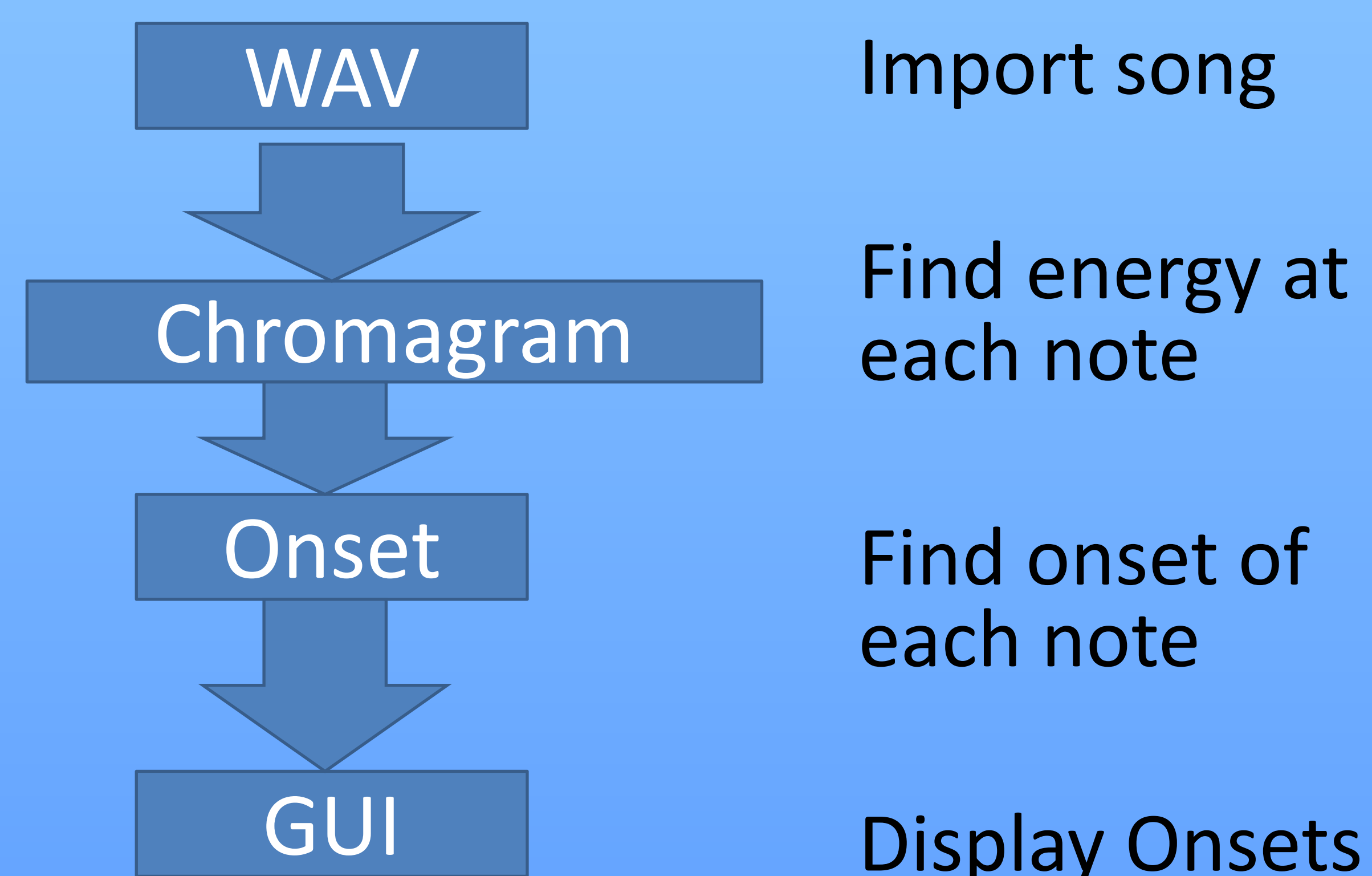# Chord and Beat Tracker
by Isaac Mosebrook

Abstract

Audio signal processing allows us to make a tool that shows a user what chords to play and visualizes the rhythm that they should be playing in real-time for any song they select. This tool has the potential to greatly assist new musicians in learning and playing along with new songs. Visual learners especially will benefit greatly by both seeing what to play and how to play it, both rhythmically and harmonically.

