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NLP BASED INTERVIEW ASSESSMENT SYSTEM

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Abstract : *Online interview is not a new thing but in this covid-19 situation it seems to be the only option. However, assessing the candidate on a video call may not be that effective. Having an AI based Interview Assessment System could prove to be useful, which would take input as speech and will give output as detailed analysis of that speech. While most the research work currently done focuses only on finding sentiment or personality from speech, our system aims to extract multiple information from the speech and provide a detailed analysis. The analysis would include a detailed report containing results about confidence level of the person, his/her emotional state, speed of the speech, frequently repeated words and also personality reflected by that speech. An interview panel consists of various members focusing on different aspect of the answer given by the candidate, some focus on technical correctness while, some simply want to check the communication skills of the candidate. Having an AI system giving a report on the soft skills part would reduce the work for interviewer and he/she could give complete focus on the technical correctness of the answer. This could eventually help save time and resources used by organizations for hiring process. This intention of creating this system is to assist the interview process and give analysis report based on the speech input instead a giving a verdict about selection of the candidate. Thus, this system could use not only by the interviewers but also by the candidates. The output provided would be a detailed report which could prove to be a good feedback for the students who are preparing for the interview. Having a feedback would help candidates work on their week points and thus perform better in further interviews.*

Keywords - *natural language processing, neural network, personality detection, regression model, speech signal.*

1. INTRODUCTION

Every year when placement season starts, company's recruitment agencies have to handle a large amount of work each day. This process consumes skilled labour and time. And even after investing time and money, they fail to recruit a perfect candidate for that particular profile. So, there is a need for a smart solution to this in order to save tons of time and money. In the covid-19 crisis online interviews are trending, like it's not a new thing to us, but just judging a candidate through audio or a video call is not that effective. Hence, we put forward a Natural Language Processing (NLP) based interview assessment system which analyses the interview text and audio getting unbiased, effective interview outcomes and also reducing the skilled labour and time of the companies. Even the time for hiring is drastically reduced. This system is not only beneficial for the recruiters but also for the candidates. The candidates can take help of this system to identify their weakness and work on them accordingly This will help them to perform better in real interviews whether they are online or face to face.

This system helps in determining the overall sentimental aspect of the candidate sentiment analysis refers to the task of detecting whether a textual item expresses a positive or negative opinion in general or about a given entity in our case is candidate also It serves as an important role in natural language processing [1].

Software available in market or research being carried out, either analyzes interview text or audio but not both. Also focus is on personality detection and not on emotions recognition. But in our system we will be doing analysis of both text and audio which is a hybrid approach considering both personality and emotions [2]. Text and speech

analysis will be done using libraries available in python such as speech recognition, etc. Finally, all the outputs from all modules that are speech analysis and text analysis and will be combined to give an overall result in graphical format.

2. METHODOLOGY

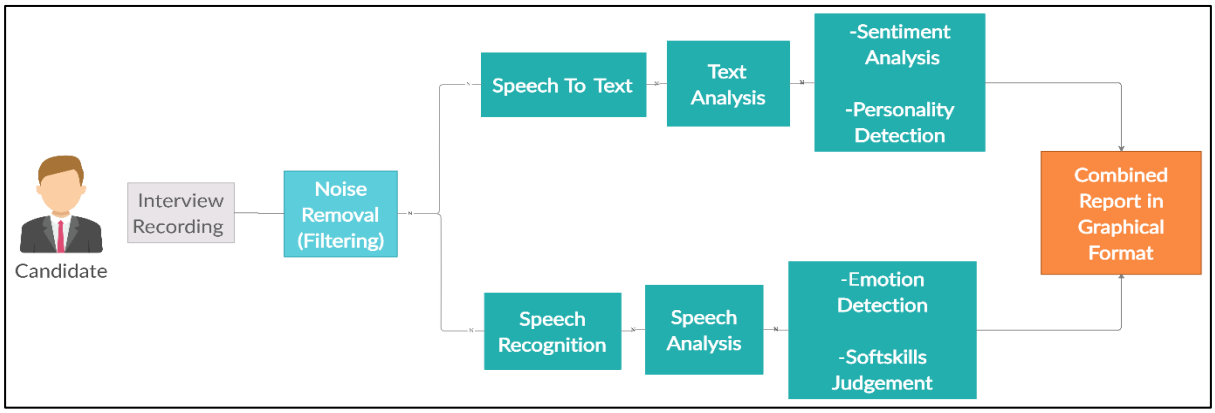

Figure 2.1 Block Diagram

This system has two main types of data to work on which is speech and text. While most of the systems works on either speech or text at a time, this system uses a hybrid approach. The speech part helps in understanding soft skill and confidence of the candidate based on the way he/she speaks, while the text part focuses on the meaning of the words spoken by the candidate. The whole system is segmented into following 5 modules:

1. Input module
2. Text analysis
3. Speech analysis
4. Report generation
5. UI designing

2.1 Input module

This is the first module of the system which deals with taking input from the user. The input provided to the system will be an audio file containing the speech of candidate's interview. User will have the option to record new audio file and submit it to the system or provide a pre-recoded file as input to the system. The system works with WAV files, so the audio file will be first converted into .wav format if it is not in that format and this process would also be carried out by this module itself.

Another task performed at this stage is speech to text conversion of the audio file. The system would convert the WAV audio file into a text file using python's speech recognition library. The audio file may contain noise and disturbances. Thus, the file first undergoes pre-processing where noise reduction is performed. After that speech to text conversion is carried out which will give output as a text file containing all the dialogues of the interview. The output of this module will be provided as input to the next module.

2.2 Text analysis

This module takes input from the previous module which is a text file of the interview conversation. Text analysis module works on understanding the meaning of the word spoken and derive a conclusion using that text. This module will try to determine the personality of the candidate by the words spoken in the interview. The system determines the sentiments of the candidate using Vader sentiment module [3]. The system would try to understand words as positive, negative or neutral words and based on that would predict the personality of the candidate [4][1].

Another feature implemented in this module is the word count feature. This would simply count the frequency of each words used throughout the conversion. This is very useful to understand the pattern of the speaking of candidate, when he/she tries to over-use some of the words. Also, would give information about the topic which was discussed more by understanding the frequency of usage of key words.

2.3 Speech Analysis

The next module of the system is the speech analysis module which works directly on the audio file provided as input to the system. Since it works directly on audio file, this module can run parallel to the above mentioned two modules. This module also works on the WAV files thus conversion is required which is done in the input module itself. Here, the speech of candidate is used to extract features from it. The speech signal is represented in terms of a wave and this wave gives lots of information about the speech signal which could be used for analysis.

Features from the speech signal are extracted using Librosa library in python. Further, the features extracted from the speech signal are given as input to the artificial neuron network model which is trained to give output as the emotion of the speech. In real-world human conversation there are various modalities of voice such as pitch , vocal tract modulation which can influence the conversation significantly in certain scenarios.[5]The neural network use is MLP classifier (Multi-Layer Perceptron model) which is used as emotion classifier model. The model is trained using RAVDESS dataset which contains a dataset of audio files with different emotions.[6] The dataset contains a audio files recorded by set of actors (both male and female) who recorded their audio giving out different emotions. The dataset contains neutral, calm, happy, sad, angry, fearful, disgust, surprised emotions out of which only sad, neutral, happy, calm and fearful emotions are used as they are relevant to the application area of this system.[7] The input audio file would be quite long, this file would be segmented in small audio parts and will be feed into the MLP classifier model. The advantage of doing segmentation is that the processing would become easy and the final result could be calculated as average of result of each segment which would also increase the accuracy of the model[8]. The current systems do not determine the emotion in the conversation individually by adapting to the speaker of each utterance. In this paper we present a new method based on multi-layer perceptron model that keeps track of the individual states throughout the conversation and uses this information for emotion classification [9]. Thus , this module would give output of emotional state of the candidate based on the speech of the candidate which helps in assessment process.

Further, additional feature in this module is the speed of speech feature. This feature would simply calculate the words spoken per minute in the speech and thus would give us an idea about how fast or slow the candidate speaks. This, information is useful in the interview assessment process as it helps understand more about candidate as some people tend to speak fast when nervous, or slow when they are thinking a lot about the answer.

2.4 Report generation

Now that the results are obtained of the speech and text analysis, they need to presented in a way which make them easy to read and get a conclusion from them. This module would work on representing the results from the about module in graphical way which is easy to understand for the interviewer. The report would be generated using matplotlib and Numpy libraries of python. This module would give the results of the analysis in a pdf file which would also give out more information about results obtained and how they can be improved which would prove to be valuable feedback for the candidate.

