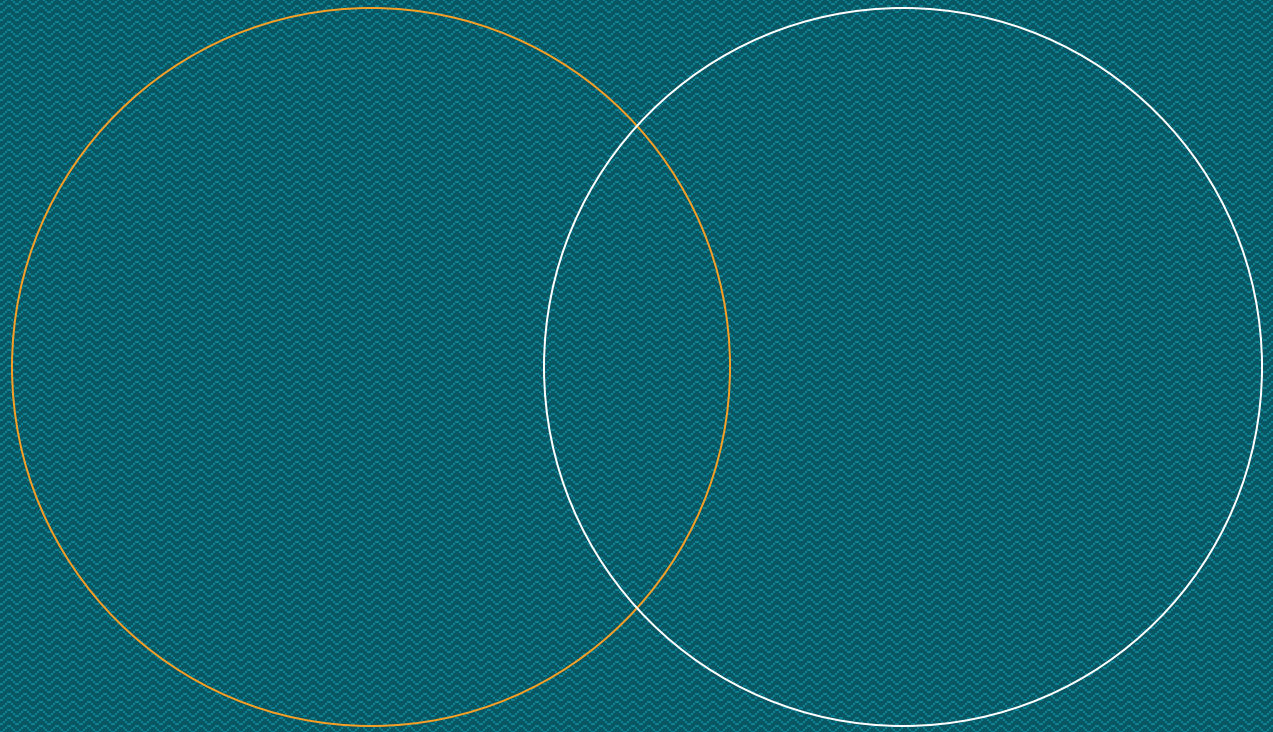
Amerena Matteo
Minetti Andrea



ACTAM

project presentation

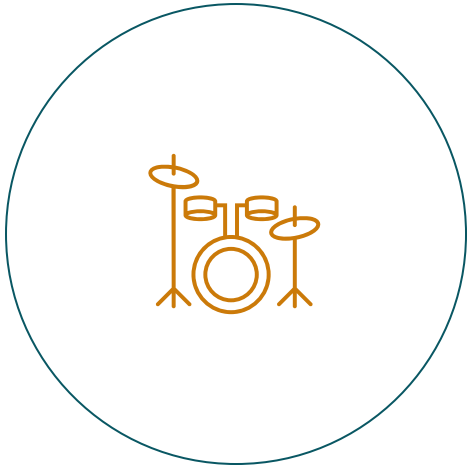
POLITECNICO
MILANO 1863

SAMPLE

ANALYZER

HARMONY

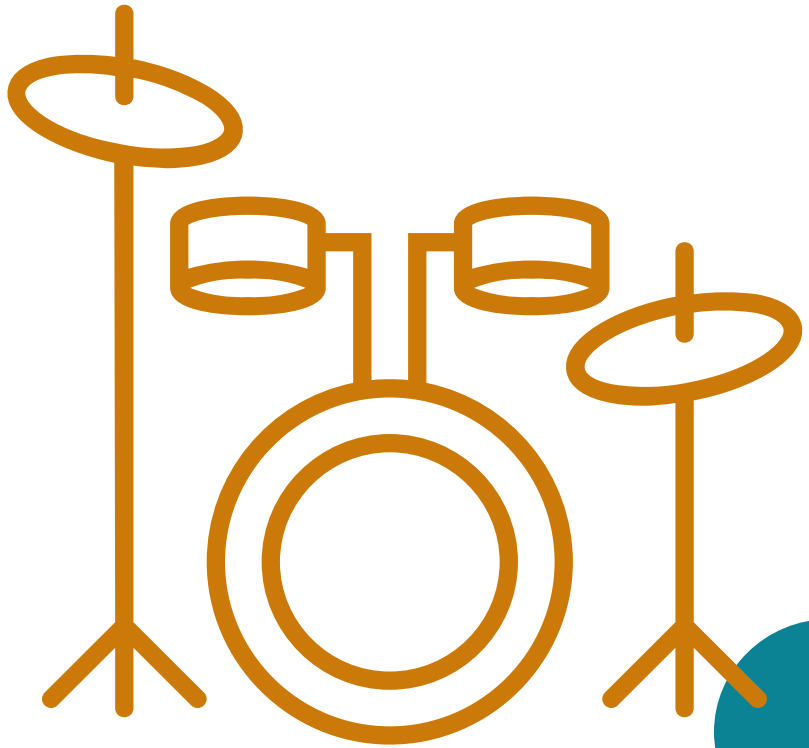
RHYTHM



Rhythmic analysis

- Find the underlying beat and guess the BPM

- Visually represent a superposition of different rhythms



Harmonic analysis

- Spectrum through FFT (average of the sample, not framewise)
