SPEECH RECOGNITION
- MODELLING USING KERAS -

03-DEC-2019

AGENDA

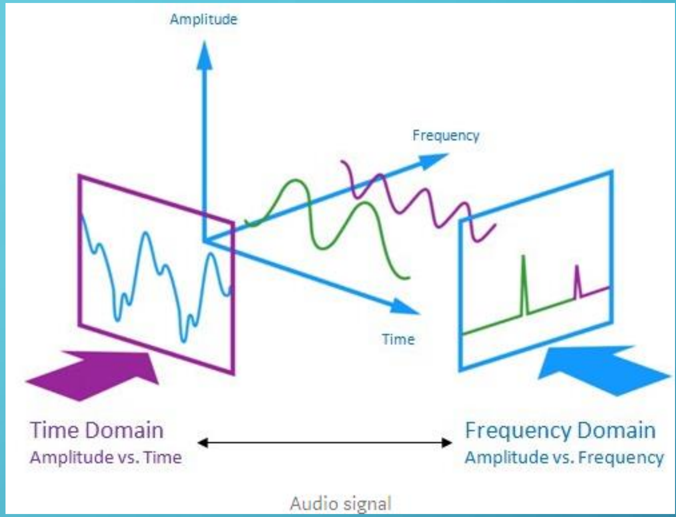
- Problem Statement
- Dataset
- Feature extraction from Speech
- Model used for learning
- Results
- Conclusion
- Further studies

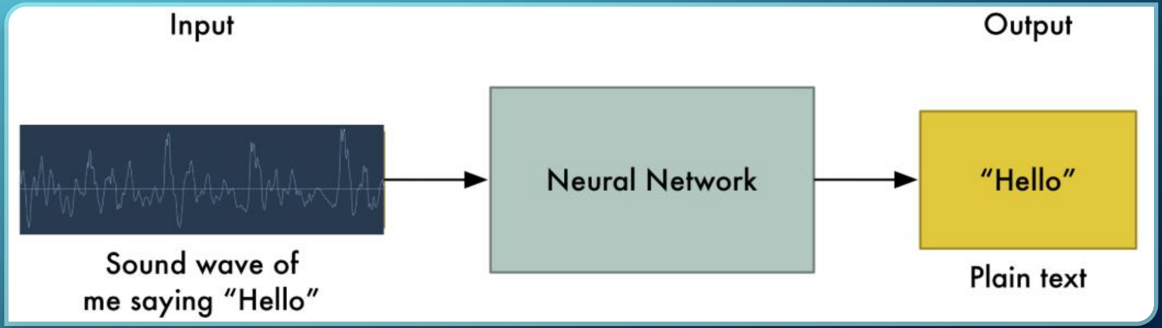
PROBLEM STATEMENT

- Business Problem :
  - Inference of the digits as said by users on phone
  - Biometric authentication using the speech dataset

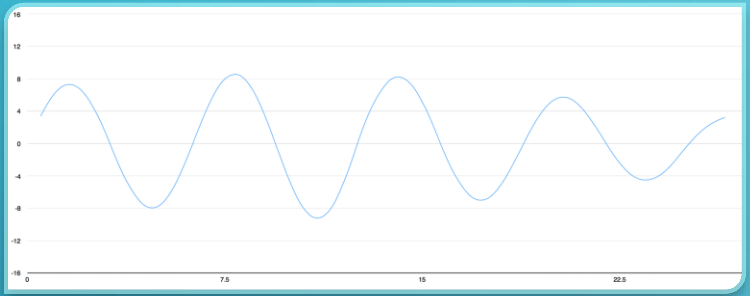
CONTEXT – SPEECH DATA PROCESSING

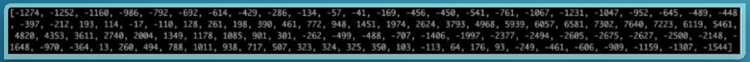
- Feed sound recordings into neural network and train to produce text
- Problems :
  - “HeeeeIlllllllooooooo” vs “Hello!”
  - Align audio files of various length to a fixed piece
  - Convert wave into numbers – record the height of wave at equally-spaced points.





SAMPLING





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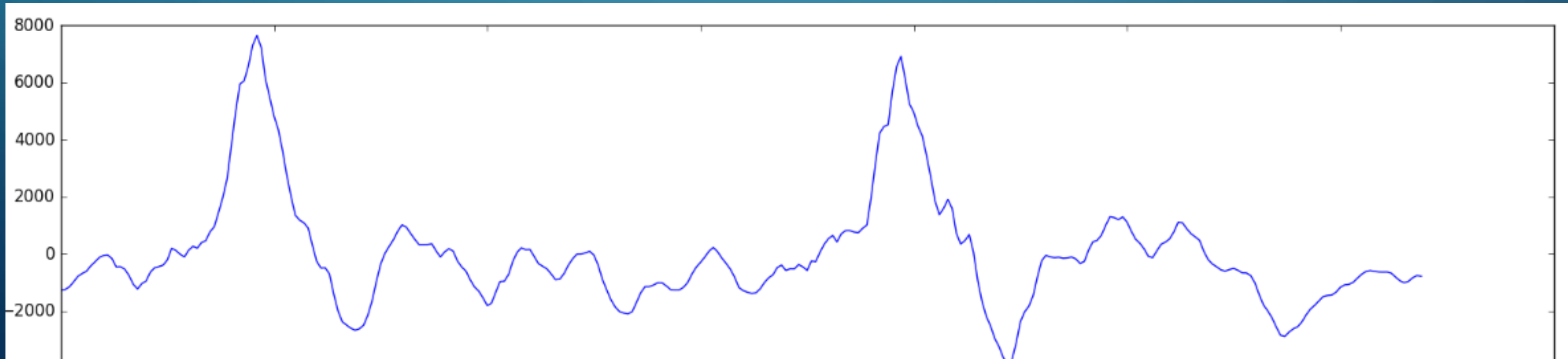
- Reading thousands of times a second and recording number representing the height of sound wave at that time
- CD quality is sampled at 44.1khz (44,100 readings per second)
- Speech recognition can be done at a sampling rate of 16Khz (16000 times per second)
- Here is an example of sample for “Hello”

