expression Analysis	Feature Extraction: Zernike moments Classification: Naive Bayesian classifier	JAFFE (Japanese Female Facial expression) database 60 images used for experiment.	Average accuracy for six emotions are 81.66% in time less than 2 seconds.	Emotion accuracy graph shows highest recognition rate of happiness and lowest recognition rate of sadness.
2	Facial expression recognition with Auto-Illumination correction	Expressions on the face are determined with Action Units (AU's)	Single and Multiple face image	60% recognition rate for multiple face image	Illumination on image plays vital role.
3	Identification-driven Emotion recognition system for a Social Robot	Hybrid approach used for personalized emotion recognition,	MUG facial expression database used. More than 50 people frontal face database used aged between 20-25 years.	82% performance achieved with KNN Classifiers.	3D model facial image used.KNN classifier gives good performance for emotion recognition.
4	The application study of learner's face detection and location in the	SVM(Support Vector Machine) classifier based	PIE face image database used	Detection and Correction rate 95% or	Presents application of face emotion recognition.

	teaching network system based on emotion recognition	Adaboost algorithm used		more.	With application of E-learning system.
5	Cognitive Face Analysis System for Future Interactive TV	Ada-LDA learning algorithm and MspLBP features used for effective multi-class pattern classifier	JAFFE and MIT+CMU database	Recognition rate of over 15 frames per second	Real time performance with high recognition rate
6	An Efficient Algorithm for Motion Detection Based Facial Expression Recognition using Optical Flow	Infra-Red(IR) illumination used for facial feature approximately localization. Source Vector (SV) used for vector collection and identification of emotion is based on highest degree of similarity between source vector and execution motion vector	Approximately 1000 images sequences of Cohn-Kanada Facial Expression Database with 65% female facial image used for experiment	94% recognition rate	Only three frames are sufficient to detect facial expression.
7	Emotion Recognition System Using Open Web Platform	Facial Action Coding System(FACS) and Facial Action Coding System Affect Interpretation Dictionary		Accuracy of 76.6% for Determining exact emotion	Classification of Emotion id Made Based in the Movement of Reading Point
8	Multimode Emotion Recognition(MER) System	The use Microsoft XBOX KINECT Sensor,The data include 2D facial images,3D face Feature	MER fusion Recognition part and new database		There is 25 feature in 2D data,32 feature in 3D data an 13 feature in audio data
9	Rodust Facial Expression Recognition Using Spatially Localized Geometric Model	For Feature Extraction The Algorithm Uses Edge Projection Analysis	The Cohn Kanade database consists of Grayscale image sequence	The Algorithm Achieves an Accuracy of 90% for Facial Expression Recognition	A Lip-enhancement Transform for Better Segmentation of Lip-region in color image was Proposed
10	Natural Face Classification Using Personalized	The Proposed Method is Made Rohust	CK+,ISL and Internal Database are	With low Complexity Pre-Processor	This Approach May not handle

Appearance Mode For Fast And Robust Emotion Detection	to Varius type of user head Motions	used	having a Pre-processing Accuracy of 66%	talking Face
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4.5 Classification: Classification stage follows the output of feature extraction stage. Classification stage identifies the facial image and grouped them according to certain classes and help in their proficient recognition. Classification is a complex process because it may get affected by many factors. Classification stage can also called feature selection stage, deals with extracted information and group them according to certain parameters



5. APPLICATION AREA:

With the rapid development of technologies it is required to build an intelligent system that can understand human emotion. Facial emotion recognition is an active area of research with several fields of applications. Some of the significant applications are:

- i) Alert system for driving.
- ii) Social Robot emotion recognition system.
- iii) Medical Practices.
- iv) Feedback system for e-learning.
- v) The interactive TV applications enable the customer to actively give feedback on TV Program.
- vi) Mental state identification.
- vii) Automatic counseling system.
- viii) Face expression synthesis.
- ix) Music as per mood.

- x) In research related to psychology.
- xi) In understanding human behavior.
- xii) In interview

6. CONCLUSION: Extensive efforts have been made over the past two decades in academia, industry, and government to discover more robust methods of assessing truthfulness, deception, and credibility during human interactions. Efforts have been made to catch human expressions of anyone. Emotions are due to any activity in brain and it is known through face, as face has maximum sense organs. Hence human facial activity is considered. The objective of this research paper is to give brief introduction towards techniques, application and challenges of automatic emotion recognition system

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