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Emotion Detection and Feedback Generation: Survey

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Abstract: Human emotions & facial expressions play an effective way of non-verbal communication. This is because humans demonstrate and convey a lot of evident information visually rather than verbally. Although humans recognize facial expressions virtually without effort or delay, reliable expression recognition by machines remains a challenge as of today. To automate recognition of emotional state, machines must be taught to understand facial gestures which can be used widely in different environments (like classrooms for taking automated feedback). Here we propose a system which will take will analyze the emotions of the students in classrooms and generate the required feedback based on those emotions.
Keywords: Facial Landmarks, Feature Extraction, Haar- classifier, SVM.

I. INTRODUCTION

Face plays significant role in social communication. This is a 'window' to human personality, emotions and thoughts. According to the psychological research, nonverbal part is the most informative channel in social communication. Verbal part contributes about 7% of the message, vocal – 34% and facial expression about 55% to the effect of the speaker's message.
Emotions are feeling or response to particular situation or environment. Emotions are an integral part of our existence, as one smiles to show greeting, frowns when confused, or raises one's voice when enraged. It is because we understand other emotions and react based on that expression only enriches the interactions. Computers are "emotionally challenged" i.e. they cannot directly understand human emotions or expressions. Face is a subject of study in many areas of science such as psychology, behavioural science, medicine and finally computer science. Over the last few decade lots of work done in facial Expression detection and recognition .Facial emotion recognition is one of the specific issues of computer vision. Emotions which can be classified like fear, happiness, joy, sadness and aggressiveness .Emotional expressions at face are related to the movements or positions of the muscles under the skin and are a form of nonverbal agreement.

Figure: Facial Expressions.

But there are still variety of limitations that make face & emotion detection difficult.
For example

1) Occlusion: faces may be partially occluded by other objects.
2) Presence or absence of structural components: beards, moustaches and glasses.
3) System cannot detect if a person is faking emotion.
4) Pose (Out-of Plane Rotation): frontal, 45 degree, profile, upside down.
5) Orientation (In Plane Rotation): Face appearance directly varies for different rotations about the camera's optical axis.
6) Imaging conditions: lighting and camera (sensor response, gain control, lenses), resolution.

II. LITERATURE REVIEW

"Dan Duncan", et.al introduced convolutional neural network for classifying human emotions from dynamic facial expressions in real time. The have used transfer learning on the fully connected layers of an existing convolutional neural network which was pre trained for human emotion classification.

A variety of datasets, as well as their own unique image dataset, is used to train the model. An overall training accuracy of 90.7% and test accuracy of 57.1% is achieved. Finally, a live video stream connected to a face detector.

"Saumil Srivastava," et al discusses a novel method for Facial Expression Recognition System which performs facial expression analysis in a near real time from a live web cam feed. Primary objectives were to get results in a near real time with light invariant, person independent and pose invariant way.

The system is composed of two different entities trainer and evaluator. Each frame of video feed is passed through a series of steps including haar classifiers, skin detection, feature extraction, feature points tracking, creating a learned Support Vector Machine model to classify emotions to achieve a tradeoff between accuracy and result rate. A processing time of 100-120 ms per 10 frames was achieved with accuracy of around 60%.

We measure our accuracy in terms of variety of interaction and classification scenarios.

"Marryam Murtaza", et.al introduces automatic face recognition is one of the most emphasizing dilemmas in diverse of potential relevance like in different surveillance systems, security systems, authentication or verification of individual like criminals etc. Adjoining of dynamic expression in face causes a broad range of discrepancies in recognition systems. Facial expression not only exposes the sensation or passion of any person but can also be used to judge his/her mental views and psychosomatic aspects.

"Sarbani Ghosh", et al Facial expressions play a major role in Face Recognition Systems and image processing techniques of Human Machine Interface.

There are several techniques for facial features selection like Principal Component Analysis, Distance calculation among face components, Template Matching. This algorithm describes a simple template matching based facial feature selection technique and detects facial expressions based on distances between facial features using a set of image databases. The algorithm involves three stages: Pre Processing, Facial Feature Extraction and Distance Calculations.

Then, identify whether a human is smiling or not using the measurement of Euclidean distances between pairs of eyes and mouth region of that face quality requires new tools for size and color measurement and capturing the fruit side view image, some fruit characters is extracted by using detecting algorithms.

"S. Sharmila," describes that Student engagement has been a key topic inside the educational training. The three specific styles of engagement of the students in a class are: behavioral, emotional, and cognitive. The time period behavioral engagement is commonly used to describe the scholar's willingness to participate within the getting to know system. Emotional engagement describes a scholar's emotional attitude toward learning. Cognitive engagement is a chief part of overall learning engagement. From the facial expressions the involvement of the students in the magnificence can be decided. Commonly in a lecture room it's far difficult to recognize whether the students are able to understand the lecture or no longer. So that you can know that comments form will be collected manually from the students. However those feedbacks given by using the students will now not be correct. Hence they will no longer get proper comments. This hassle can be solved by means of the use of a facial emotion evaluation. From the facial expression the emotion of the students may be analyzed and required feedback can be generated.

