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User Satisfaction Detection System for Smart Healthcare using Multimedia

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Abstract*: *Emotion plays a critical job ineffectively conveying one's convictions and intentions. As an outcome, identification of emotion has turned into focus point of few studies recently. Patient observing models are getting to be significant in patient concern and can endow with helpful feedback related to health issues for caregivers and clinicians. In this work, patient fulfilment recognition framework is proposed that uses image frames extracted from the recorded visual-audio modality dataset. The images are treated with techniques such as Local Binary Pattern (LBP) which is a ocular descriptor. The proposed framework incorporates feature extraction from the images and then the Support Vector Machine (SVM) is applied for classification. The three distinct types of emotions are whether the patient is happy, sad or neutral and the same are detected based on the results. The result of such an analysis can be made use of by a group of analysts which include doctors, healthcare experts and system experts to improve smart healthcare system in steps. The reliability of information provided by such a system makes such upgradations more meaningful.

Keywords: **Patient monitoring, Emotion detection, feature extraction, LBP, SVM**

I. INTRODUCTION

With the development of ease processing and capacity, a few smart solution platforms are picking up fascination in getting better nature of human life. Especially, elegant healthcare is in incredible interest due to the amplification in population as well as decreasing in ratio of people visiting clinic, also some of the public are busy to venture out to specific medical centre for diagnosis of disorder.

A huge number of smart phones, sensors, implantable/portable or wearable devices have been used to offer healthcare facilities in hospitals as well as in home. A winning smart healthcare system need few parameters, consisting of convenient restorative sensors, high accuracy, affordable cost, omnipresent environment of structure, also reduced setback in arriving at conclusion. This is not accomplished in solitary construction, despite the fact that effects were made throughout the last previous years.

For a organized healthcare framework to be proficient, various demands and issues certainly necessitate to be conquered. The key concerns are to provide safety and to maintain privacy, as such a smart healthcare would necessary to contribute to a lot of data about users and patients with others for example, medical practitioners, physicians, specialists, researchers and government agencies. The discovery of an increased number of healthcare services, information and technologies, has fascinated awareness from industry as well as academic world to know thoroughly about the patients, detecting their diseases, taking medical decisions and to carry out research for the patient care. Customer contentment is a crucial objective for keen healthcare dealing. A clinical co-operator can acquire feedback on consumer satisfaction with the help of review conducted by paper or machine-dependent. Problem in arranging analysis from time to time is based on user interest or they will run out of time. An automatic satisfaction detecting from the emotions through expression of face or user gestures can solve this problem to a great extent. The work described here takes video clips as the input. As the patients come out of the consultancy room the videos are automatically recorded and face images are extracted from that. In this work, the video which is already recorded is taken as input dataset. The features such as mean, standard deviation, skewness and kurtosis are detected. Local Binary Pattern (LBP) is applied for the visual emotion description. LBP is specifically designed for monochromatic images then extended for colour images and advanced for videos. The labels or their statistics are straightforwardly used for additional analysis. Then the Support Vector Machine (SVM) is applied for the classification. The dataset taken as input is divided into training and testing dataset. Based on the classification the outcome is predicted whether the patient is satisfied by the diagnosis or not. The result shows three predictions neutral that indicates neither improvement nor nuisance in health, negative which shows issues in health and smile indicating satisfaction. This automatic recognition of patient health condition aids in obtaining automatic feedback without manual survey. The feedback further assists in diagnosing the disorder.

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II. RELATED WORKS

Emotion identification and recognition were presented by researches with individual observers. Saeed Turabzadeh et al. [2] analysed that computerized recognition and the revise of the facial emotions speak to generous proposals for the manner by which an individual performs, and are exceptionally useful for identifying, examining and managing defenceless persons to be safe for instance patients who suffer mental problems, people who experience severe mental pressure, and youngsters with less capacity to handle themselves. With the help of emotion recognition capability, equipments like robots, computers, game consoles and toys will have the ability to so as to impact the abuser in versatile ways applicable to the patient's psychological situation. Monika Dubey et al. [3] examined necessities and applications of facial expression recognition. This work incorporates overture of facial emotion identification system, functions, comprehensive study of popular face idiom recognition methods and stages of system. Prachi Shukla et al.

