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Prediction of Psychological Disorder using ANN

Purva D. Kekatpure [#1], Prof. Rekha S. Sugandhi [*2]
[#] *Department of Computer Engineering, M.I.T. College of Engineering Kothrud, Pune, India, University of Pune*
[*] *Department of Computer Engineering, M.I.T. College of Engineering Kothrud, Pune, India, University of Pune*

***Abstract*— The analysis of emotions can be performed on various sources of input. In this paper, a multimodal emotion recognition method is used to extract emotion information from both speech signals i.e. Spoken contents as well as image. This paper discusses a system that can interpret affect data in psychological disorder with ANN mining technique and computational models. We take into account the complexities of human emotion representation in images, videos and speech or voice that is more challenging and susceptible to inconsistent outcomes. The design of proposed system aims towards a generalized solution for such kind of text mining, opinion mining applications which emphasizes a simplified emotion representation and analysis system that can be subjected to fine-tuned analysis, depending on future requirements. The aim of our work is to develop a paradigm that can be used for (unsupervised) learning from some given speech and facial recognition, Speech is most direct way of communicating with any person or system, facial recognition provides an elegant way of interacting with visual objects.**

***Keywords*— Affective Computing, Natural Language Processing, Computational Modeling, Opinion mining, Text mining, Text analysis.**

I. INTRODUCTION

The Affective Computing is one of the basic field of psychology, in which "affect" means "emotion". Emotion recognition is a technique that serves as a part of affective computing where the emotion level of the source is measured on a certain scale. In general representing emotions is a very difficult task, since it represents an abstraction of human feelings that cannot be measured directly through physical symptoms. The other issue related to emotion recognition is the type of emotion and the intensity of that particular emotion. Emotion expressed in the input may not be analysed consistently depending on the techniques used to filter contents. For example, the sentence, "jerk his hands and react" might not be expressive enough to indicate the involved emotion with regard to the statement. It is important to weigh these words or expressions with relevance and intensity measures to decide the Dominance of the sentiments expressed. The "Jerk his hands" mentioned in the example statement, may be indicative of "anger", "feeling of aggressiveness", "disappointment", or may be "sadness"[17].

There are various sources of input (namely text, speech, facial expressions, body language etc.) that exhibit human affects. This paper considers video(image/speech) as the source input to be analysed to identify the (set of) emotions or sentiments expressed, opinion mining applications are often required to analyse a dataset for affects and summarize them at various levels of the data contents namely, as a topic feature or at different contexts in the document body.

At such a time, the Analysis model should be tuneable on parameters the choice of prevalent "n" number of affects in the database content in a certain order of relevance, the monitoring of variations in the exhibited aspects throughout the flow and so on. Hence, a flexible and robust model that can cater to the above tuning parameters.

In this paper, a model is proposed that takes multimedia (video and audio) files as its input and analyses it to give the various emotions that it is related to. The system initially represents the organization of emotions in a graphical-cum-taxonomical form. This necessarily includes the partitioning of all known emotions into sets and subsets that follow the human perceptions of theses emotions. It is hence presumed that a certain predefined set of thoughts and perceptions shall be provided in the form of an emotion database that will assist the system in analysing the input data for the related expressions or emotions expressed in it. This important assumption is made since the method of categorizing emotions depends on the intended purpose of the analysis. The emotions that are considered relevant in an input source would be different for psychoanalysis, weblog mining for commercial products, analysing candidates for job interviews, and so on.

The granularity of emotion analysis may differ depending on the application. For summarization of most relevant set of emotions at the various levels, the granularity of semantic representation may be kept low. But often, it is needed to scrutinize an entire set of documents and keep track of the emotional level of all animate entities involved, and give a detailed analysis of all those entities. In such cases, the level of granularity while processing the data for semantics is very high. It is preferable, if the method of emotion analysis can be tuned to the preferred level of granularity.