III. PROPOSED SYSTEM

The proposed system will be able to analyse the emotion or expressions of the students in a classroom and generate the required feedback. This feedback can be used by the teacher to evaluate student engagement and improve interaction (like slowing down, speeding up etc.).

A. System Architecture

The proposed system architecture is given below

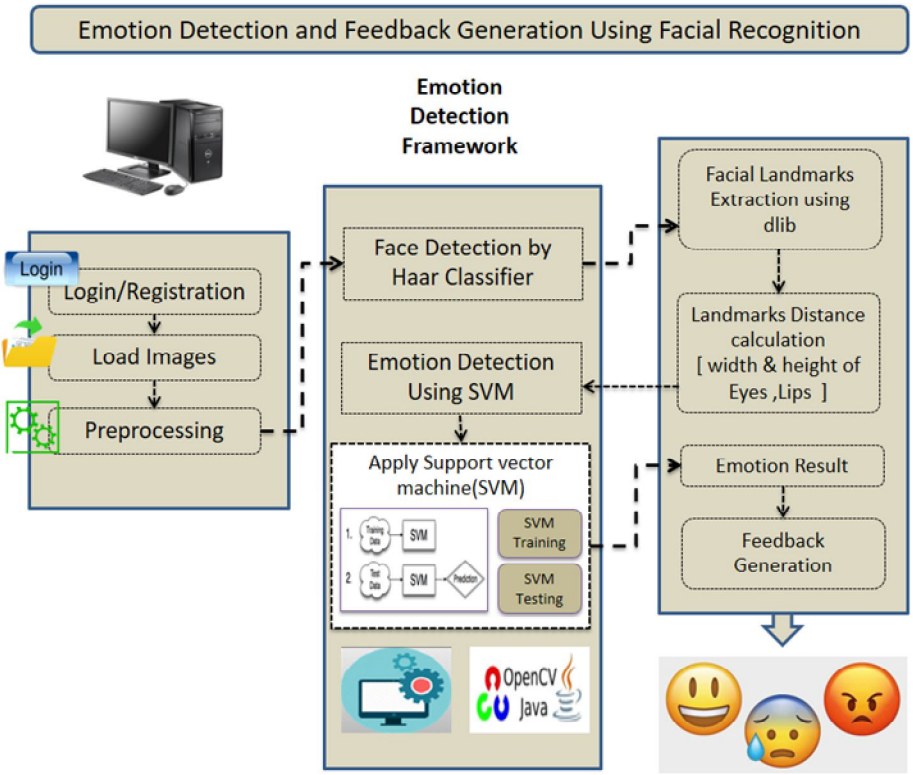


Figure: - System Architecture.

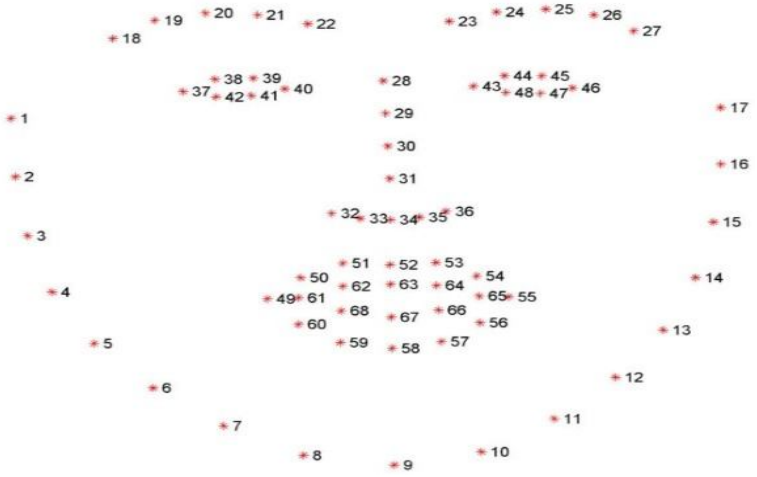
B. Procedurals Steps

Facial expression recognition is composed of three major steps

1) *Face Detection:* Open-CV a popular image processing library is used in the proposed system. Pre-processing of image (like noise removal, RGB to Grey-scale conversion etc.) is needed and can be easily done using Open-CV's pre-defined library functions. After the pre-processing is done Haar-Classifier (a popular face detection algorithm) can be used for Face detection to detect all the student faces in the image.
2) *Feature Extraction:* The next step is feature extraction. On all the faces that are detected in the first step we will be extracting facial landmarks using the dlib library. The pre-trained facial landmark detector inside the dlib library is used to estimate the location of 68 (x, y)-coordinates that map to facial structures on the face. Then the features can be evaluated by calculating the Euclidian distance between two points (like in above image when a person is smiling the distance between the points 49-55 will increase). Examining the image, we can see that facial regions can be accessed via simple indexing

a) The mouth can be accessed through points.
b) The right eyebrow through points.
c) The left eyebrow through points.
d) The right eye using.
e) The left eye with.
f) The nose using.
g) And the jaw via.