[4] gives a overview of research effort accomplished and available in the field of facial emotion identification and numerous approaches utilized for facial expression detection. Assel Davletcharova et al.[5] conducted an investigational learning on detecting emotions from human voice. The emotions that are taken into count for the experiments are angry, sad, glad or neutral. The discrimination of emotional characteristics in voice has been studied initially followed by emotion categorization carried out on a dataset.

Alpert et al. [6] reviews the audio course of patient voice with sadness. In this study, they analysed audio characteristics measuring voice confidence and metrics in the voice of patients with sadness for therapeutic treatment evaluation. Ghulam Muhammad et al. [7] proposed a system that applies a transform called to a face image to extort bands. Then CS-LBP is applied to every band. The block histograms of the CS-LBP are integrated producing a characteristic vector of image for face. Wang et al. [8] proposed A Fourier parameter (FP) system that utilizes intuitive aspect of speech eminence along with differences of first and second order voice indication. H. Muthusamy et al. [9] projected a feature improvement method with the help of a Gaussian mixture model (GMM). Inequitable influence of features extorted by voice and signals of glottal on the basis of probable GMM score are enriched. Hossain [10] devised a patient state-identification model for health system in which the mind status of a patient is automatically detected as whether the patient is suffering from pain or is normal or in tension by using audio and visual inputs. Then these are handled in cloud servers integrating the two inputs. It is intended to facilitate healthcare professionals providing fast solutions.

Atif Alamri[11] proposed a user fulfilment recognition system by utilising 2 multimedia like image and voice. 3 categories classified such as fulfilled, not fulfilled, and then unconcerned. In this framework, voice and face image of patient were taken, which are sent to cloud for analyzation. Conclusion on the fulfilment is conveyed to suitable collaborators. Di Huang et al. [13] presented in this paper a broad review of LBP procedure, inclusive of few more current variations. As a distinctive appliance of the LBP method, LBP-dependent facial image study is expansively reviewed, as well as its victorious extensions, which deal with a variety of errands of facial image investigation, are highlighted too. S. Datta et al. [12] presented a quick facial emotion categorization method that implies the concatenation of texture-based and geometric characteristics. For sorting, to influence the binary taxonomy abilities of a support vector machine classifier to a stratified graph-depended design that permits multi-class organization is purposed.

By considering the evaluation of all existing methods for patient emotion monitoring, some of the drawbacks are resolved using the proposed work here. LBP is applied for images pixels which are extracted from the video. The work includes some distinct features extraction such as mean, standard deviation, skewness and kurtosis from the image. The effective technique like SVM and RF are applied in consistent to obtain the appropriate outcomes.

III. PROPOSED SYSTEM

The proposed workflow consists of obtaining the video clips and extracting frames of face images from the video as the first step. Here the dataset used is CREMA-D dataset. The dataset includes emotions of persons uttering diverse sentences. However the perspective of voice is unlike, it models emotions in audio and video in the manner we expect. The emotions that are covered in the dataset are Disgust (DIS), Neutral (NEU), Fear (FEA), Sad (SAD), Anger (ANG) and Happy/Joy (HAP).

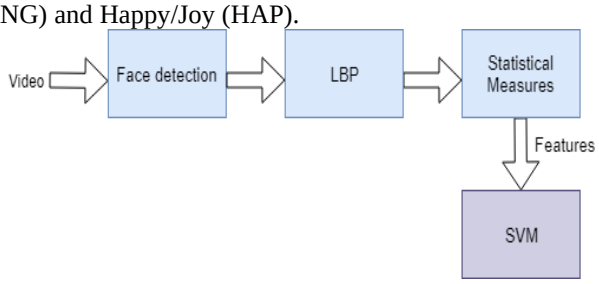

Figure 1: Block diagram of patient emotion monitoring System

A. PROCESSING OF VIDEO DATA

A key image frame per second video is selected. It is determined by comparing the frames in histogram. The key frame is selected when the distance between a frame and its previous and next frames is minimal. This key frame is then called as the image signal. The face area of the image signal is extracted by using a face detection algorithm. An LBP is applied to the extracted face image to obtain an LBP image. LBP is a powerful texture descriptor and is computationally efficient

In a rectangular LBP, a window size of 3 x 3 pixels is selected. The intensity of the middle pixel is set as a threshold of the window. If the intensity value of a neighboring pixel is greater than the threshold, then “1” is assign to neighboring pixel location; otherwise “0” is assigned. The arrangement of “1” and “0” of location of the eight neighboring pixels is concatenated to form an 8-bit binary number, which is then transformed to a denary value. The denary value is the LBP of the middle pixel. The window is slid by one pixel, and the process is repeated. A histogram is formed from the LBP image. Several features like mean, standard deviation, skewness and kurtosis are calculated from the histogram to describe the facial image.