- Find spectral peaks
- Harmonic Pitch Class Profile (HPCP) detection
- Set of rules for voicing suggestion

Voicings (art of creating chords)

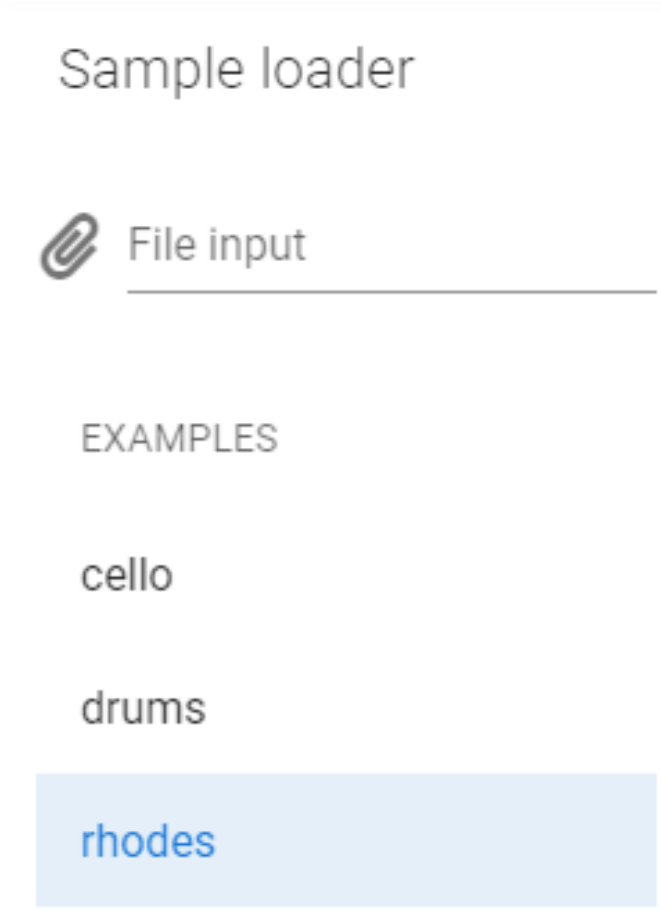
- Avoid too many 3rds intervals
- 4ths and tritones create «suspended» sound
- Wider intervals at low notes (avoid muddiness)
- Avoid doubling notes except the top note
- Keep all the intervals within the range of a perfect 5th