These seven features can then be stored for every face in our database (MySQL).



3) Expression Classification or Recognition: The third step is to classify or recognize the emotion in the image based on the features extracted. A supervised machine learning algorithm (SVM) can be used for this purpose. SVM will be pre-trained to recognize the emotions in the image and then our database will be passed to SVM as testing data and it will map all the faces in the image to an emotion. Then the percentage of the every emotion in the image will be evaluated and based on that a rating will be generated as a feedback.

*4) **Applications:*** Health care, Games, E-learning, Education System.

IV. CONCLUSIONS

This system proposes an effective way for Emotion detection and Feedback generation using Image Processing techniques. The system will perform various operations like face detection, feature extraction and expression classification and based on the classified emotions feedback can generated and engagement of the students in the classroom can be evaluated.

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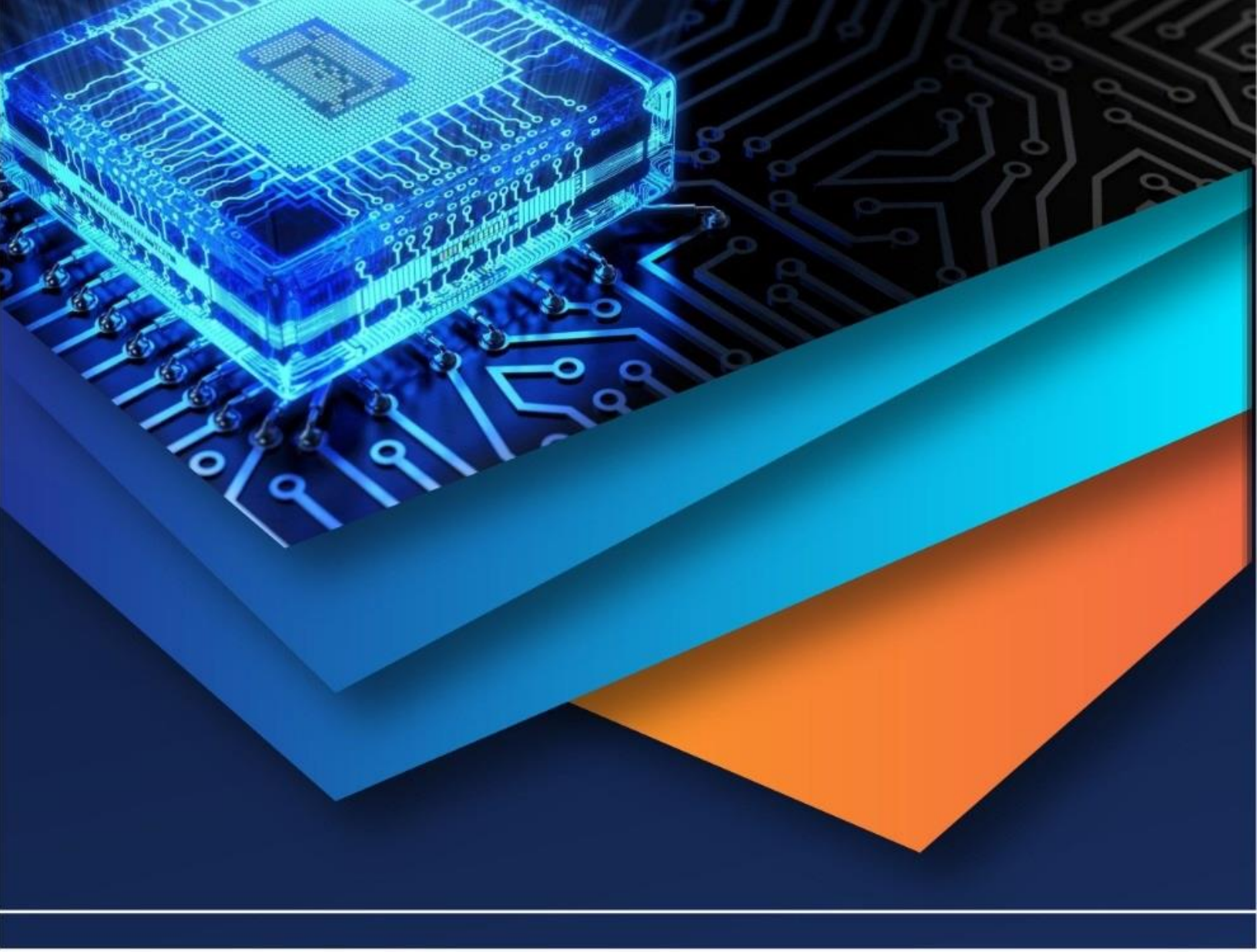

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