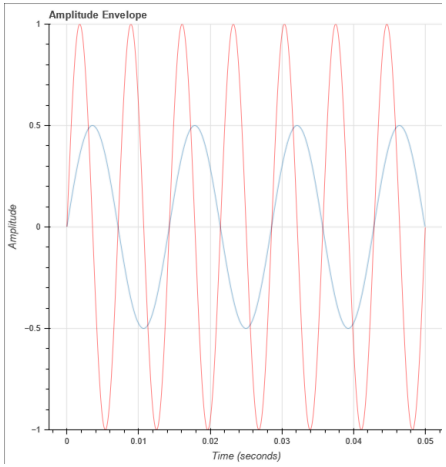
Visualizing Audio Using Stacked Graphs

Introduction

Audio visualization allows sounds to be compared simultaneously while revealing specific information about the signal. In this project we explore the benefits of using stacked graphs to display audio by comparing them to other common visualization methods.

Understanding Audio

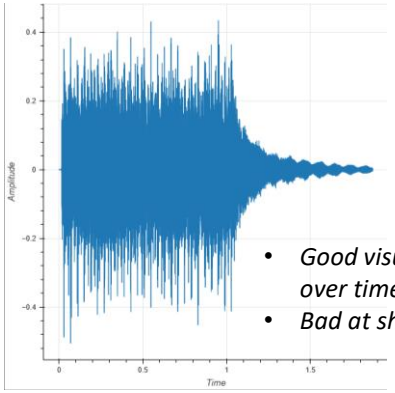
Physically, sound is the rapid change in air pressure. Digitally, audio is just list of numbers which usually range from negative to positive one. Since we only hear through changes in air pressure these values must oscillate rapidly so that a speaker reading them can create sound. Otherwise, we would get a constant and thus soundless stream of pressure. The faster these values oscillate the higher a frequency we hear and the further they oscillate the louder the sound.



Visual comparison of two sinusoidal waves (using amplitude envelope) Red as the louder and higher pitch wave (880 Hz) and Blue as the quieter lower pitch wave (440 Hz).

Amplitude Envelope

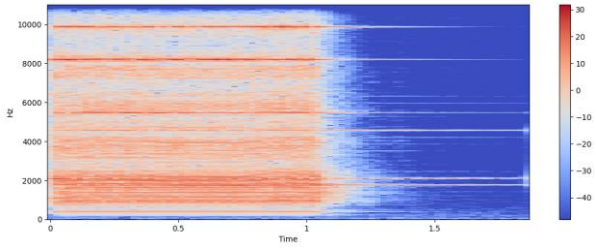
The most direct way to visualize audio is to simply plot each value in the list chronologically to make a graph. This is called plotting the amplitude envelope. Here is audio of a ring tone displayed using this method.



- *Good visualization of loudness over time*
- *Bad at showing pitch or tone*

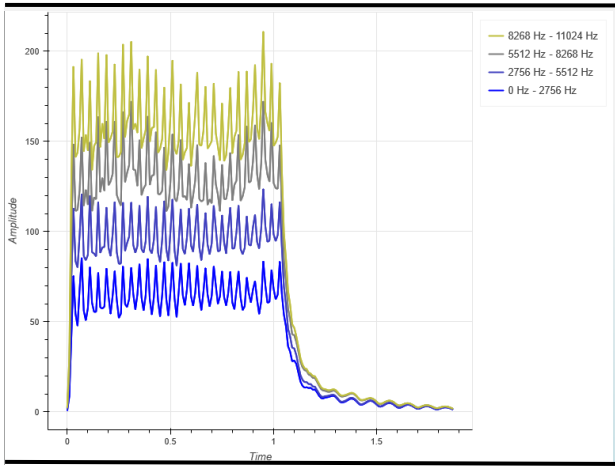
Spectrogram

Spectrograms breakdown the frequencies within a signal and allow us to see the loudness of different frequencies over time. Here is the same ring tone as a spectrogram.



- *Good visualization of pitch and tone over time*
- *Unintuitive representation of loudness over time*

Stacked Graph



Finally, we have the same audio visualized using a stacked graph. We get this by plotting the loudness over time of different frequency ranges within our audio and stacking them from lowest to highest.

- *Good visualization of loudness over time*
- *Decent visual of pitch and tone over time*

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