Some specifics

- Vue framework + Vuetify (material design)
- Typescript -> class-style components
- Essentia -> state-of-the-art algorithms for analysis

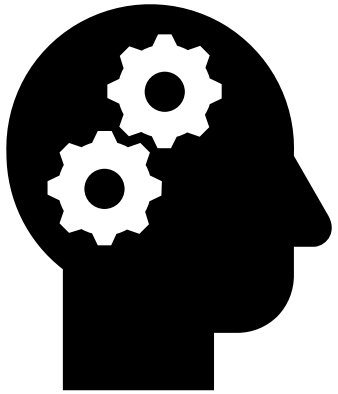
How it works


User input
asynchronous access
Essentia wrapper
ESSENTIA
Store service
Subscribed components



Upload

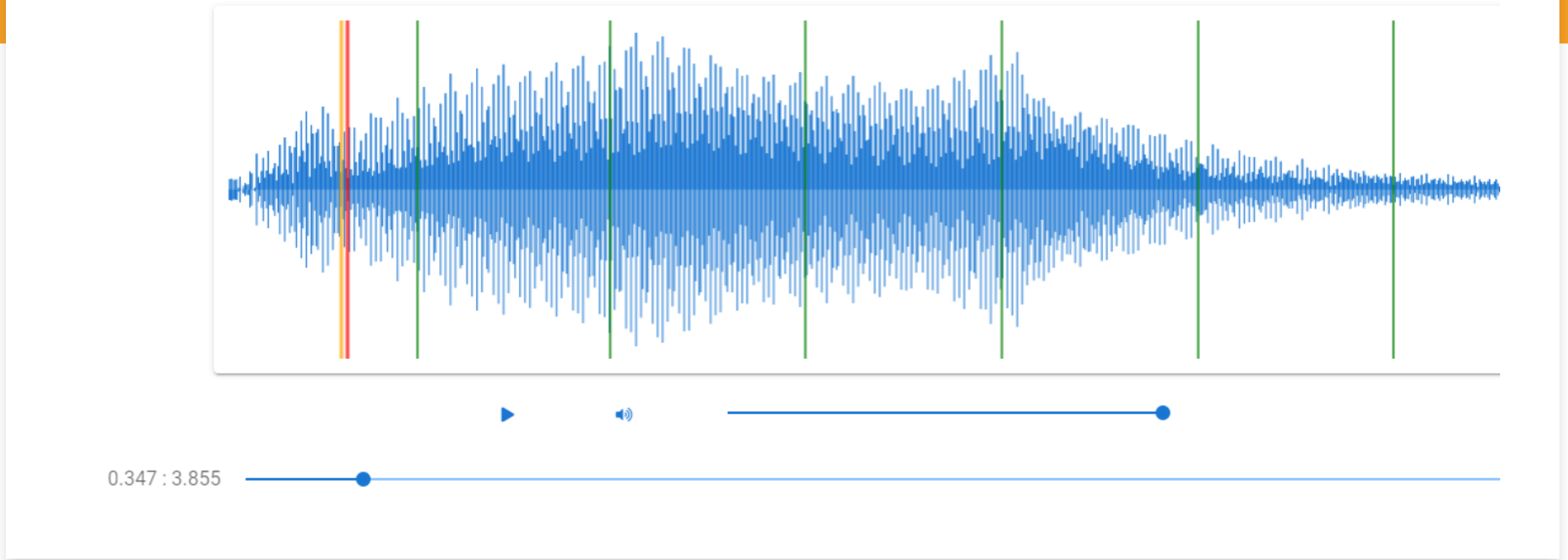
- User uploads a sample
- Waits until the analysis stage is complete



Highly semantic process.

