CMPE 255 - Data Mining (Spring 2018)

Audio Classification (Multi-Class)

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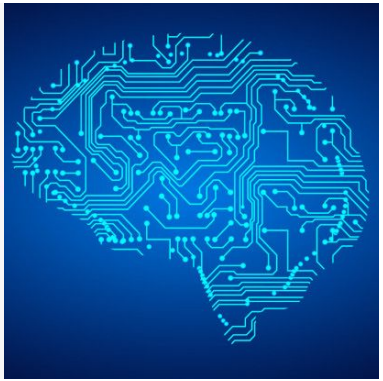
CONTENTS

ISSUE & MOTIVATION

- A hearing impaired person will not be able to detect various types of necessary sounds (Door Opening, Fire Alarm etc.)
- In some scenarios it could turn out to be a real danger.
- Hence, there is a need to have an alert system, which will notify the person about possible danger in his surroundings.

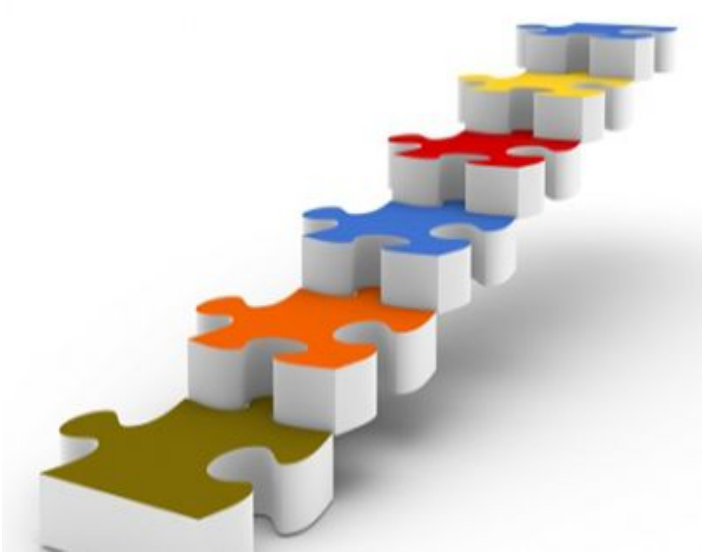
CENTRAL IDEA

- Designed an alert system using Machine Learning Techniques.
- Processed audio clips consisting of various ambient sounds.
- Classified processed audio clips into one of the 50 types of classes.
- An email is sent to the user’s email id, alerting him about the possible danger along with the type of predicted by the algorithm.



PROJECT PIPELINE

- Research and Data assessment
- Pre-processing
- Analysing Various Classification Algorithms
- Classification Model
- Model Evaluation and Visualisation
- Classification Results
- Development of an Alert System

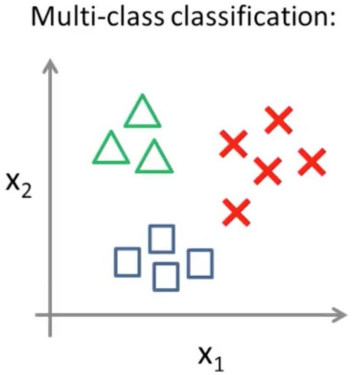


TECHNOLOGIES

- Librosa Module (Python):
  To convert Audio clippings into ML compatible input format.
  https://librosa.github.io/librosa/

- Languages and Libraries (Pre-processing, Model Building):
  Python, Pandas, Numpy, Scikit-Learn Classification

