Singapore Institute of Technology

BEng (Hons) Information and Communications Technology majoring in Software Engineering

INF2009 Edge Computing and Analytics

Academic Year 2024/2025 Trimester 2

Week 2 Lab – Sound Analytics

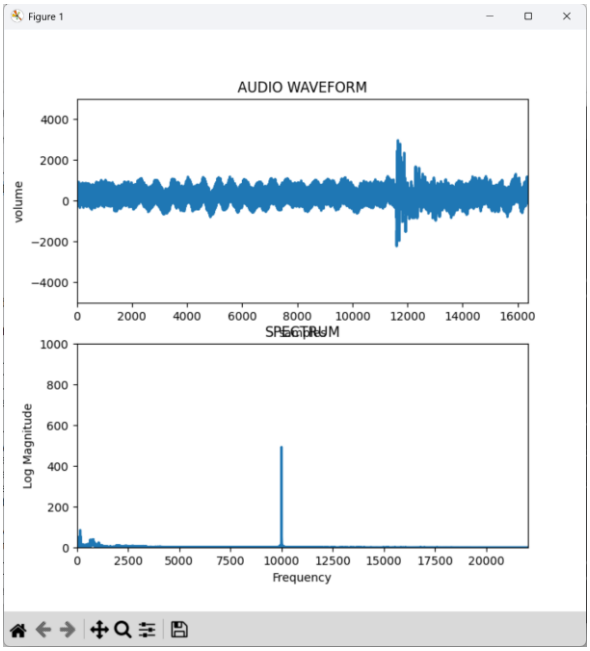
Name: Lim Chee Hean

Student ID: 2201529

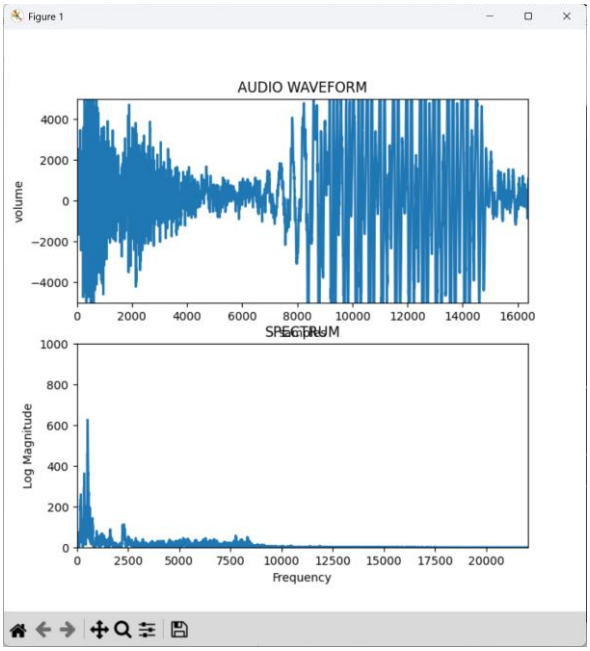
3. Connecting and Testing the Microphone

```
(audio) cheehean@raspberrypi:~/labs/audio $ arecord --duration=10 test.wav
Warning: Some sources (like microphones) may produce inaudible results
         with 8-bit sampling. Use '-f' argument to increase resolution
         e.g. '-f S16_LE'.
Recording WAVE 'test.wav' : Unsigned 8 bit, Rate 8000 Hz, Mono
(audio) cheehean@raspberrypi:~/labs/audio $ aplay test.wav
Playing WAVE 'test.wav' : Unsigned 8 bit, Rate 8000 Hz, Mono
(audio) cheehean@raspberrypi:~/labs/audio $
```