II. RELATED WORK

In many different ways researchers have tried various approaches to solve problems related to affective computing through AI techniques, like Support Vector Machines, Hidden Markov Model, Bayesian networks and

simple taxonomical approaches. The task of multimodal sentiment analysis demonstrate a joint model that integrates visual, audio and textual features which can be effectively used to identify sentiment, from these researchers also identified five multimodal features helpful to differentiate negative, neutral and positive sentiments: polarized words, smile, gaze, pause and voice pitch. Further work in emotion recognition also involved categorizing the document in one of the major categories of emotions namely Anger, Fear, Happiness, Sorrow and the like. Some thoughtful reading of many different methods followed previously for audio visual emotion recognition or text based sentiment analysis. Each of these methods involves a different approach, dealing with either the extraction and processing of data, or with machine learning algorithms used for classification. Numerous text processing applications have already used various techniques for automatic subjectivity and sentiment analysis, including automatic expressive text to speech synthesis. Many Natural Language processing tasks uses subjectivity and sentiment classification as a first phase filtering to generate more feasible outcome.

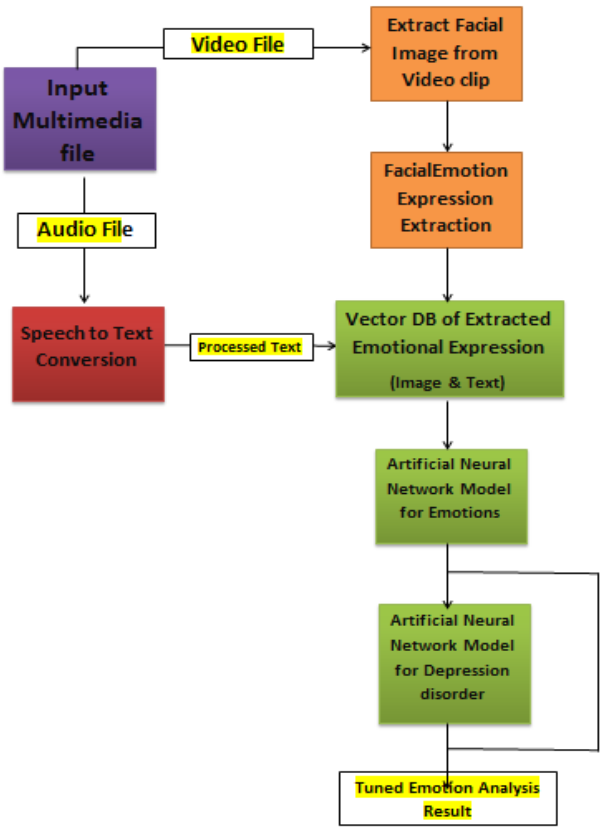

Fig: 1 System Architecture for Proposed System

III. ARCHITECTURE

First, identify context blocks in the input as Video clip then decode that clip to extract the emotional expression images. Similarly, for speech to text conversion follow the process and extract the emotion content, for that system requires a knowledge-base for the natural language in which the input text document is expressed. Thus for word sense disambiguation, we need a lexicon. The lexicon that we refer to in our system is the widely-used Word Net. Word Net is used to find the semantic relation in the identified words in order to find their possible links to emotive words or actions. The system design allows use of any online dictionary that can be used as a lexical resource. And finally transfer all the data content which are obtained from image and audio data to integrated database. Based on the granularity required, output the major emotion in the document, either block-wise or document wise. Further detailed implementation steps of analysis and mapping of data content is given below in Fig2 and Fig3.i.e. Preprocessing of Integrated Database obtained from image data and Speech data via Artificial Neural Networks and Graph based approach of Emotion analysis.

IV. GRAPHICAL CLASSIFICATION OF VARIOUS EMOTION

The idea behind our classification method for the listed (known) emotions below is to be able to reach the required level expected from the granularity tuning parameter value. The graph structure now simplifies the relation (linkages) between the various sets of emotions. The graph structure is conceptually built on a single, layered Directed Acyclic Graph. It grows upwards, with the root(s) at the bottom. Its growth upwards is strictly non-decreasing. An upper layer contains all the nodes from lower ones. A node has a scale value/weight associated with it; so does a link. The weights on nodes and links are calculated from top to bottom. That is, from one layer to the next (in the downward direction), Note that the top two levels, all downward links are one-to-one; otherwise, the links downward from any node must be normalized to have their weights sum to one. The basic idea here is to let the information filter down the graph through the links attached depending on the strength of the links (that is indicated by the link weights).Emotions have been classified based on the general taxonomical structure and notion that there are four Pure emotions, namely, anger, fear, happiness and, sadness. These four pure emotions can be appended to eighteen more general or basic emotions that in our terminology give twenty-two primary emotions. The set of pure and primary emotions thus can be as listed below pure emotions:Pu = {anger, fear, happiness, sadness, surprise} primary emotions: Pr={aggressiveness, anger, avoidance, compassion, courage, excitement, fear, happiness, helplessness, humility, impatience, indifference, joy, optimism, pain, patience, pessimism, sadness, selfishness, surprise, unselfishness, vigilance }[17]