- Algorithms: KNN, SGD Classifier and SVM



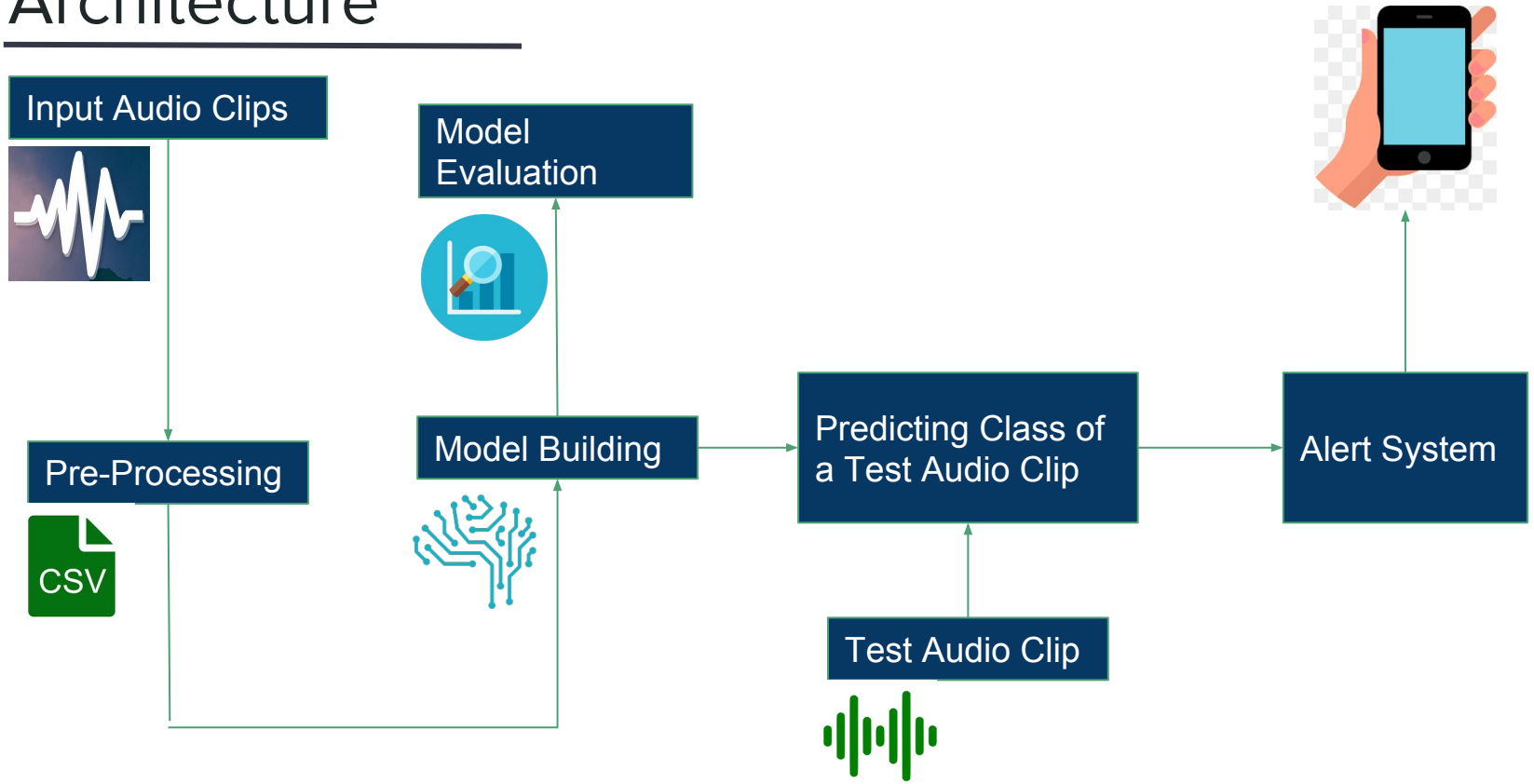
jupyter python NumPy librosa scikit learn Pandas

DATASET

- The ESC-50 dataset is a labeled collection of 2000 environmental audio recording.
- Dataset Link: Download ESC-50 dataset

Animals	Natural soundscapes & water sounds	Human, non-speech sounds	Interior/domestic sounds	Exterior/urban noises
Dog	Rain	Crying baby	Door knock	Helicopter
Rooster	Sea waves	Sneezing	Mouse click	Chainsaw
Pig	Crackling fire	Clapping	Keyboard typing	Siren
Cow	Crickets	Breathing	Door, wood creaks	Car horn
Frog	Chirping birds	Coughing	Can opening	Engine
Cat	Water drops	Footsteps	Washing machine	Train
Hen	Wind	Laughing	Vacuum cleaner	Church bells
Insects (flying)	Pouring water	Brushing teeth	Clock alarm	Airplane
Sheep	Toilet flush	Snoring	Clock tick	Fireworks
Crow	Thunderstorm	Drinking, sipping	Glass breaking	Hand saw