B. CLASSIFICATION

The Support Vector Machine (SVM) is used as the classifiers that are known to have promising performance over visual data.

The dataset is classified into 80 percent training and 20 percent testing dataset.

The workflow of the proposed framework is shown in figure

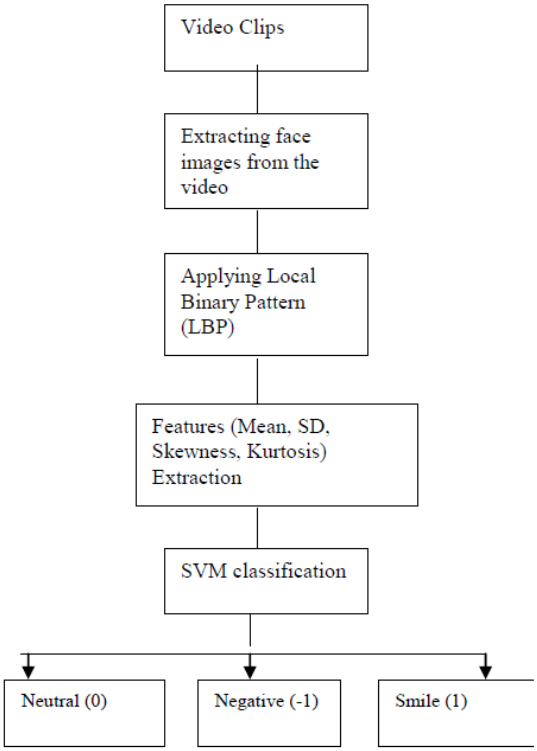

Figure 2: Flow diagram of patient emotion monitoring System

As displayed in the figure 2 the SVM classification results in the three final predictions. Neutral indicated by 0 shows that the patient is not affected by consulting a doctor. Negative indicated by -1 shows that the patient is not satisfied by the treatment. Smile indicated by 1 shows that patient is happy with the treatment.

IV. RESULTS AND DISCUSSION

In this work by using SVM technique the result obtained is: Training score is 0.6813 and testing score is 0.6993

Table 1: Accuracy evaluation with distinct data splits.

Sl.no	Split	SVM		RF	
		Training score	Testing score	Training score	Testing score
1	10 %	0.684485	0.671140	0.998524	0.815470
2	30 %	0.684584	0.678011	0.962871	0.752212
3	40 %	0.681522	0.685589	0.934431	0.725991

As we know, SVM is more popular for the analysis of hyperspectral data. The principal cause of SVM's esteem for classification is to achieve the elevated accurateness of classification along with reduced quantity of training data and capable of outperforming than any other traditional approaches (not every time, of course). However in some cases, RF can outperform SVM depending upon the input data and training data.

Table 1 depicts framework accuracy whenever the data splits are 10%, 30% and 40%.In the case of SVM technique, the training and testing accuracy remains almost constant for each different split. whereas in the case of RF technique, the training and testing accuracy decreases for each increased split. So, from the table, we can conclude that SVM performs better by achieving the same amount of accuracy with the small number of training data set also.

V. CONCLUSION

Widespread efforts have been done in excess of past 2 decades in industry, academic and government sector to determine more vigorous approaches of assessing reliability, deception, and integrity throughout human communications. Efforts have been carried out to grab human emotions. Expressions are based on the activities in mind and are expressed via face, as face have utmost sense organs. A patient satisfaction recognition system using image video for a intelligent model of health is projected here. LBP features are utilized for image signal. Few tests are executed by making use of SVM and RF as the classifiers and the system achieves best accuracies as discussed in Results and Discussion section.

In future work, to use extremely complicated classifying model, for example active learning is intended, that has been profitably utilized for sentiment identification. MPEG-7 audio characteristics are proficiently utilized for auditory–video feeling detection. Such attributes are used as well as incorporating few other contribution modalities for improving the accurateness of the model proposed.

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