The emotion graph has been organized as layers of nodes (that resembles an inverted tree data structure) with the height of a layer representing the granularity of emotional classification. There are no links between nodes in the same layer – all links are to the layer beneath. The link weight represents how connected that emotion is to the (more fundamental) one below. The link weights are right now subjective, and can be modified considering the purpose or motive of the emotion analysis. The emotion graph (GE) – a multistage directed acyclic graph- has a basic layer of nodes that represent pure or most primitive emotions. These are connected (subjectively, depending on the semantic relations) to the next layer of nodes that include the primary

emotions as well as the pure emotions of the basic layer. The next layer is further organized as collection of pure and primary emotion nodes along with the secondary emotion nodes. Strictly speaking, each stage can be derived directly from the first, but the stages are retained for the purpose of displaying the results of analysis at different granularities (Fig. 1).This layered network of nodes has two objectives: ease of construction and modification, and the ability to distil the data in the first layer into later layers. Thus a current layer node can derive values as a function of the nodes of the previous layer it is connected to and its link weight. As distillation is an operation meaningful only when at least two layers are present, it is layers, not nodes, which contain a reference to the previous layer. The basic structure (*GE*) is extended into a larger graph during the ANN process and analysis steps. The extracted images of facial expression from the video input and the textual document are checked for emotion content and then linked to the predefined set of Nodes[17]

Fig: 2 Various Emotion State

V. IMPLEMENTATION DETAILS

A. Basic Steps :

Prediction Model for detection of psychological disorder. For Prediction Analysis input would be Multimedia File(Video/Audio) which were used to interpret what type of Psychological disorder person has.

The Figure 1 System Architecture shows the basic Architecture of system:

Step by step process that how data preparation is done.

Step 1: Input Multimedia file, Processed that file into video file and audio file through GAVE 1.02 API to extract WAV file which is stored in input Folder.

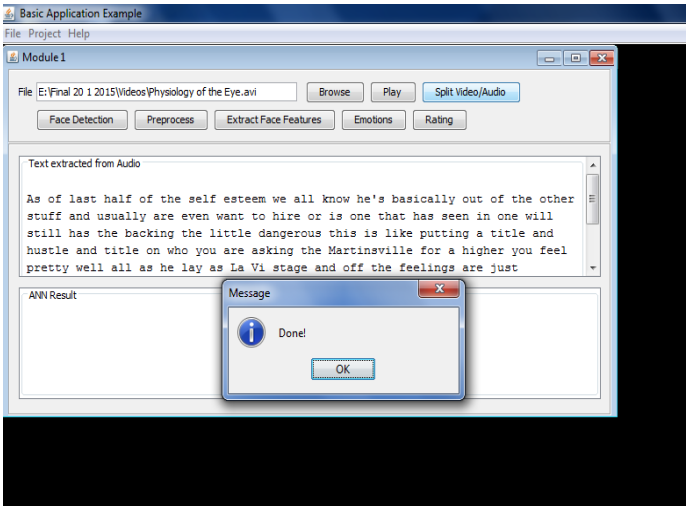

Figure 3: Split Multimedia File

Step 2: In audio files- convert that speech to text document through Cloud garden API in JAVA which can be used to convert Speech to text Data.