Looking for chord suggestion with a kick sample …

Tab switch

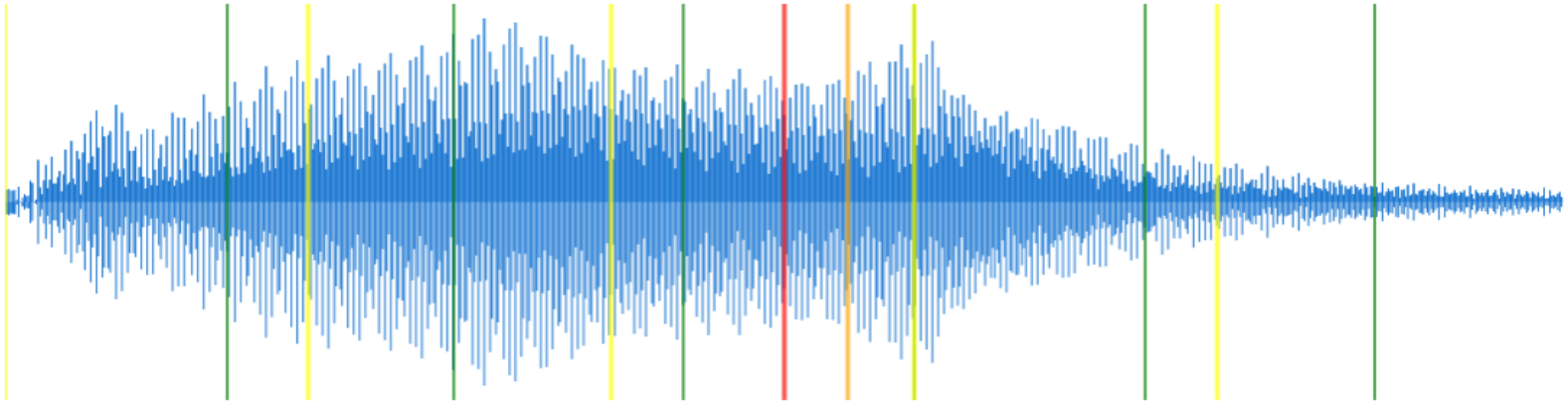


Waveform

Audio player is integrated, allows user to move through the sample also while reproducing the audio file.

HARMONY

RHYTHM



beat

mouse position

playing position

polyrhythm?

