# Research Functions

1. Facial expression recognition
2. Voice recognition
3. Answer verification and rewarding
4. Behavior of the interviewer(Avatar)

# Problems

1. There is a use case named “Check the validity of the answer“ in our use case diagram. How can we check the validity of answer? Do we have to maintain a knowledge base or do we have to search it from the web.

(Issues – If we maintain a database, we have to include a large amount of keywords.)

1. Are we going to consider about the interaction between the agents?
2. It is really difficult to divide the four functions.
3. It is really difficult to identify the research parts of the 4 functions separately.
4. It is difficult to identify the technologies of the functions.
5. We discussed two methods to generate questions in the last meeting. Which method will be the most suitable one? One is selecting questions from a question bank and the other one is generating a question from a web search by using a keyword.

(Issue – If we get from the question bank, the interaction with the questions will be lost. It should be inter relation between අනුයාත questions.)

# Facial Detection

## Function Declaration

Facial expression detection is able to identify people’s faces within digital images. Face detection applications employ algorithms focused on detecting human faces within larger images that might contain landscapes, objects and other parts of humans.

There are 6 different expressions that we can identify; **anger, disgust, fear, joy, sadness and surprise**.

## Used in our topic

We mainly focused to detect the “fear” expression because it is the expression that user in fear, anxiety and nervousness. But we detect the other expressions during the interview.

In maintaining the performance scale, we give a negative mark for fear, anger, disgust and sadness. The positive marks are given for good expressions like joy. According to the user’s expressions, the scale is changed into up or down and gives the reward for asked question.

## Technology

* To identify the facial expressions we use a traditional way because it has algorithms and stored data set.
* The identifying process will be developed by considering the **Facial Action Coding System (FACS)** principles and concepts.
* The analyzing the Action unit is done by the **Convolutional Neural Network (CNN).**
* We can use **Tensorflow** technique to object detection.

## Research part

**Consider the facial expressions by taking the changes in the eyebrows and the lips**.

As a example :- In fear, we mainly analyze the change of eye brow and lip. Further we consider the changes in fore head.



# Voice Recognition

## Function declaration

Human use speech as primary mode of communication. According to the tone of the voice meaning will be different. Speech has potential of being important mode of interaction with compute. There are various kinds of speeches. Isolated word, connected word, continuous speech, Spontaneous speech.

## Used in our project

In our project we measure the performance of the interviewee. To measure the performance of the interviewee we consider voice data and facial data. Here we mainly discuss on the voice data. By analyzing the voice cut we will be able understand the situation of the interviewee. In this interview scenario every interviewee has to face multiple questions. For each question we take answers as voice cuts. While giving an answer for a question we analyze the features of the voice. When analyzing the voice these factors are considered.

* Clearity of the voice
* Gap between two words
* Frequency of the tone

## Technology

* Hidden Markov Model (HMM)
  + statistical Markov model in which the system being modeled is assumed to be a Markov process with unobserved (i.e. hidden) states
* Dynamic time warping (DTW)
  + It is an algorithm for measuring similarity between two sequences that may vary in time or speed
* Neural networks
  + It is used in phoneme classification, isolated word recognition, audiovisual speech recognition, audiovisual speaker recognition and speaker adaptation
  + Recurrent Neural Networks (RNN) / Time Delay Neural Networks(TDNN)
  + Deep Neural Networks (DNN) / Denoising Autoencoders
    - experimented with to tackle this problem in an effective manner
    - generate compositional models, where extra layers enable composition of features from lower layers, giving a huge learning capacity and thus the potential of modeling complex patterns of speech data

we will be using one of these techniques.

## Research part

1. **Identify emotions of users by analyzing voice**.

Eg:- fear, having lack of knowledge of particular subject, in active mode

# Answer verification and rewarding.

## Function declaration

NLP is a way for computers to analyze, understand, and derive meaning from human language in a smart and useful way. NLU is a subpart of NLP.

Natural language understanding (NLU) is a branch of artificial intelligence ([AI](http://searchcio.techtarget.com/definition/AI)) that uses computer software to understand input made in the form of sentences in text or speech format.

NLU directly enables human-computer interaction ([HCI](http://searchsoftwarequality.techtarget.com/definition/HCI-human-computer-interaction)). NLU understanding of [natural human languages](http://whatis.techtarget.com/definition/natural-language) enables computers to understand commands without the formalized [syntax](http://whatis.techtarget.com/definition/syntax) of computer languages and for computers to communicate back to humans in their own languages.

NLU is tasked with communicating with untrained individuals and understanding their intent, meaning that NLU goes beyond understanding words and interprets meaning. NLU is even programmed with the ability to understand meaning in spite of common human errors like mispronunciations or transposed letters or words.

NLU uses algorithms to reduce human speech into a structured ontology.

## Used in our project

When an interviewee provides an answer, the answer is converted to a text and that text must be checked with a knowledge base to substantiate the answer and it should give a reward to the specific answer to the interviewer (system). If interviewee (user) provide the correct answer for a specific knowledge area, the interviewer (system) will reduce the probability of asking question from that knowledge area. If the interviewee (user) answer the question with a wrong answer the system will increase the probability of asking question from that knowledge area.

## Technology

**NLTK (Natural Language Tool Kit)** or **Watson Natural Language Understanding Service** can be used to check the validity of the answer.

## Research part

**Giving a reward to the answer and changing the complexity of the question according to the reward given.**

# Behavior of the interviewer

## Function Declaration.

In this function, interviewer (system) behavior will change according to interviewee behavior (user). Interviewer (system) is always competing with user. But the behavior, way interviewer ask questions or question areas will change according to user behavior.

## Used in our topic

First step of Smart Interview System is that requesting user CV. So asking simple questions and checking answers are matching with user CV. Then system will asking questions according to the user’s selected area.

In the meantime system will detect user’s facial expression, voice expression and the interviewee’s (user) answers to interviewer’s (system) questions and make decisions. So Interviewer behavior will change according to that decisions. Mainly system will developed to challenge user then user can improve his/her skills. Different users have different levels of facing an interview. Behavior of the interviewer (system) will change according to the level of the user.

Basically it’s a game. When user plays it system will identify what are the weak points of the user then system will increase probability of asking questions according to user’s weak points.

## Technology

Smart Interview System will depend on **reinforcement** technique. Reinforcements are stimuli that can strengthen or weaken specific behaviors. Learn about the many different ways that rewards and punishment are used to change and reinforce system's behaviors, and find out why some are more effective than others.

There are multiple types of reinforcement that can be used in operant conditioning. The two most common forms are known as positive reinforcement and negative reinforcement.

1. **Positive reinforcement.**

When a token or reward is given to strengthen a desired behavior.

1. **Negative reinforcement.**

Strengthens a behavior by removing something that is unwanted.

## Research part

According to both positive and negative reinforcement, success of the system goal will change. So have to decide which reinforcement type is/are the most suitable for the situation.

For example in our system, assume there are four questions areas. If system can defeat user many times in one area. System will be rewarded in that area and system will mostly ask questions from that area (**Positive reinforcement**). If user defeat system many times in one area. System will rarely ask questions from that area (**Negative reinforcement**). So goal of the system is defeating the user.