HACKATHON 2021

Presentation by Runtime Terror

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AGENDA

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Problem Statement

An AI driven solution for user authentication based on voice password and facial recognition. The solution should be two parts:

1. The first part where the user is prompted to enter his/her unique id and then pronounce a pre-defined pass phrase.

2. The second part where the system matches the user's voice pattern and facial image with previously saved data, and accordingly authenticate or reject the user.

Idea/Objective

We propose a Web Based solution where the user can enroll the biometrics i.e., the face and the voice.

It is a 2-Step-Authentication process where the 1st step is the voice authentication, and the 2nd step is the facial recognition mechanism.

Fig 1. High Level Objective

How the solution works

- ✓ We will be using deep learning, to improve the recognition rate of Automatic speech recognition (ASR) systems and map the speech signal into its corresponding text. It is a simplified model-building process and abilities to directly map speech into the text without any predefined alignments.
- ✓ In our project, we will exploring many different models such as CNN-based model for raw speech signal.

Generic framework of automatic speech recognition system:

Preprocessing:

- **Solving the Cocktail Party Problem** : Removing background noise using Fourier analysis.

Feature Extraction :

- Using features from **Mel Frequency Cepstral Coefficient (MFCC) and MEL Spectrogram**

Fig 2. Speaker Recognition Training

How the solution works

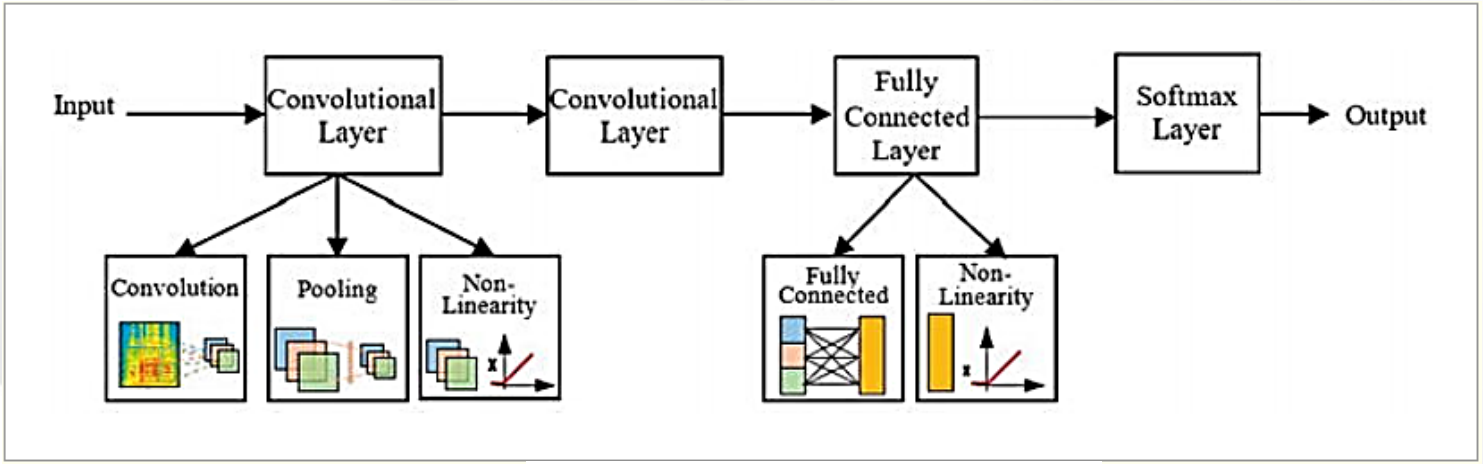


Fig 3. Block diagram of convolutional neural network

CNN Approach:

- Relevant features and classifier both will jointly be learned from the raw speech.
- Raw speech will be processed by first convolutional layer (in CNN model) to learn the feature representation.
- The output of first convolutional layer (in CNN model) , that is, intermediate representation, will be more discriminative and further processed by rest convolutional layers.
- This system will use only few parameters and perform better than traditional cepstral feature-based systems.
- The performance of the system will be evaluated for TIMIT and claimed similar performance as MFCC.

