

Identify chroma feature for chord recognition

December, 2022

Agenda

- Music concepts
- Project description
- Pitch extraction
- Chroma identification
- Results

What is a chord?

- Several notes that sound simultaneously.
 - 2 notes: dyad
 - 3 notes: triad
 - 4 notes: tetrad
- What's a note?
 - A named pitch: A, B, C...
- What's a pitch?
 - A sound in a certain frequency: A=440 Hz, C=261 Hz

The image displays four musical staves, each illustrating a different type of triad. Each staff is divided into four sections: the first shows the full triad, the second shows the 'Root note', the third shows the 'Interval' (third or fifth), and the fourth shows the 'Fifth' note. The staves are labeled as follows:

- Major triad:** Shows a C major triad (C4, E4, G4). The intervals are a major third (C4 to E4) and a perfect fifth (C4 to G4).
- Minor triad:** Shows a C minor triad (C4, B3, E4). The intervals are a minor third (C4 to B3) and a perfect fifth (C4 to E4).
- Diminished triad:** Shows a C diminished triad (C4, Bb3, Eb4). The intervals are a minor third (C4 to Bb3) and a diminished fifth (C4 to Eb4).
- Augmented triad:** Shows a C augmented triad (C4, D#4, F#4). The intervals are a major third (C4 to D#4) and an augmented fifth (C4 to F#4).

Figure 5.5 from [Müller, FMP, Springer 2015]

What is a chroma? 1/2

- All pitches equally spaced in frequency domain, belongs to the same Pitch Class.
- A pitch can be separated in two components: *tone height* and *chroma*.
- A Chroma is a way to categorize pitches from the same Pitch Class.
 - C2 and C5 both have the same chroma value C



All C from C1 to C7

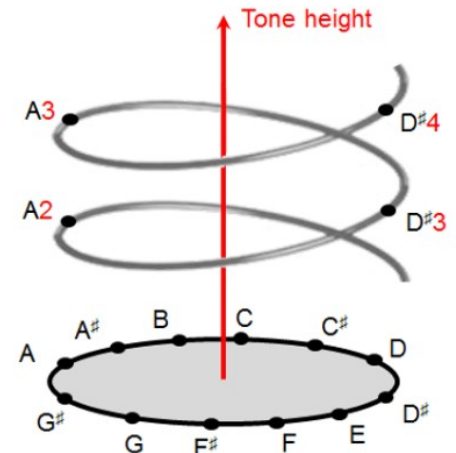
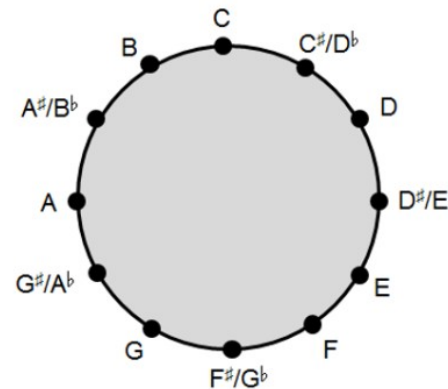
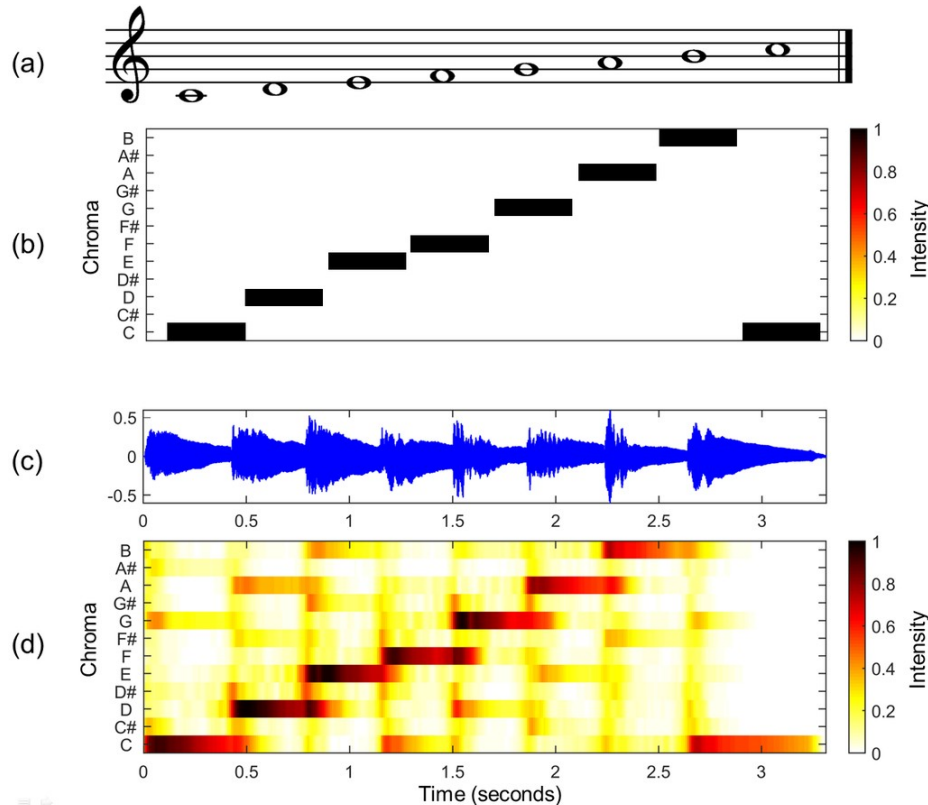