4. Introduction to Sound Processing with Python

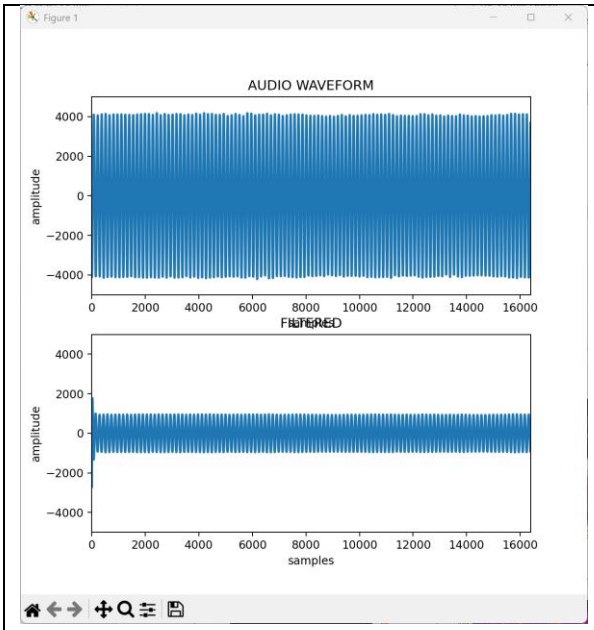


10000 Hz Tone

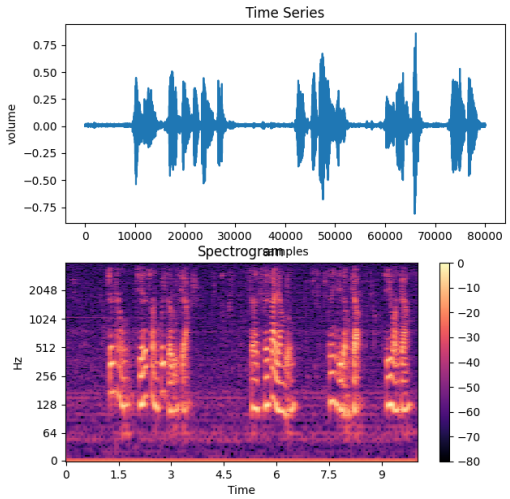


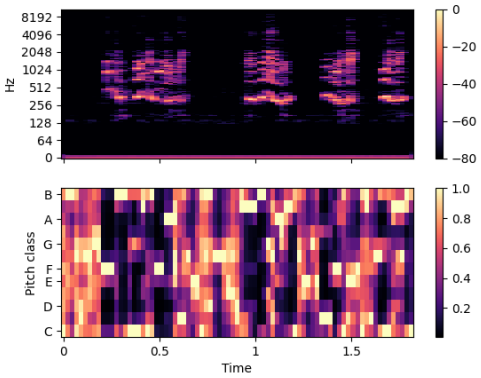
Speaking

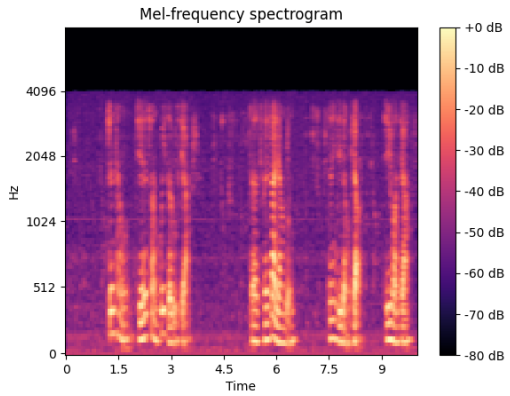
5. Basic Sound Analytics

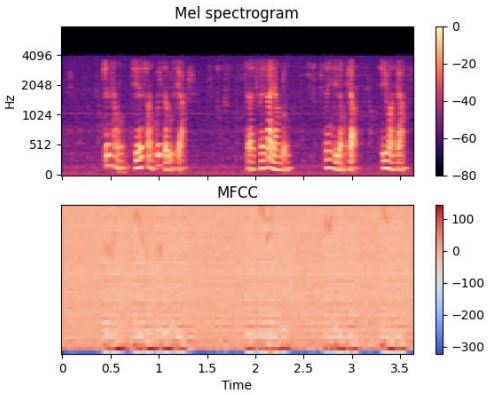


Playing a 500 Hz tone with a band pass filter between 1000 Hz and 10000 Hz









6. Advanced Sound Analysis

```
Say something!
Google Speech Recognition thinks you said hello how are you doing today
Time for Google Speech Recognition recognition = 1 seconds
Sphinx thinks you said i will aha you're doing today
Time for Sphinx recognition = 2 seconds
(audio) cheehean@raspberrypi:~/labs/audio $
```

```
Say something!
Sphnix thinks you said the quick brothels jobs or to the fiddle
Time taken for Sphnix recognition: 2.54 seconds
Google thinks you said the quick brown fox jumps over the lazy dog
Time taken for Google recognition: 0.67 seconds
Wit.ai thinks you said The quick brown fox jobs over the lady dog
Time taken for Wit.ai recognition: 5.2 seconds
Houndify thinks you said the quick brown fox jumps over the lazy dog
Time taken for Houndify recognition: 2.34 seconds
Whisper thinks you said  The quick brown fox jumps over the lady dog.
Time taken for Whisper recognition: 7.32 seconds
   API     | Time Taken
-----------------------------
  Sphnix   | 2.54 seconds
  Google   | 0.67 seconds
  Wit.ai   | 5.2 seconds
 Houndify  | 2.34 seconds
 Whisper   | 7.32 seconds
(audio) cheehean@raspberrypi:~/labs/audio $
```

Running several other speech recognition APIs in the speech_recognition library.

- Google has the best recognition time and accuracy.
- Although Whisper is a local model, it is able to match the accuracy of other cloud APIs, even though it has the longest inference time.

Wake word detection on next page

```python
# Code adapted from https://github.com/Uberi/speech_recognition/blob/master/examples/background_listening.py
import speech_recognition as sr

wake_word = "OK Google"

1 usage
def callback(recognizer, audio):
    try:
        speech = recognizer.recognize_google(audio)
        if wake_word.lower() in speech.lower():
            print(f"{wake_word} detected!")
    except sr.UnknownValueError:
        print("Google Speech Recognition could not understand audio")
    except sr.RequestError as e:
        print("Could not request results from Google Speech Recognition service; {0}".format(e))


r = sr.Recognizer()
m = sr.Microphone()
with m as source:
    r.adjust_for_ambient_noise(source)

print("Begin listening...")
stop_listening = r.listen_in_background(m, callback)

while True:
    pass
```

```
OK Google detected!
OK Google detected!
OK Google detected!
OK Google detected!
^CTraceback (most recent call last):
  File "/home/cheehean/labs/audio/background_listening.py", line 25, in <module>
    while True:
KeyboardInterrupt

(audio) cheehean@raspberrypi:~/labs/audio $
```

Detecting wake word "OK Google" for system control.