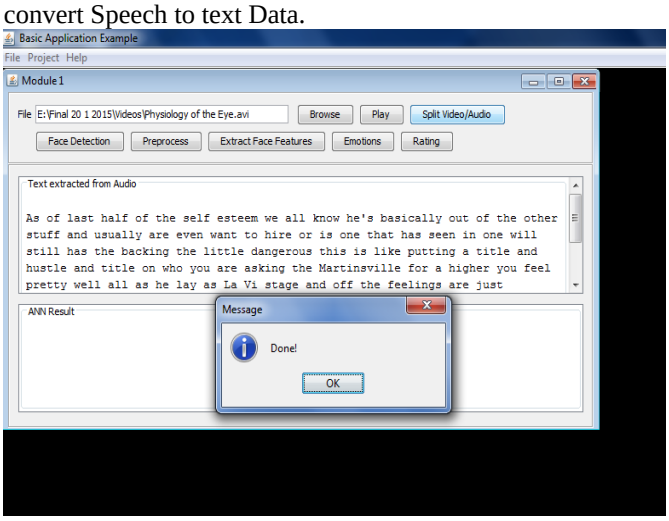

Figure 4: Audio File (Speech to text doc File)

Step 3: In video files- Extract the Facial Image through FFMPEG tool ,it is key for extraction faces from video. Processed that image through JAI tool and Edge detection Sobel Algorithm, Haar cascade algorithm, to extract the Facial emotion expression.

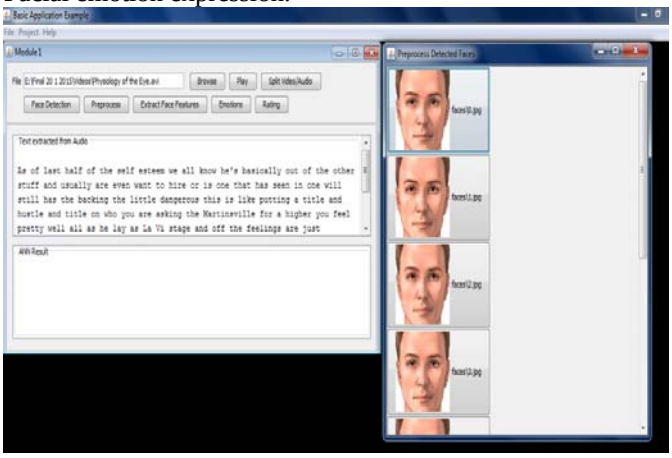

Figure 5: Face Extraction from video clips

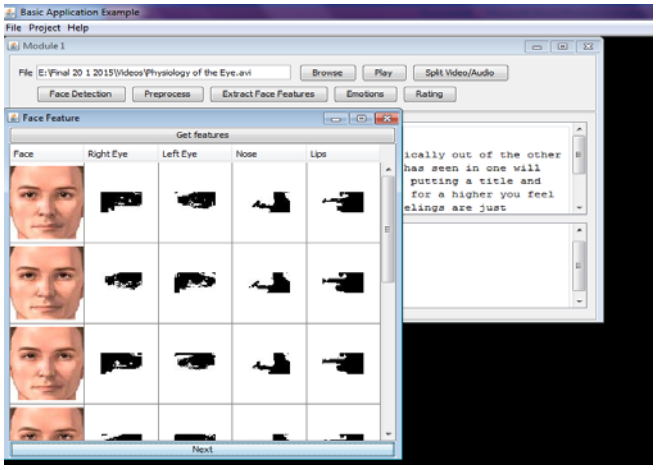

Figure 6: Face Detection

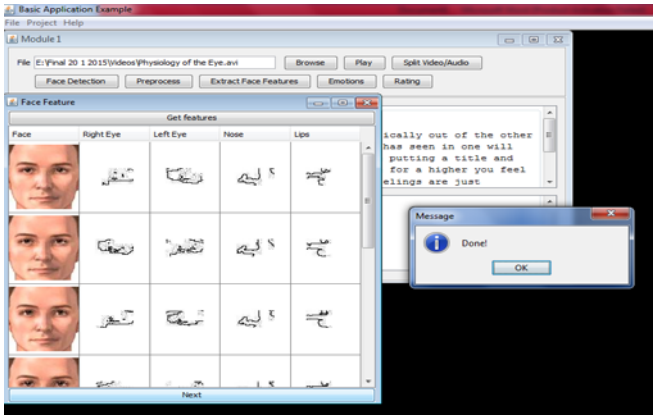

Figure 6.1: Facial Expression Extraction

Step 4: Processed data can be further used for analysis purpose, whether that person has depression disorder or not, for that neural network model is designed.
Processing on Vector Database of Emotion for Analysis via ANN:
Like in all Artificial Neural Networks applications, here also it is necessary to pre-process raw input and prepare it for further analysis and processing. The input for the pre-processing includes the data contents that are obtained after pre-processing of video images and speech conversion to text document. The standard pre-processing that we perform on the data are in the sequence as follows:

In Artificial Neural Networks there are three layers of units as:
1.Input Layer: The activity of input units represents the raw information or pre-processed information of data that is fed into network for analysis.
2. Hidden Layer: The activity of hidden unit is determined by activities of input units and the weights (scale) on the connection between the input and hidden layer.
3. Output Layer: The behaviour of the output unit depends on activity of hidden unit and weight between hidden layer and output layer.

For more potential computational power single layer organization is beneficial than hierarchically structure multilayer organization.

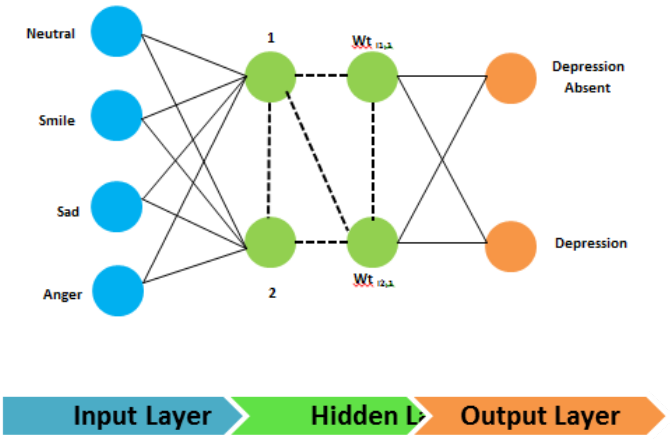

Figure 7: Network Architecture for Emotion

Step 5: For Further analysis, neurons can be trained on the basis of few parameters of disorder as depression for that Feed forward back propagation algorithm can be used. The following Figure gives the idea that what parameters are taken into consideration for Analysis part.

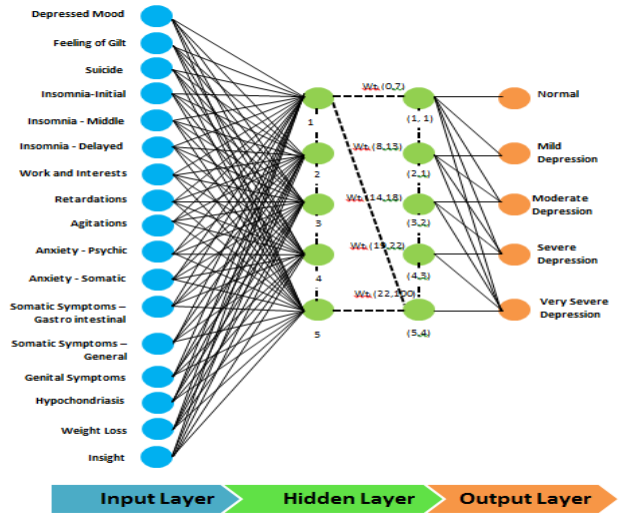

Figure 8: Network Architecture for Depression Disorder

Step 6: With the help of Hamilton Rating scale for depression, predict severity of Depression.

VI. Result Analysis

The data sets consist of real traces from People in the form of Audio and Video clips. The proposed system runs in a background service which extracts the meaningful patterns from the gathered data. This refined Patient history will be used for the prediction process.

VII. Conclusion And Future Scope

Earlier, emotion analysis was a manual process conducted by psychiatrists and a much ignored area from the artificial intelligence point of view. Our evaluation shows that data mining techniques can effectively assist affective computation to make more accurate psychological disorder prediction like Depression.

Our analysis demonstrates that the accuracy in predicting the disorder is in the range of 89 % for dataset.

The application can further be enhanced for prediction of other psychological disorder like Anxiety and Schizophrenia. This concept can be used by psychologist and counselors to assist in counseling people with weak or negative mental and emotional state.

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