Figure 1.3 from [Müller, FMP, Springer 2015]

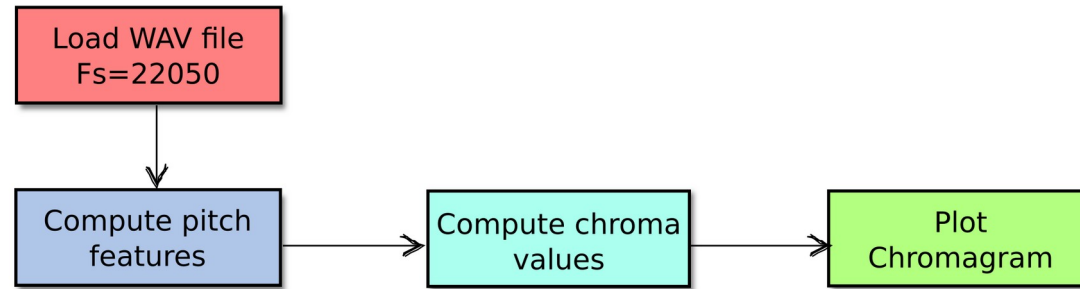
What is a chroma? 2/2



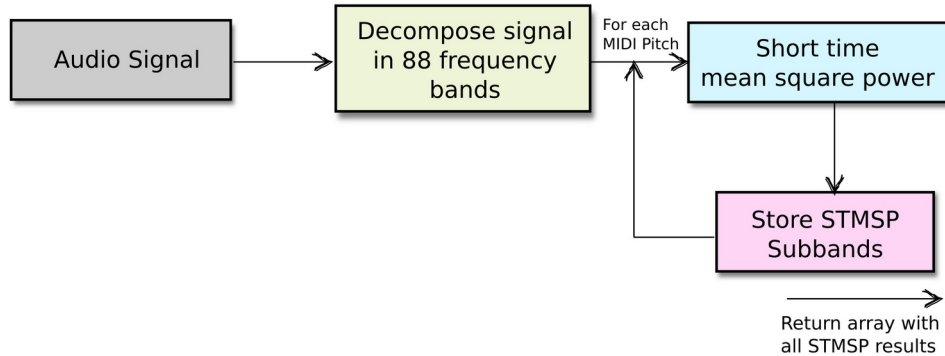
- A Chromagram shows the presence of all chromas in an audio signal for a given time window.

Objective

- For a given audio signal, compute and display the chroma values found.



