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Stress Detection Using Facial Expression

Suyash Patinge, Akash dhanwari, Renu Lode, Sayali Nakhate, Gaurab Biswas, Nikita Hatwar

Department of Information Technology, Priyadarshini College of Engineering, Nagpur

suyashpatinge@gmail.com

Abstract: Classifying face image as a picture of given individual is probably the most difficult recognition task that human carry out on a routine basis with nearly perfect rate. Various strategies for facial feature detection have ever been proposed starting from using "Generalized symmetry operators". There are many techniques and algorithms for evaluating human expression. Facial expressions place an important role in stress detection. There are many factors that have significant role in evaluating stress like lips corner, forehead, eyebrows, etc. Facial expression can be identified by comparing the different images stored in database. Mostly effort was put on extraction of face graph with as many as 48 nodes to code on face. Only 17 facial features all of which have different meaning and exact position are localized for each face new image. It provides basis for highly accurate facial feature detection.

Keywords: Symmetry, Face Graph.

1. INTRODUCTION

Human stress is becoming the most trending topic in the field of research over last few decades in healthcare sector. New more advanced software and applications are being developed to study the stress levels in human body. Facial muscle contraction are the major factors in determining the stress from face. Nowadays people are becoming more prone to more prolonged chronic stress, in this paper we are trying to explore various stress detection techniques to track various stress levels of human through facial expressions.

There are many techniques and algorithms like support vector machine, local binary patterns, image morphology and neural networks which can help us to determine stress through facial expressions. There are many issues in facial recognition system like improper illumination and overlapping and quality of images.

Its studies about the detection of stress through videos recorded facial cues. It is a camera based activity. Facial expressions place an important role in stress detection. There are many factors that have significant role in evaluating stress like lips corner, forehead, eyebrows, etc.

Head	Eyes	Mouth
Head movement	Blink rate	Mouth shape
Skin colour	Eyelid response	Lip deformation
Heart rate (facial PPG)	Eye aperture	Lip corner puller/depressor
	Eyebrow movements	Lip pressor

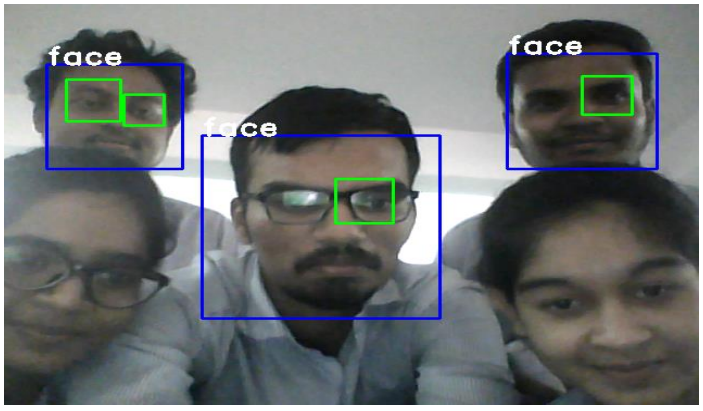
Fig 1.Senses

In this work, we developed a stress detection system based on the analysis of facial expressions. We evaluate the proposed system on different recorded datasets. We detect an individual emotion in each video frame and decision should be concluded from the stress level. Nowadays human psychological stress is vast and it is highly increased to avoid this stress we have been studied to track stress of human being.

2. METHODOLOGY

2.1 FACE ROI DETECTION

The fundamental step of facial analysis via image/video recordings is face detection. It is the initial pre-processing step for facial recognition and facial expression face modelling and head pose estimation. The various methods used to differentiate are support vector machine ,artificial neural networks(ANN),Gaussian filter ,active shape models, Euclidean distance calculation are used for basic classification .This algorithm uses the combination of AdaBoost algorithm and Haar like features.