Architecture



PREPROCESSING

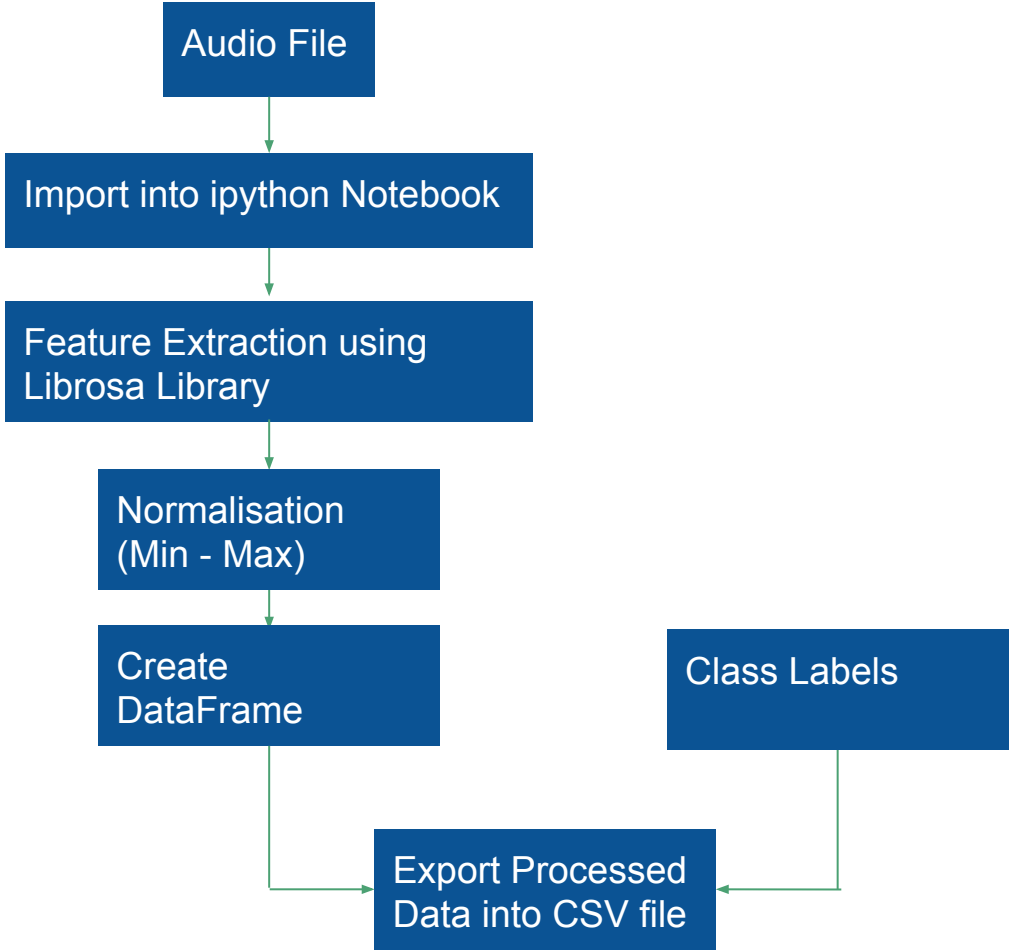
Librosa:
https://github.com/librosa/librosa