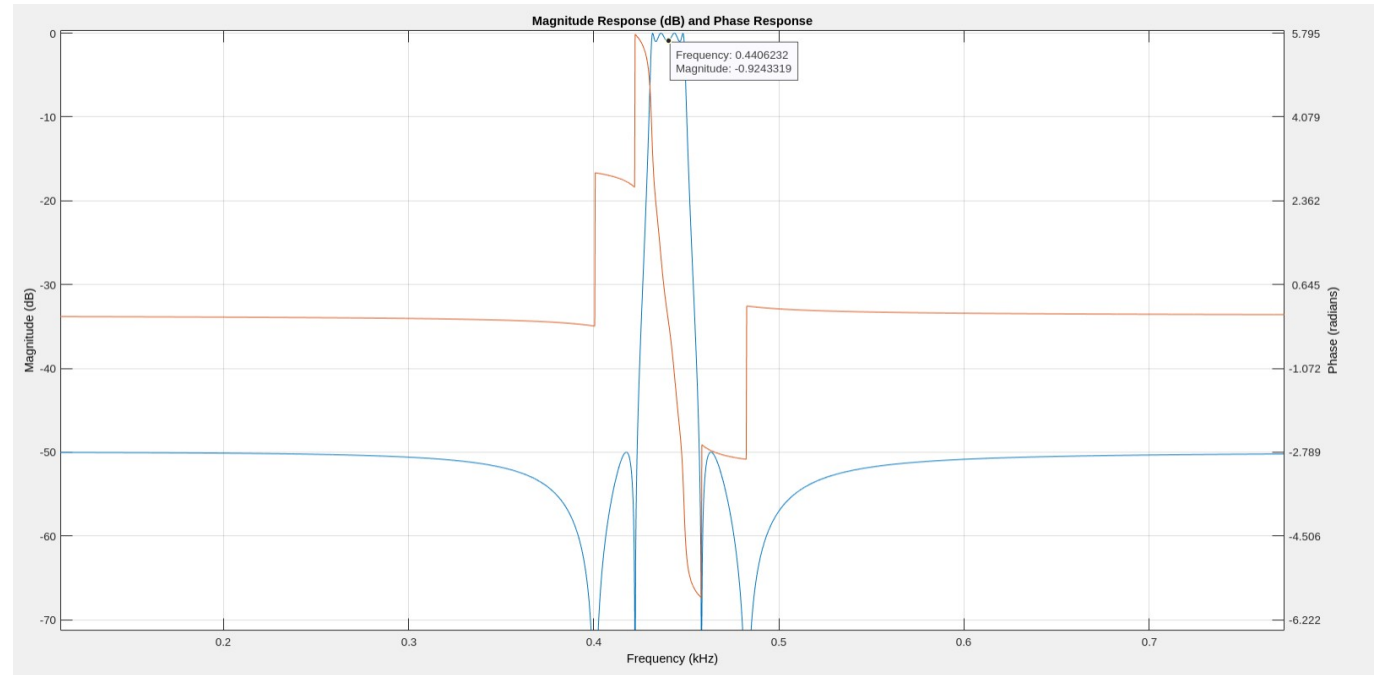
Compute pitch



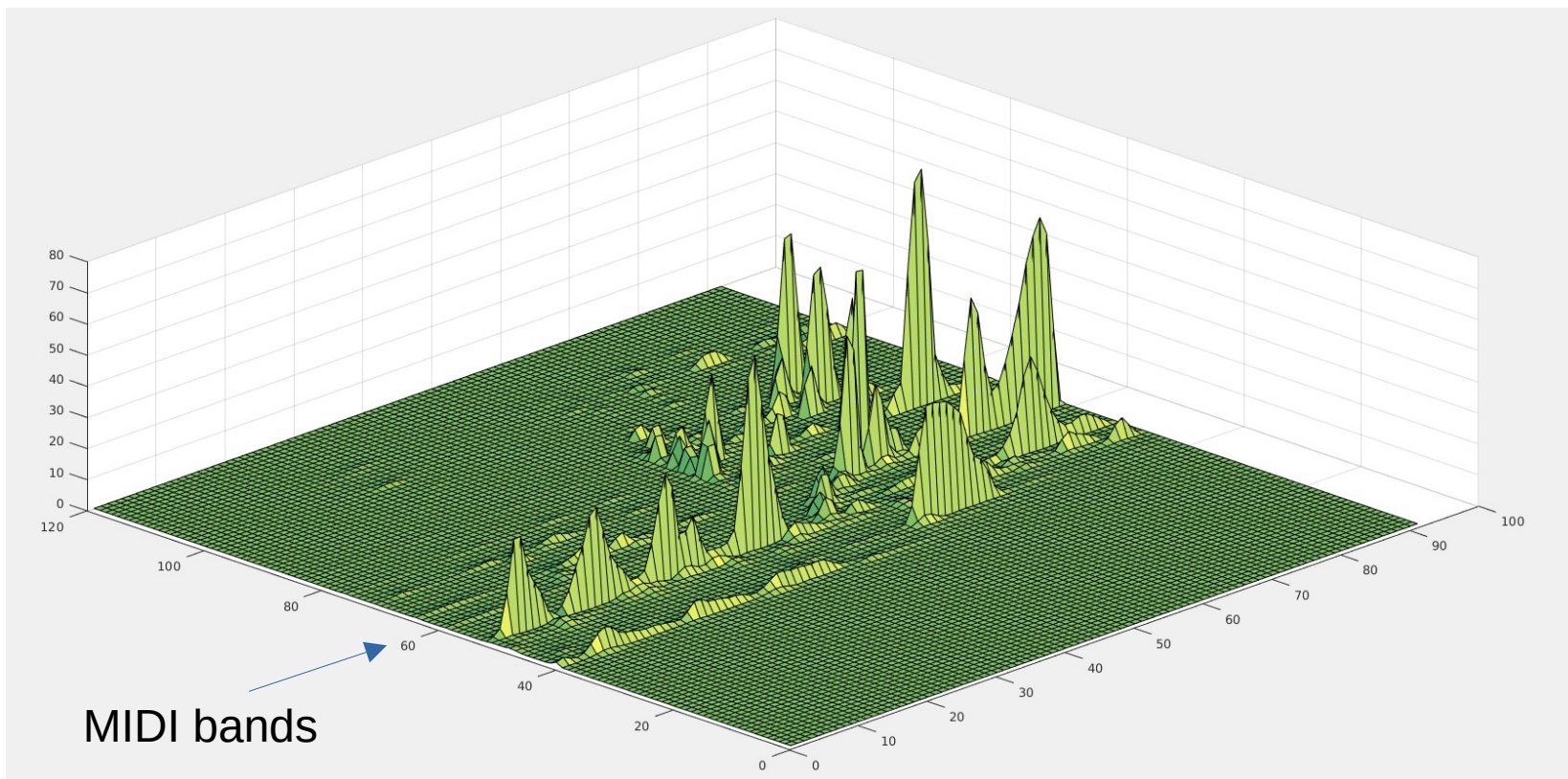
- Use a predefined filter bank to decompose signal in 88 sub-bands. (MIDI 21 to 108)
- On each MIDI pitch compute the STMSP
- Save the result in an array and return