PREPROCESSING

- Each number in array represents sound wave amplitude at 1/16,000th of a second
- Instead we start grouping samples into 20 ms chunks (it would consists of 320 samples)
- Still different frequencies mix together to make up complex sound of human speech



PREPROCESSING

- To make it easier, break apart this complex sound wave into it’s component part.
- Break into low-pitched paths, the next-lowest-pitched-parts and so on.
- Then add up how much energy is in each of those frequency bands (from low to high), we create a fingerpart of sorts from this audio.
- Use Fourier transform , to break apart the complex sound wave into the simple sound waves and then add up to get a sum of energy contained in each one.
- End result is a score of how important each frequency range is. Each number below represents energy in each of 50hz band of our 20 ms audio clip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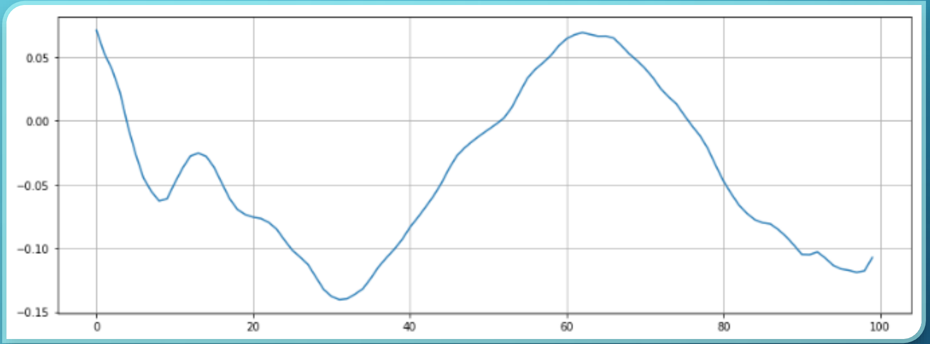
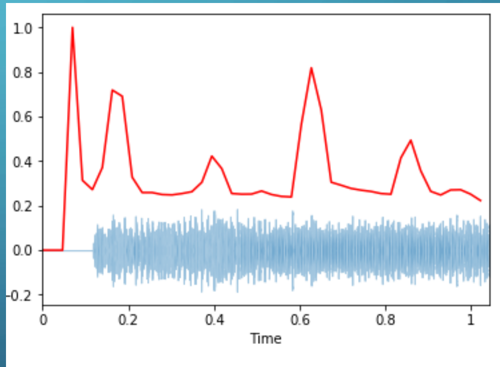
FEATURE ENGINEERING

- **Zero Crossing Rate : Rate of sign changes along a signal (ie the rate at which the signal changes from positive to negative or back.**



- **Spectral Centroid : It indicates where the “center of mass” for a sound is located and is calculated as weighted mean of the frequencies present in the sound.**



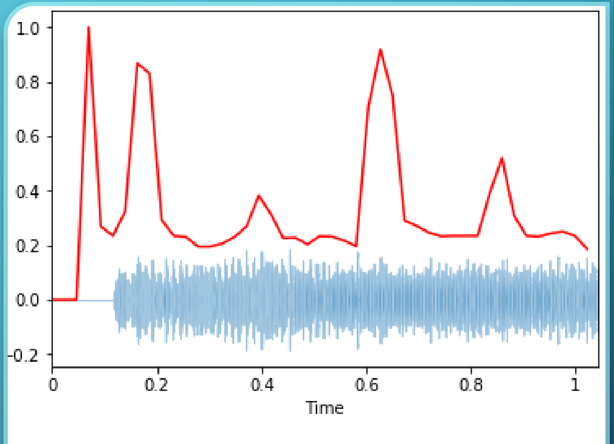
spectral centroid

FEATURE ENGINEERING

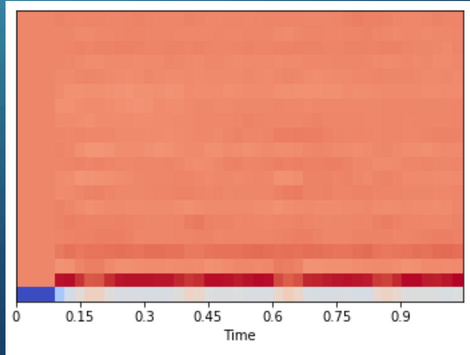
- Spectral Roll off : It's the frequency below which a specified percentage of the total spectral energy, e.g. 85%, lies.

- Chroma : It's a typically 12-element feature vector indicating how much energy of each pitch class is present in the signal

- MFCC (Mel-Frequency Cepstral Coefficients) : These are small set of features (usually about 10–20) which concisely describe the overall shape of a spectral envelope.



Spectral Rolloff



MFCC