Other Libraries:

music21
http://web.mit.edu/music21/

LibXtract:
https://github.com/jamiebullock/LibXtract/

Yaafe:
http://yaafe.sourceforge.net



VISUALISATION

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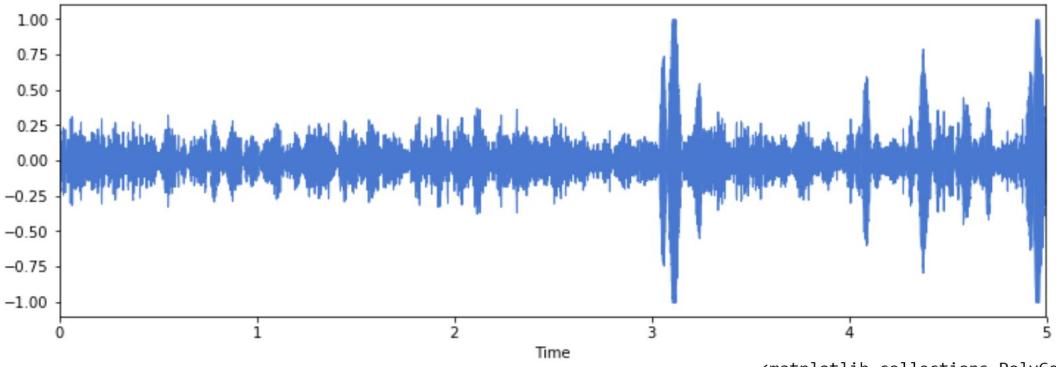

Waveform of wind

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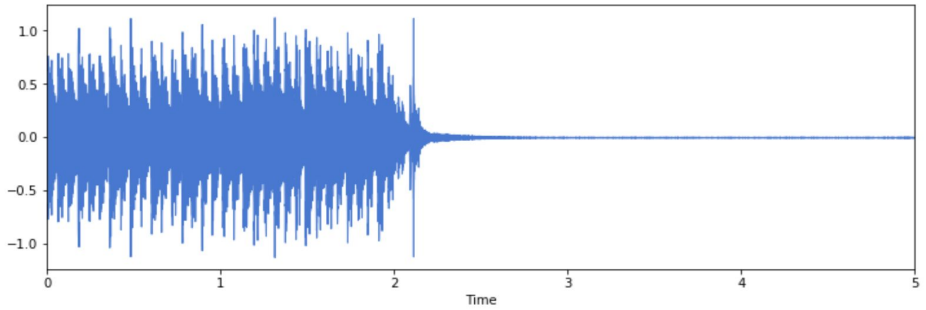
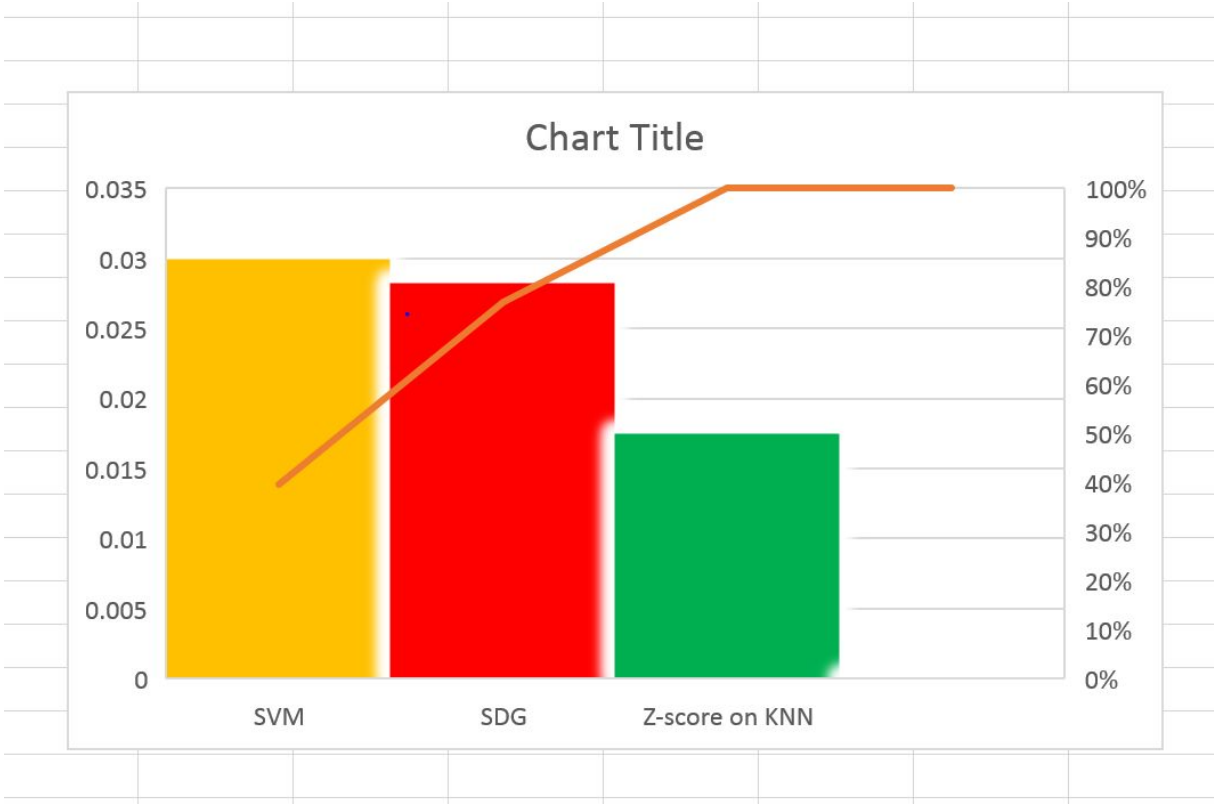