Decomposing the signal

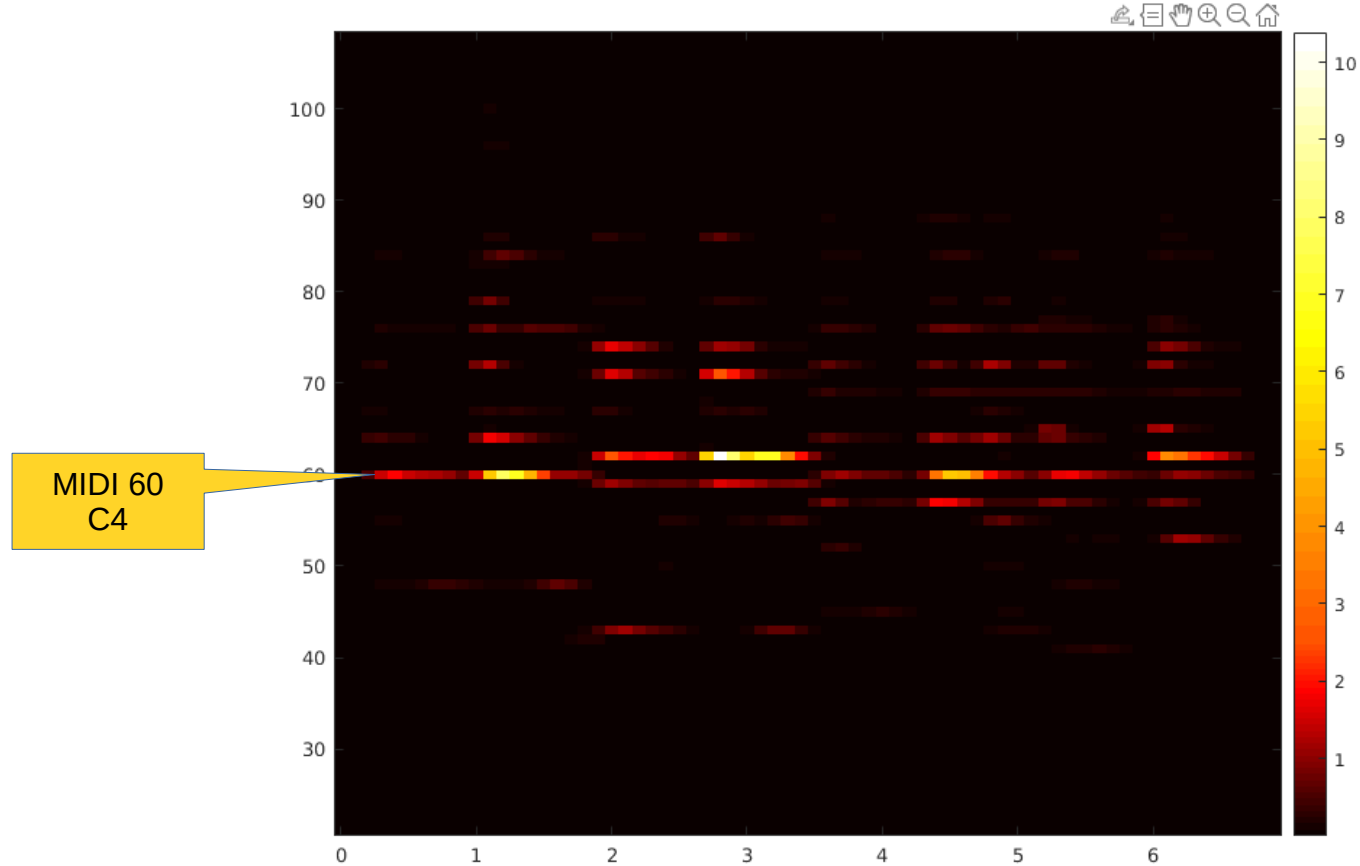
- Predefined filters created by paper's authors.
- Band pass filter for A4 = 440 Hz



