Overview

Many modern music player applications come with a built-in audio visualizer. An audio visualizer is a graphic that evolves in time with audio playback, changing according to the characteristics of the sound. These characteristics can include volume, frequency spectrum, spectral envelope, onsets, and tempo.

This project implements such an audio visualizer in MATLAB. Using MATLAB accomplishes the whimsical goal of transforming the dull MATLAB plot, with all its negative, schoolwork-related associations, into an object of artistic beauty. In addition, we show that the Audio Systems Toolbox and MATLAB’s normal plotting functions are sufficient for implementing the project in real time with low latency, preventing the need to interface with another language or API.

Structure

Audio input reader

dsp.AudioFileReader
audioDeviceReader

Audio signal frame

Audio analyzer

MyAnalyzer

Signal characteristic parameters

Audio output writer

audioDeviceWriter

Audio output

Figure window

Visualizer

MyVisualizer

Results

A pop music recording was used to test file input. The red circle followed the bass drum hits in a very regular pattern, whereas the other two circles varied more unpredictably, since there were more sonic elements in the mid and treble ranges. The complexity of the sound made it difficult to predict the envelope changes.

Microphone input was tested as well. Clicks and snaps produced large, noticeable visual changes. For voice input, vowels and singing tended to trigger the green circle, while shrill consonants (e.g. “s” and “k”) triggered the blue circle. Steady vowel sounds caused the rear waveform to exhibit a nice-looking envelope.

Conclusion

The visualizer implemented in this project gives a listener visual insight into the characteristics of an audio signal. These insights should trigger associations with the listener’s sonic observations—for example, the circles, representing frequency bands, could be associated with specific instruments. Calling attention to frequency content in this way is especially helpful to an untrained listener.

That said, plenty of audio metering tools already exist for those looking for strict visual-sound correspondence. The visualizer in this project presents a degree of abstraction, such that the visual elements are only suggestions of sonic characteristics. This allows for some artistic interpretation on the part of the listener.