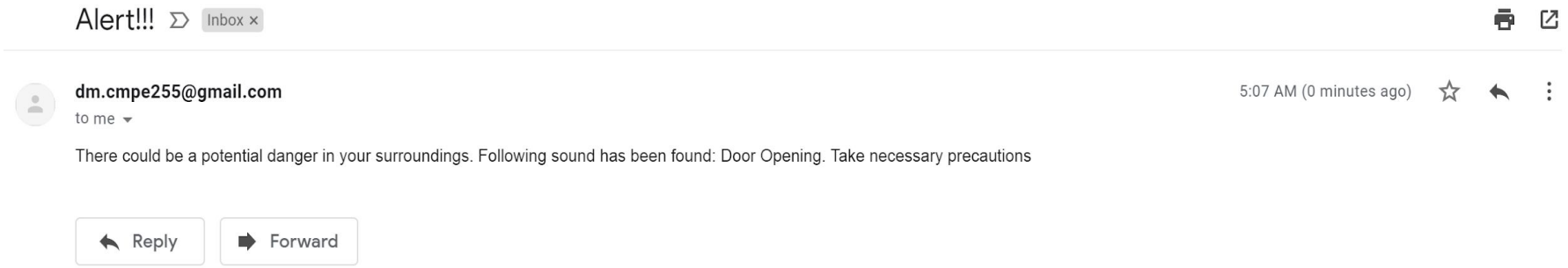
Waveform for alarm clock

CLASSIFICATION MODELS - ANALYSIS



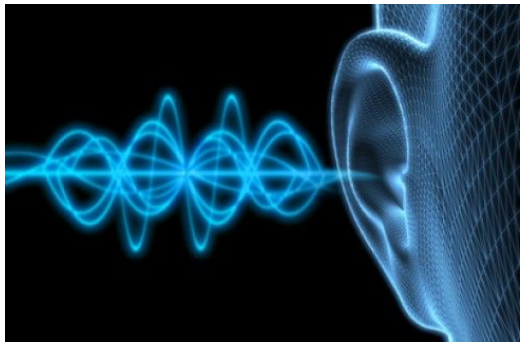
ALERT SYSTEM

- An email will be sent to the user, alerting him/her of a potential danger approaching their way.
- Techniques: “email.MIMEMultipart”, “email.MIMEText” and “smtplib” python libraries.



APPLICATION AND FUTURE SCOPE

- Before an unfortunate event occurs the user will know about it and take necessary precautions and prevent that event from happening.
- Person will be able to overcome his disability and can perform duties as a normal person will.
- In the future, the model can be trained to give more accurate results even if there is much noise in the input.
- Detect relevant sounds by eliminating noise.



Thank you!