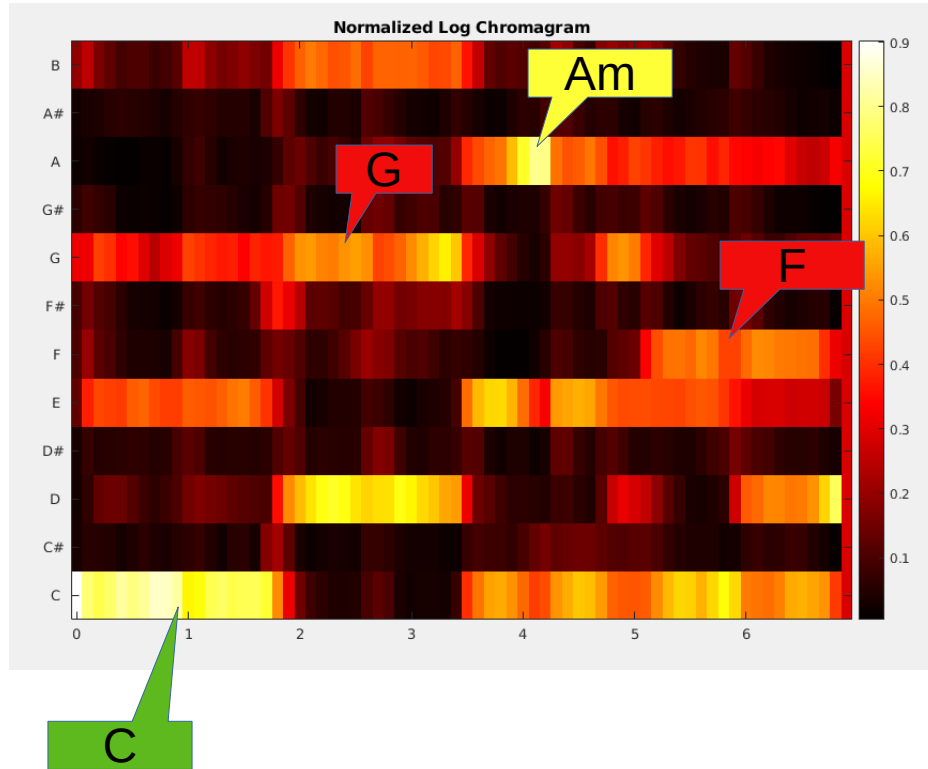
Pitches detected



Pitches colormap

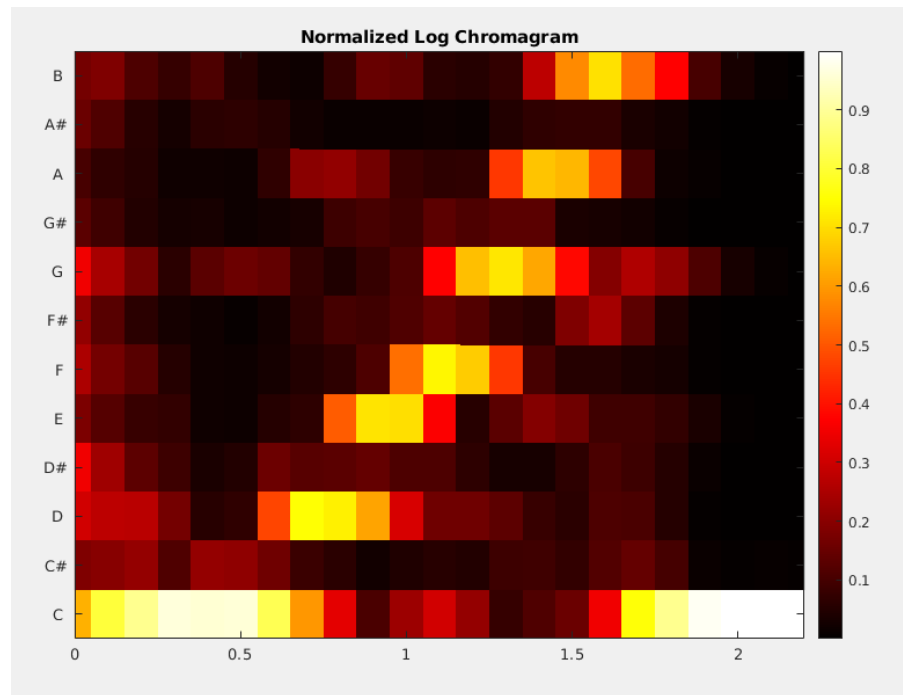
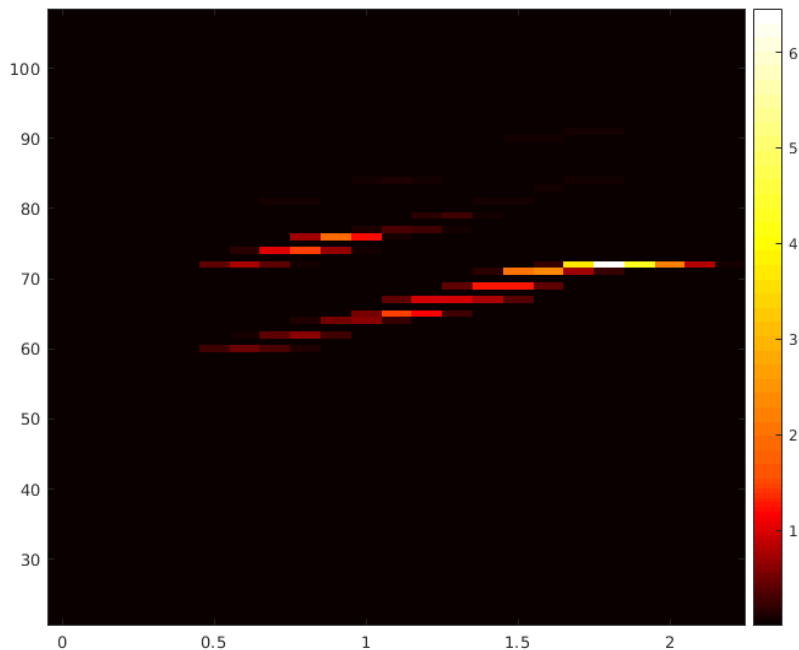


Chroma detection



- The first chord is identified correctly.
- The notes marked in red were wrong
- Am in yellow seems to be correct.

Trying sample audio



A scale C to B identified correctly