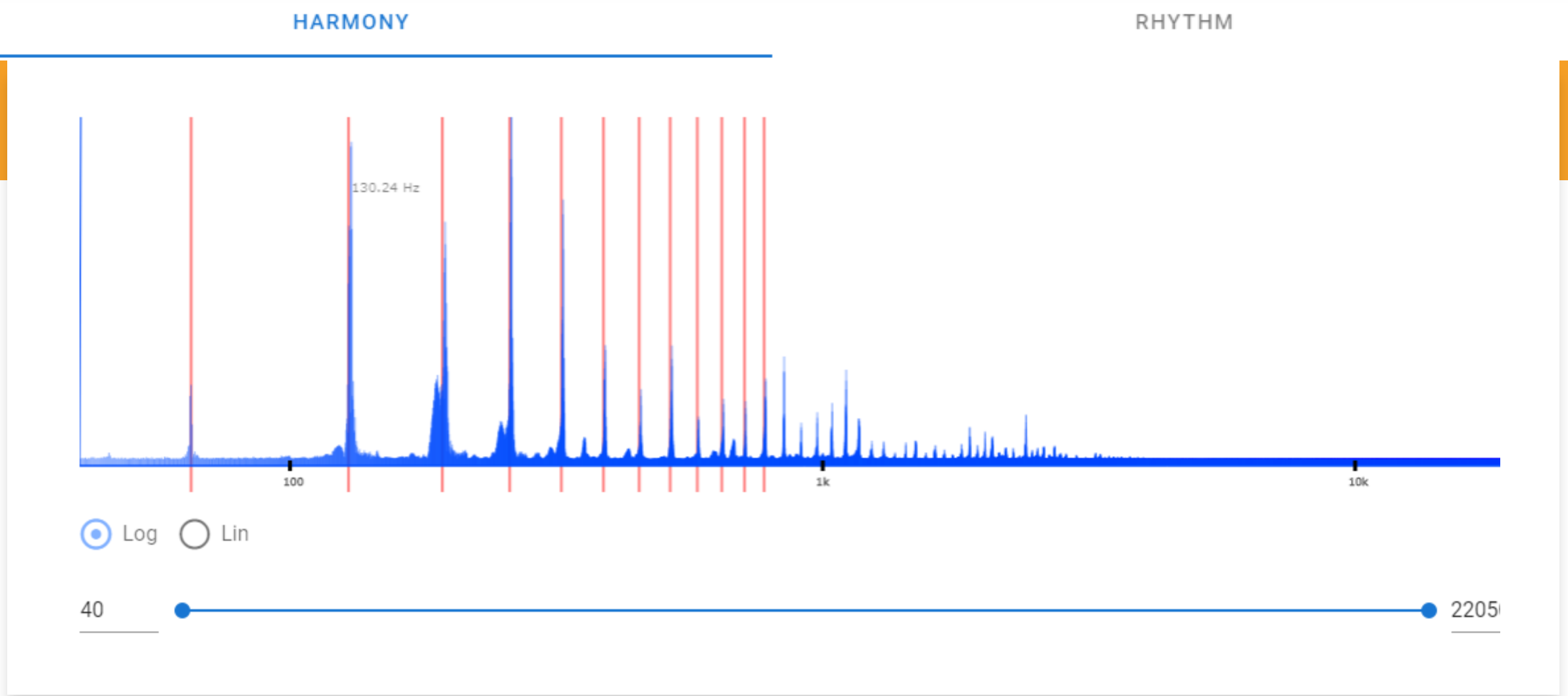
Rhythmic analysis

Polyrhythm: a visual help

- Polyrhythmic detection is not simple
- Visually help understanding the simple math behind

How to draw and animate the canvas?

Canvas
on a layer-structure
(cheat and redraw only
«moving» objects)



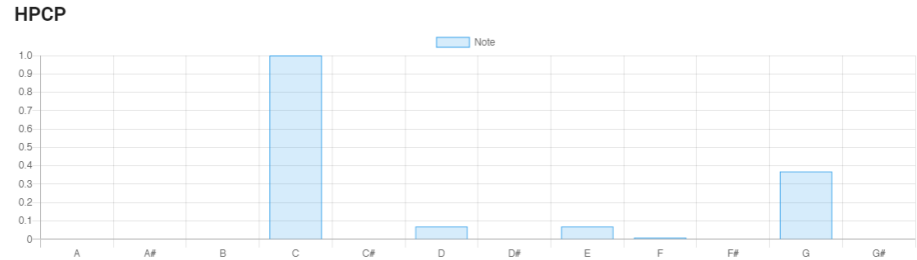
Spectrum presenter

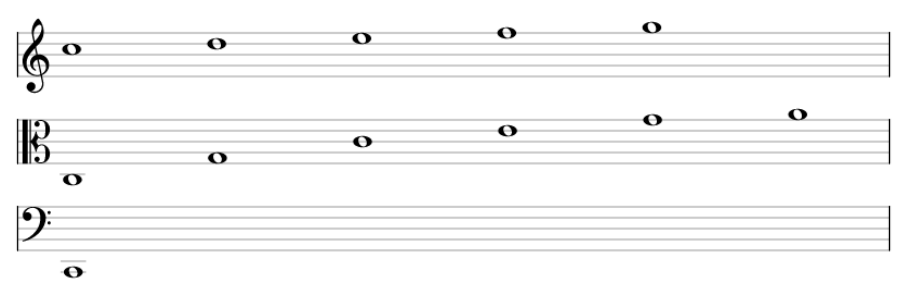
- Switch between logarithmic and linear view
- Select a range of frequencies to zoom in
- Mouse hover tells the user the approximated frequency of the peaks

From spectrum to data

HPCP is used in chord recognition systems and tells us the presence of a certain harmonic in a certain range (in our case a 12-semitone tempered scale).