Process

WAV → Import song

Chromagram → Find energy at each note

Onset → Find onset of each note

GUI → Display Onsets

Method

The first step is for the user to import the song they want to play. Next we can analyze this signal using the Short Time Fourier Transform (STFT). To convert the result from the frequency domain to musical notes, we can multiply the STFT by a conversion matrix. Once this is complete, we have an array with the energy over time for each note. The next step is to is to find the onsets for each note using energy-based onset detection. This is done by calculating the signal envelope, taking the derivative of this envelope, and then thresholding. Once this is complete, we have an array of data that indicates simply what time each note in the song is played. This data is displayed in a GUI by telling Matlab when to light up a key on the keyboard, completing the program.

Results

Chromagram of D Minor

Detected Onsets of Each Note
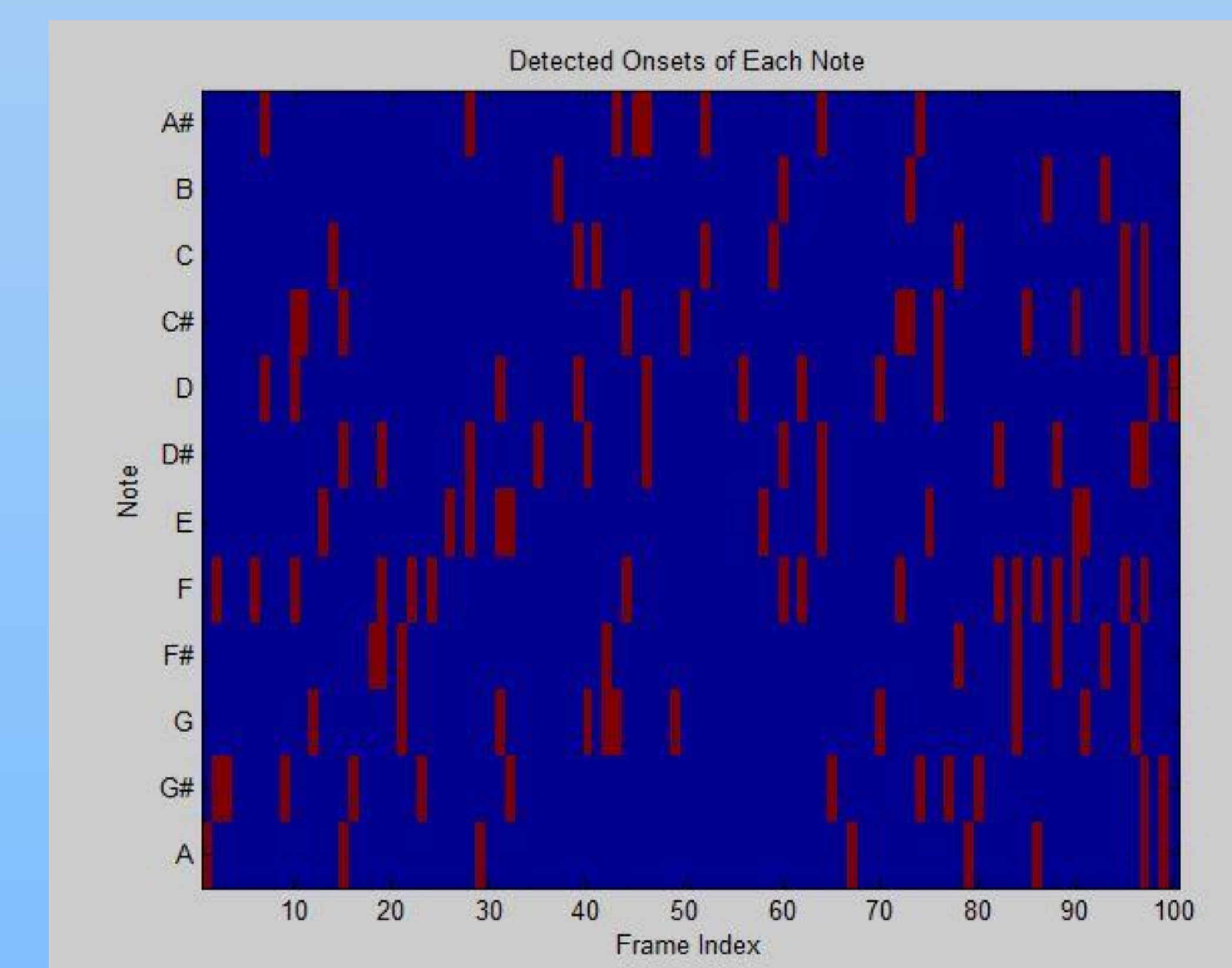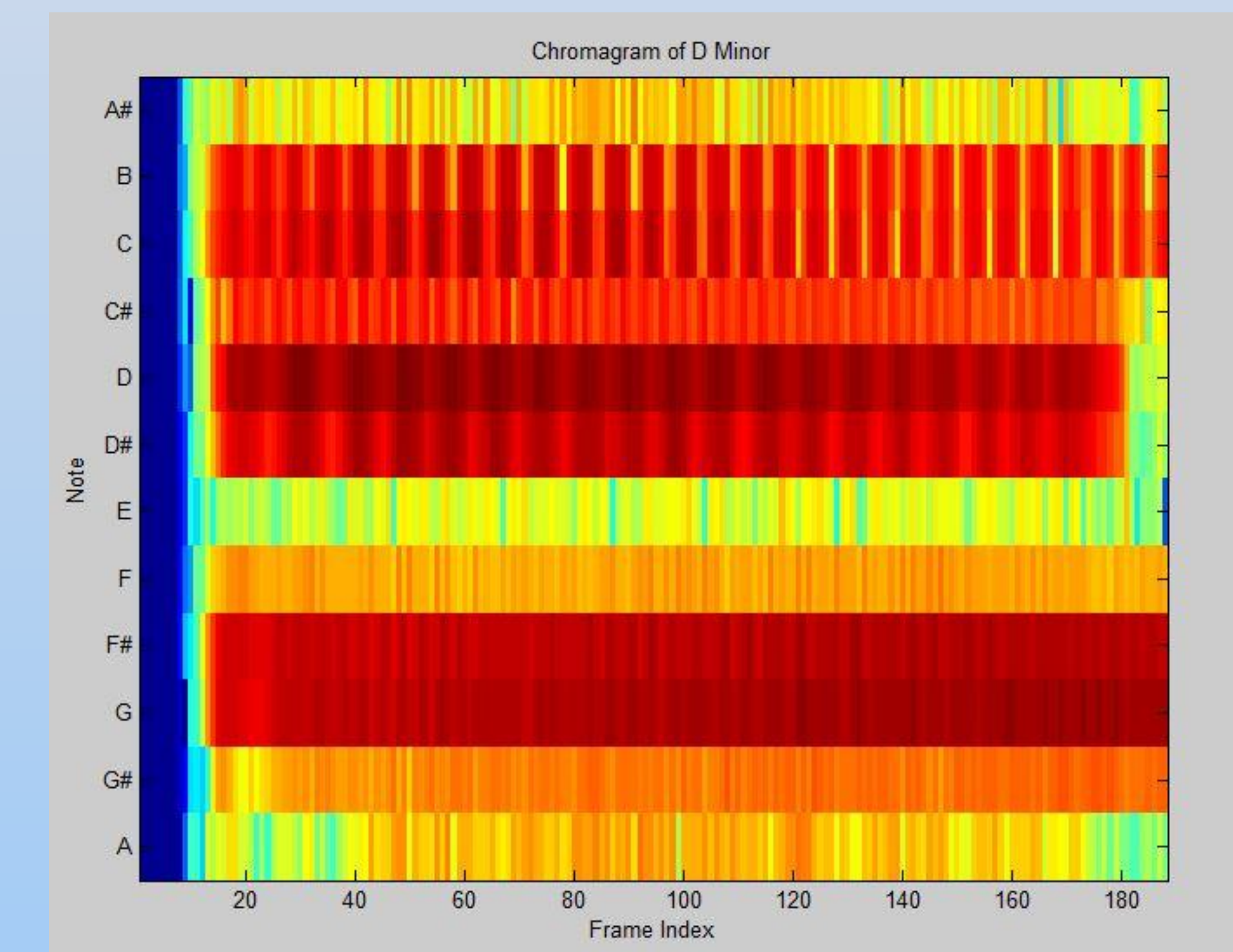
Future Work

-Add decay from the start of the note

-Quantize the onsets to a tempo