PSYCHOMETRIC ANALYSIS TOOL

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INTRODUCTION

The word 'psychometric' conflates the word 'psyche', which is defined as 'mind', with the word 'meter', which means 'measure'. So, psychometric testing and psychometric assessments are effective tools that quantify a person's psychological characteristics in a way that can be measured and analyzed. For example, psychometric tests and psychometric assessments can be used to measure with a great degree of accuracy the characteristics of a person, like their personality, cognitive abilities, behavioural patterns, situational judgments as well as a wide range of other factors. Psychometric Analyzer is a tool that powers judgment based on the mental assessment and emotional state of an individual. Our software aims at provisioning solutions to administer the same in the absence of a human interviewer and/or psychologist. It acts as the interface between the two interacting parties, one of which evaluates the other using the various modules provided by the software as mentioned further.

PROBLEM STATEMENT

To design a replacement tool for existing interviewers and/or psychologists that powers judgement by analysing the person's psychological characteristics based on different factors including expressions and assessments.

OBJECTIVES:

1. A face detection module that is used to detect a face through web camera and take screenshot which is transported to CNN model for classification of emotions from facial expressions
2. An LSTM based Speech Emotion Recognition model
3. An ANN model for Sentiment Analysis of the image based description to test the cognitive aptitude of a person
4. A model that matches/finds similarity in the answers judging based upon prospective answers from database itself
5. Provision for adding images; questions and their expected answers to the database
6. A GUI for better experience with all functionalities

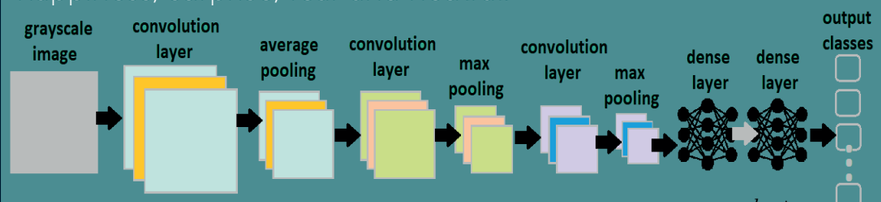
ARCHITECTURE & METHODOLOGY

Graphical User Interface: GUI interface with separate window for each module giving an enhanced test experience to both the user and the responder. Libraries: Tkinter, PIL.Image

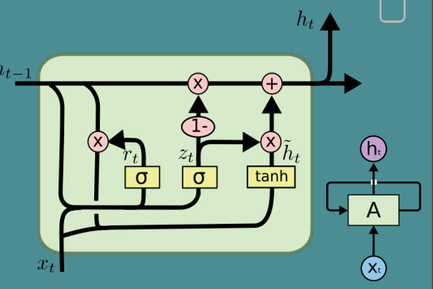
Face detection: Haar-feature based cascade classifier used for detection of face from video camera feed.Library:cv2 (OpenCV)

Classification Models:

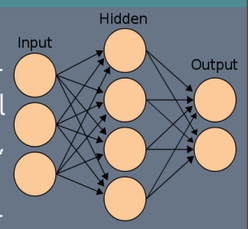
Facial Expression Recognition: Images captured periodically are fed to a trained convolutional neural network model for classification of expression into disgust, anger, sadness, happiness, surprise, fear and neutral.



Speech Emotion Recognition: Audio recorded periodically is fed to a trained LSTM model for classification of speech into disgust, anger, sadness, happiness, surprise, fear and neutral.



Sentiment Analysis of Image Based Description: Responder's description of a displayed image is fed to a trained ANN model for sentiment classification into positive, negative and neutral.



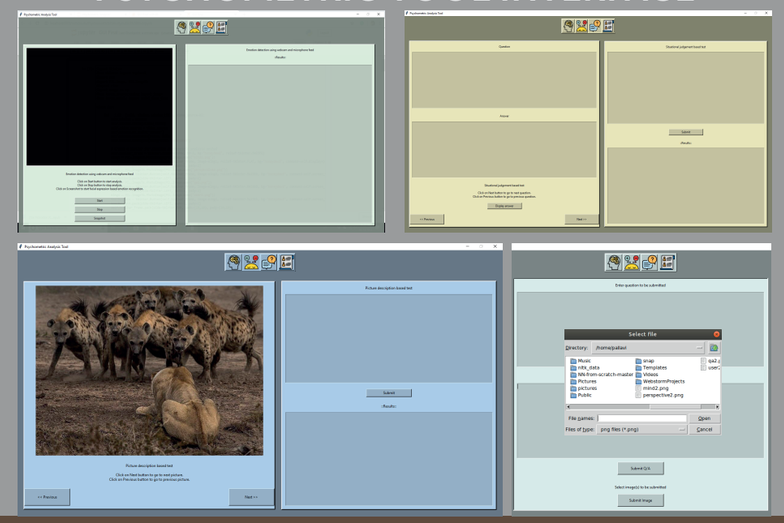
Datasets: FER-2013, RAVDESS, AmazonReviews, imdbReviews. **Libraries**: keras, numpy, scipy, sklearn, nltk

Degree of Similarity: The responder's answers to the questions are analyzed by measuring degree of similarity between existing answers in database and the responder's answers using cosine similarity and jaccard similarity measures. Libraries: nltk,sklearn

$$similarity = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|_2 \|\mathbf{B}\|_2} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \sqrt{\sum_{i=1}^{n} B_i^2}}$$

Database for Images and Questions: The user can add images and questions with responses to the database and organize the tests using the GUI. Library: sqlite

PSYCHOMETRIC TOOL INTERFACE



RESULTS AND CONCLUSION

We have created a psychometric analysis tool that eases the assessment performed by psychologists by automating the discernment of psychological state from face, speech and text input. The sentiment analysis model used to analyse the image based text works with nearly 87% accuracy. Both the speech and facial emotion recognition models of classification were trained and tested with about 70%-75% of accuracy.

APPLICATIONS & FUTURE WORK

There can be an added functionality for chat service that enables the user and the responder to communicate between the test,and user feedback for increasing model reliability.

Psychometric tests can be used to measure candidates' suitability for a role based on the required personality characteristics and aptitude or cognitive abilities. The reliance of psychologists on classical test theory prevents them from seeing the distinction between observable variables and psychological attributes. This is due to the definition of the true score as the expectation of an observable variable. Thus, research is led in the direction of investigating reliability and validity of test scores and away from studying relationships between psychological attributes and behavior elicited by the test.