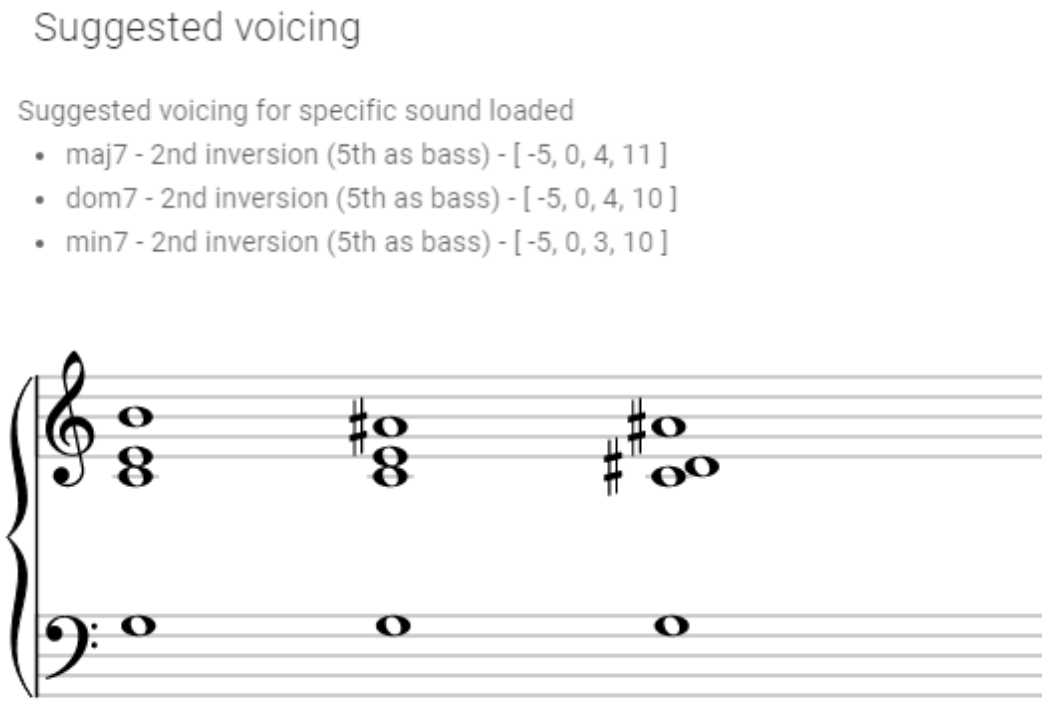
Harmonic peaks are detected and translated from frequencies to note transcription using Vexflow, a library for music notation.





Finally, suggest voicing!

- The engine follows some easy rules we defined to suggest a good voicing.



- With vexflow, we write the chord to the stave.

Project analysis

	PROS	CONS
INTERNAL	STRENGHTS › Fully reactive › Fresh design › Clean and simple	WEAKNESSES › Not too flexible › Lack of tests › No checks on type of sample uploaded
EXTERNAL	OPPORTUNITIES › Great sandbox for more complicated projects	THREATS › Relies a lot on external libraries

Materials

Vexflow: (https://github.com/0xfe/vexflow)

API to render music notations, sheets, guitar tabs.

Inversify: (https://github.com/inversify/InversifyJS)

IOC: Inversion of control. Classes helpful to have SOLID code properties, especially dependency inversion principle. In other words: it helps to have classes that testable and isolated.

Vuetify (https://vuetifyjs.com/en/)

Material design for Vue framework

RxJS (https://rxjs-dev.firebaseapp.com/)

Reactive programming using Observables for asynchronous calls.

Chart.js(https://www.chartjs.org/)

Open source library for plotting charts.

Essentia (https://github.com/MTG/essentia.js/tree/master)

State-of-the-art algorithms ported in Javascript.

Thank you