2.2 ACTIVE APPEARANCE MODEL

Active Appearance Models are widely applied

Towards facial expression classification and

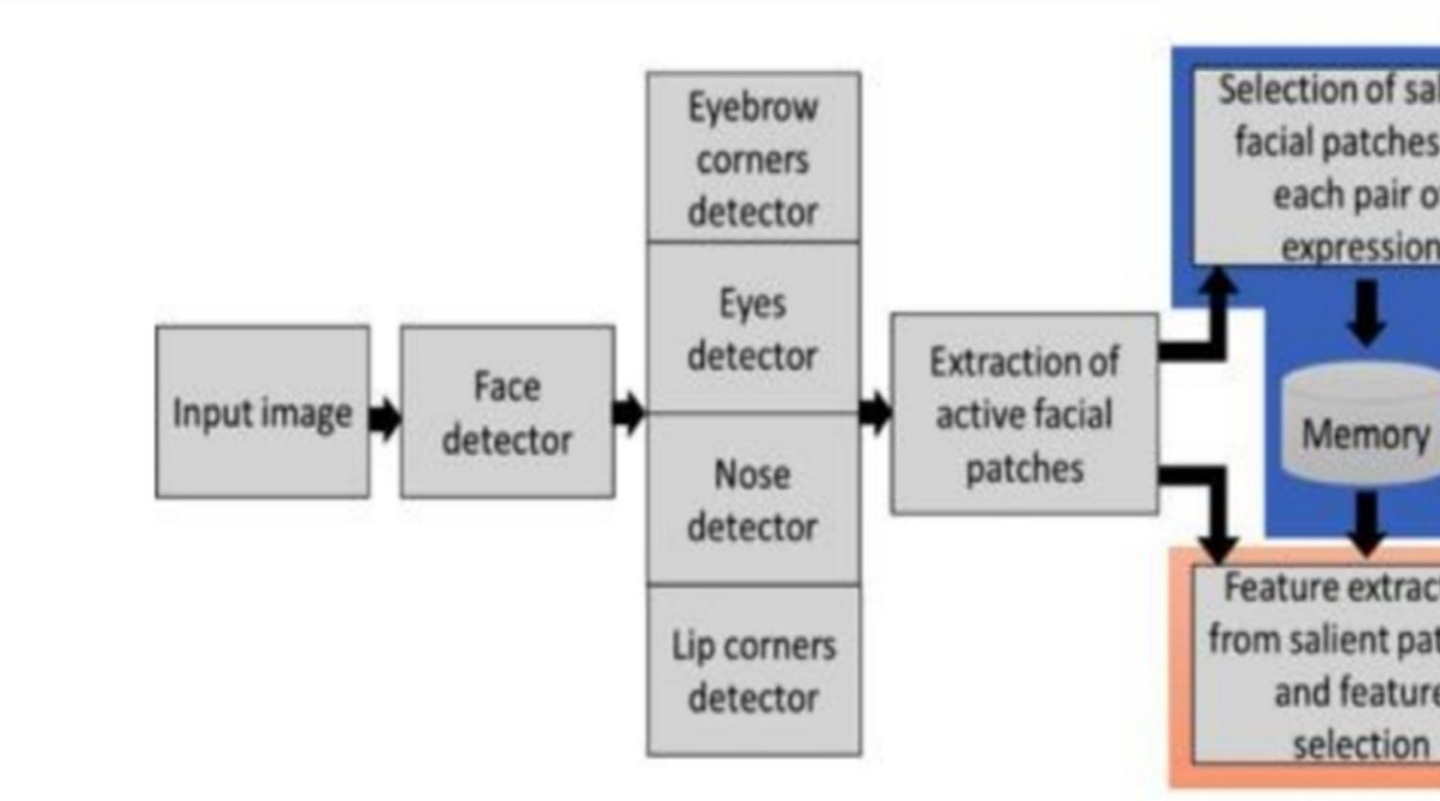
emotion recognition as it provides stationary appearance and representation of face.

2.3 RANDOM FOREST ALGORITHM

Random forest algorithm creates decision trees on data samples and then gets the prediction from each of them and finally selects the best solution by means of voting. It is an ensemble method which is better than a single decision tree because it reduces the over-fitting by averaging the result.

Random forest is a supervised learning algorithm which is used for both classification as well as regression.

SYSTEM ARCHITECTURE



2.4 EYEBROW DETECTION

The pattern of the various different facial features can be extracted using several approaches. The analysis of every row of normalized image can be done by using Pixel value analysis of the input image from the extreme top left. We use scale of (500 x 500) pixels to investigate the approaches of Pixel value analysis.

2.5 EUCLIDEAN DISTANCE CALCULATION

There are various ways to compute distance on a plane. Euclidean distance calculation is used to calculate the distance between two objects in an image.

$$\sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}$$

q=actual distance

p=input distance

A digital image that has only two possible ways for each pixel is known as binary converted image .Two colors used for binary image are black and white every single bit of 0 or 1 stores pixel of this bitonal image .The bit value 0 corresponds to black and white 1 .The image converted to binary form is used for the pixel analysis technique, which produces the (i,j) coordinates of the eyebrow as depicted.

The major area of interest in the phase of facial feature analysis are the rigid transformations which are shown by eyebrow movements which acts a major contributor for stress detection methodology which uses the submodules for variation and calculation of displacement ,classifier which helps in stress detection.

The variability of eyebrow transformation in the subsequent image is calculated over a period of time. The set of images which shows the variance over threshold is classified as stressed over an interval of time by sub-modules.

1.6 DEEP LEARNING

The final modules which consists of all the submodules of training dataset is known as deep learning. The prediction ,training and modelling was done with the learning regression algorithm which is trained using the python package tensor flow and incorporated with gradient descent algorithm to achieve maximum optimization.

$$\mathbf{Y=mX+c,}$$

Where X=eyebrow movements, Y=The corresponding emotion.

Conclusion and Future work:

The proposed system integrates image processing and deep learning .We developed a system which can help to monitor stress on daily basis for an individual. To train our model we used 68_landmarks shape predictor.

These processing of image was done in order to extract a feature(**eyebrow)** with input which were used to train linear regression model and test this model with test dataset. Although the obtained results are primary ,the main added value of our work is achieved by enabling the end user to successfully detect stress and minimize the health risk in future.A study on a larger scale will be part of our future work.

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