How the solution works – Enrollment Process

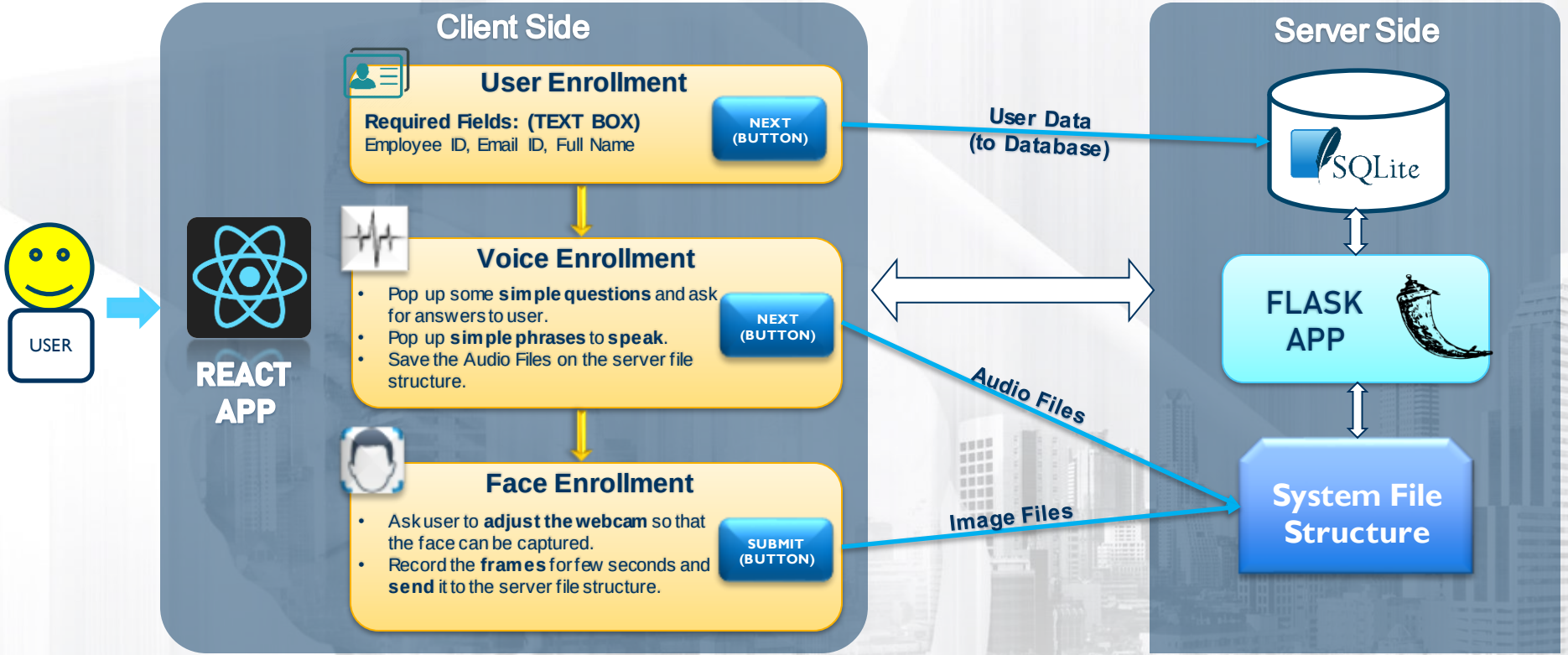


Fig 4. Enrollment Process Flow Diagram

How the solution works – Authentication Process

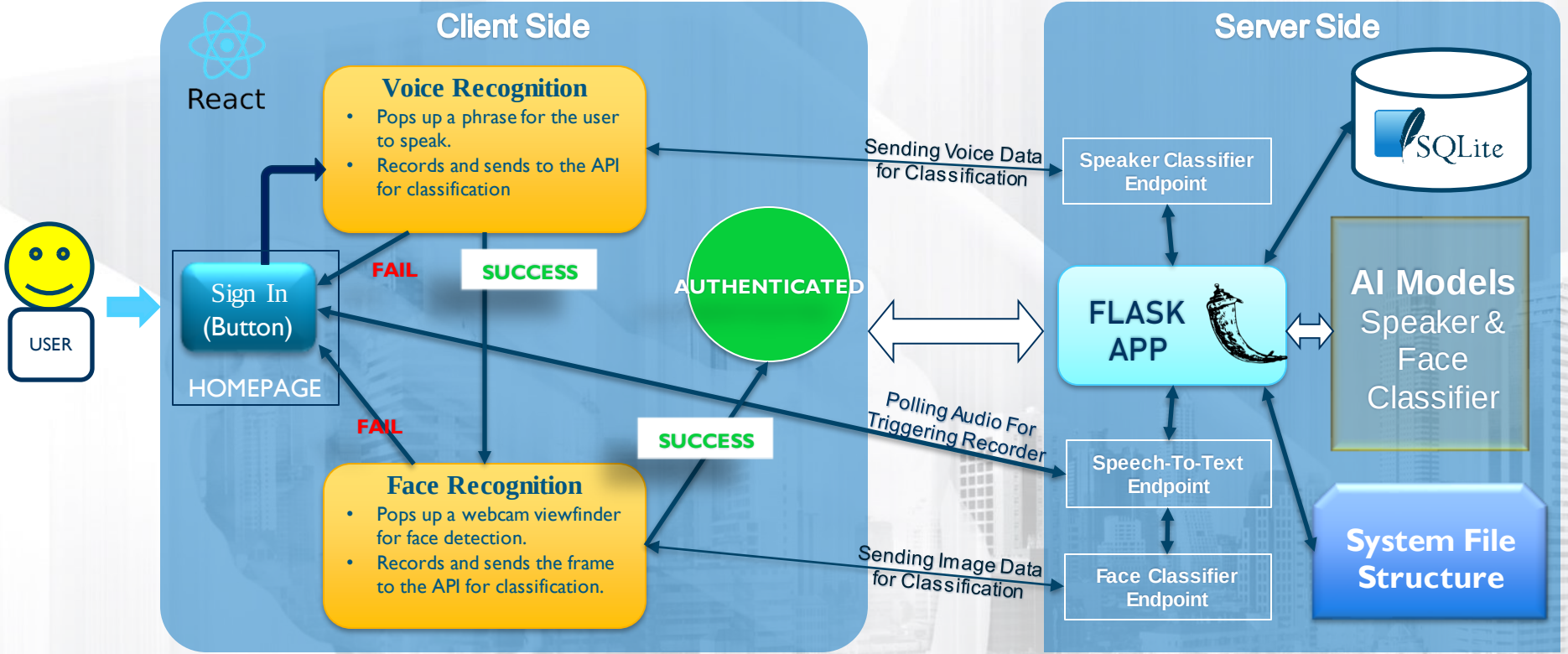
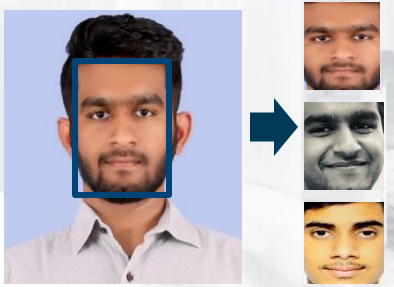


Fig 5. Authentication Process Flow Diagram

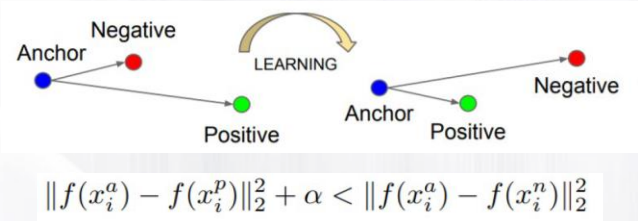
How the solution works – Face Recognition (FR)

The model



Detection via MTCNN

160x160 px



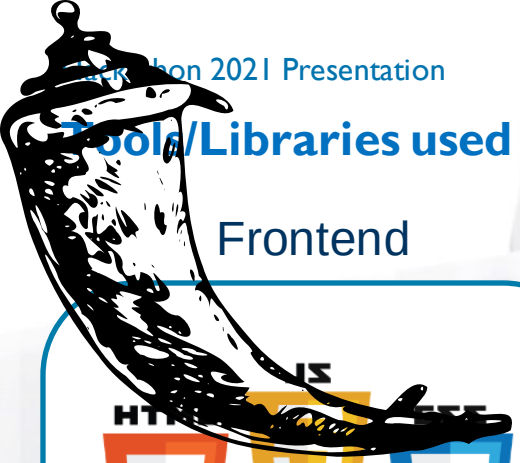
$$\|f(x_i^a) - f(x_i^p)\|_2^2 + \alpha < \|f(x_i^a) - f(x_i^n)\|_2^2$$

f(x)

Fig 6. Face Recognition Training

Actual deployment

Tools/Libraries used in the project



Frontend

Backend

Flask

React

Bootstrap

API

NumPy

pandas

TensorFlow

Keras

python

librosa

SQLite

scikit learn

jupyter

Fig 7. Technology Stack

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Plans for future enhancement

- We can explore other ASR algorithms to improve accuracy
- Multilingual support for Speaker recognition
- Improve the training algorithm used in deep learning for face recognition
- Improvement of face recognition under different environmental conditions such as dim/bright light, different eyes (Korean, Japanese)
- Caching access information while the server is down.
- Improvements in Speech-To-Text such as semantic corrections, etc.
- Try out different approaches to bring down the cost such as server less deployment,etc.