2.5 UI Designing

This is the final module which would merge all the above module and form a single system. The user interface would be created using PyQt library of python. Here, the system will be completed with a user friendly interface.

3. FIGURES AND TABLES

Table 3.1 Analysis Table

Sr. No	Title	Summary	Technology	Advantages	Limitations/Future scope
1	Predicting Personality Using Answers to Open-Ended Interview Questions [10]	The paper focuses on using text of interview answers to predict the personality of the candidate. The model used was simple regression model	NLP, HEXACO model Regression Model	Dataset used is very relevant for our system which is based on interviews Model implemented was very simple	PoS (Parts of Speech) not considered, Does not make use of Neural network
2	Automatic Personality Recognition of Authors Using Big Five Factor Model[11]	The paper focuses on detecting personality of author based on the author's writings. It performs text analyses for personality detection	NLP (NLTK), Big-Five model, Parts of Speech Tagging, Parse trees Datasets: Pennebaker & Kin, My Personality	Polarity based term for every factor of personality	Lacks Sentiment analysis part
3	Personality Detection from Text using Convolutional Neural Network[12]	This paper is a research on effectiveness of different activation functions and results given by each of them for personality detection	Dataset: Stream of consciousness	Detailed results for each factor and by using different activation functions	
4	Sentiment Analysis on Interview Transcripts: An application of NLP for Quantitative Analysis [13]	In this paper a system analyze sentiments using (NLP) and perform various quantitative techniques. Insights are derived by finding patterns and building a simple linear model to explain the variations in sentiments patterns.	Lexicon based method, simple linear regression	Validates the genuineness of the interview by classifying positive, negative and neutral sentiment	Insights lack objectivity, size of data points can be increased, weighted average analysis can be performed
5	Personality Recognition based on User Generated Content [14]	In this research authors have proposed a personality detection model using convolutional neural network (CNN) with the Linguistic Inquiry and Word Count (LIWC) and a standard data set	CNN, word2vec, OCEAN model, Linguistic Inquiry and Word Count (LIWC) dictionary tool, FB update status dataset	Recognizes ones personality based on his/her social media content	Other social network dataset can be experimented to detect personality

4. RESULTS

This system takes the audio as input and convert it into text. Either it converts the audio file into text or real time speech to text conversion and stores the text generated in text file format for further text analysis. Further the text is passed for Sentiment Analysis and Personality Detection, Sentiment Analysis module uses vader sentiment model which classifies the text into positive and negative sentiments [14]. Along with this speech analysis is done to classify emotions from speech.

Sentiment Analysis module is classifying text into positive, negative and neutral sentiments. It focuses not only on polarity but also on the context of the text as a whole also it gives us result about how positive or negative a text is in percentages. One of the most important subtask in sentiment analysis is subjectivity detection, i.e., the removal of 'factual' or 'neutral' comments that lack sentiment [14]. It is possibly the most essential subtask of sentiment analysis as sentiment classifiers are often optimized to categorize text as either negative or positive and, hence for finding the overall sentiment of the text distinct polarity range has been used which tells the polarity even if majority of the text is having neutral sentiment [14][15].

Personality Detection module is classifying text into various classes of emotions like (happy, surprised, independent) based on words used in the interview and this result are displayed using matplotlib library of python in graphical chart format.

Speech Analysis is done to classify the emotions from speech. the accuracy of the speech analysis module is 80.21% Speech Analysis is done using hexaco personality model which uses speech parameters like power , pitch and vocal tract configuration.

At the end this system generates a detailed report of the assessment in pdf format based on the results obtained from sub-modules.

5. CONCLUSION

In this paper we presented a hybrid approach which can be used for interview assessment of the candidate. This proposed system will be able to assess the interviews more effectively, contrast to traditional interviews which fails to do so. As it is a hybrid system that is a combination of text and speech analysis proper output of personality and emotions will help the recruiters to make unbiased decisions. Along with recruiters, candidates will also be able to take advantage of this dynamic system for self-assessment and hence working on their weaknesses. The report generated will present the results of the analysis in a pdf file which would also give out more information about results obtained and how they can be improved which would prove to be valuable feedback for the candidate.

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