The Original Beat

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Objective

Web based harmonizing, layering, and inspiration for electronic music producers

Requirements

Requirements

Functional

- Secure login system
- Upload a MIDI file
- Enter a melody from an on screen keyboard
- Generate a harmony to the initial MIDI file
- Download the newly generated MIDI file
- View generated tracks in a piano roll

Requirements

Non-Functional

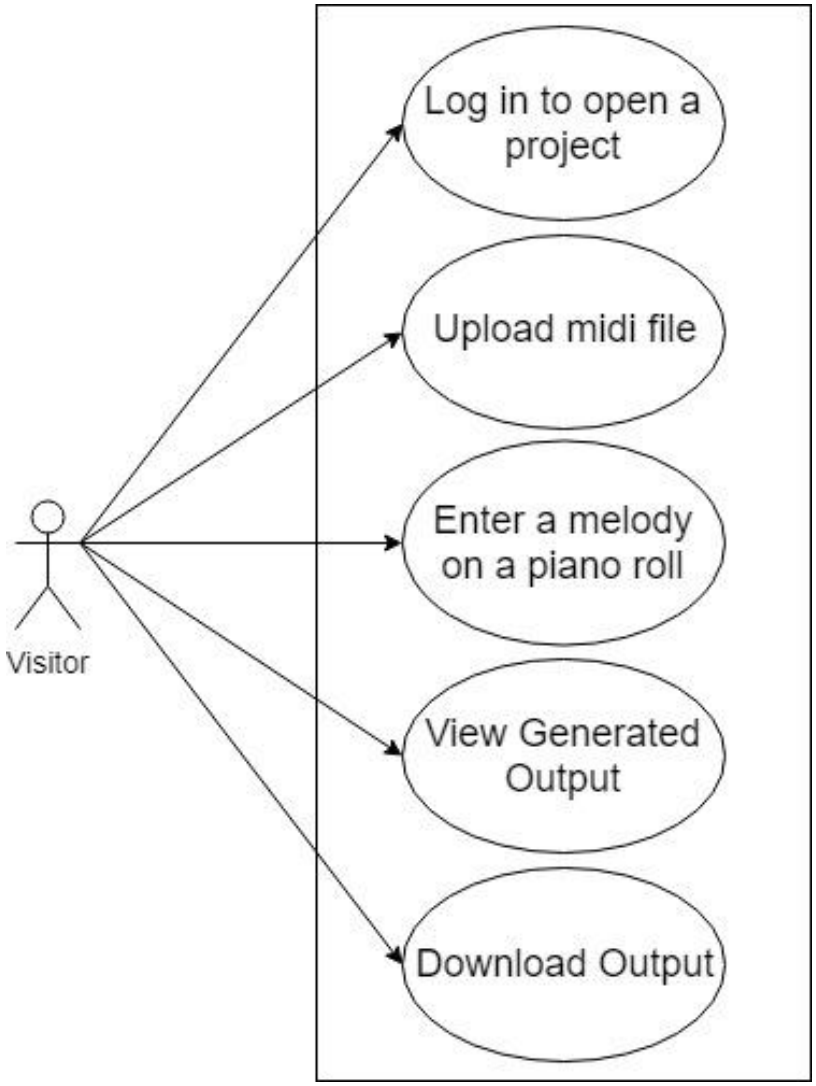
- User friendly
- Quick response time
- Reliable system
- Minimalist design
- *Allow more than 50 users at one time

Requirements

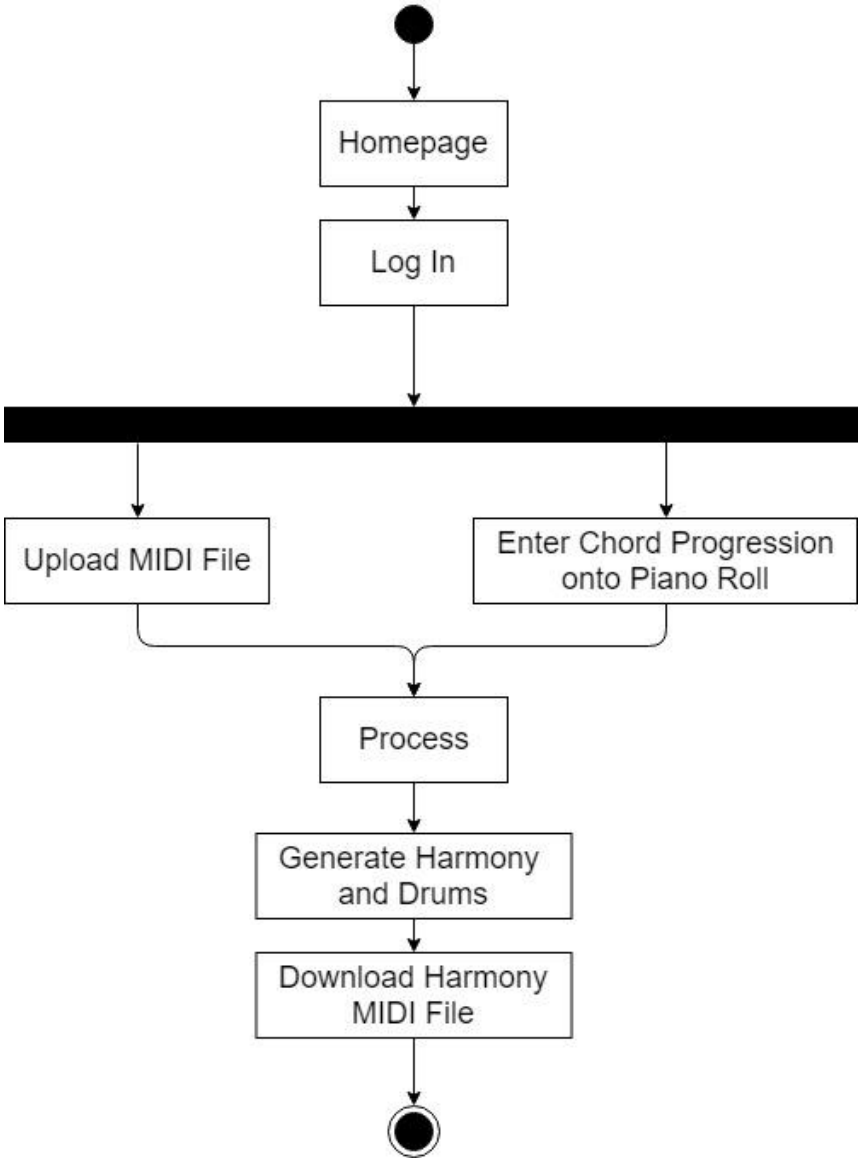
Design Constraints

- Deployed on DigitalOcean
- OS and server stack independent

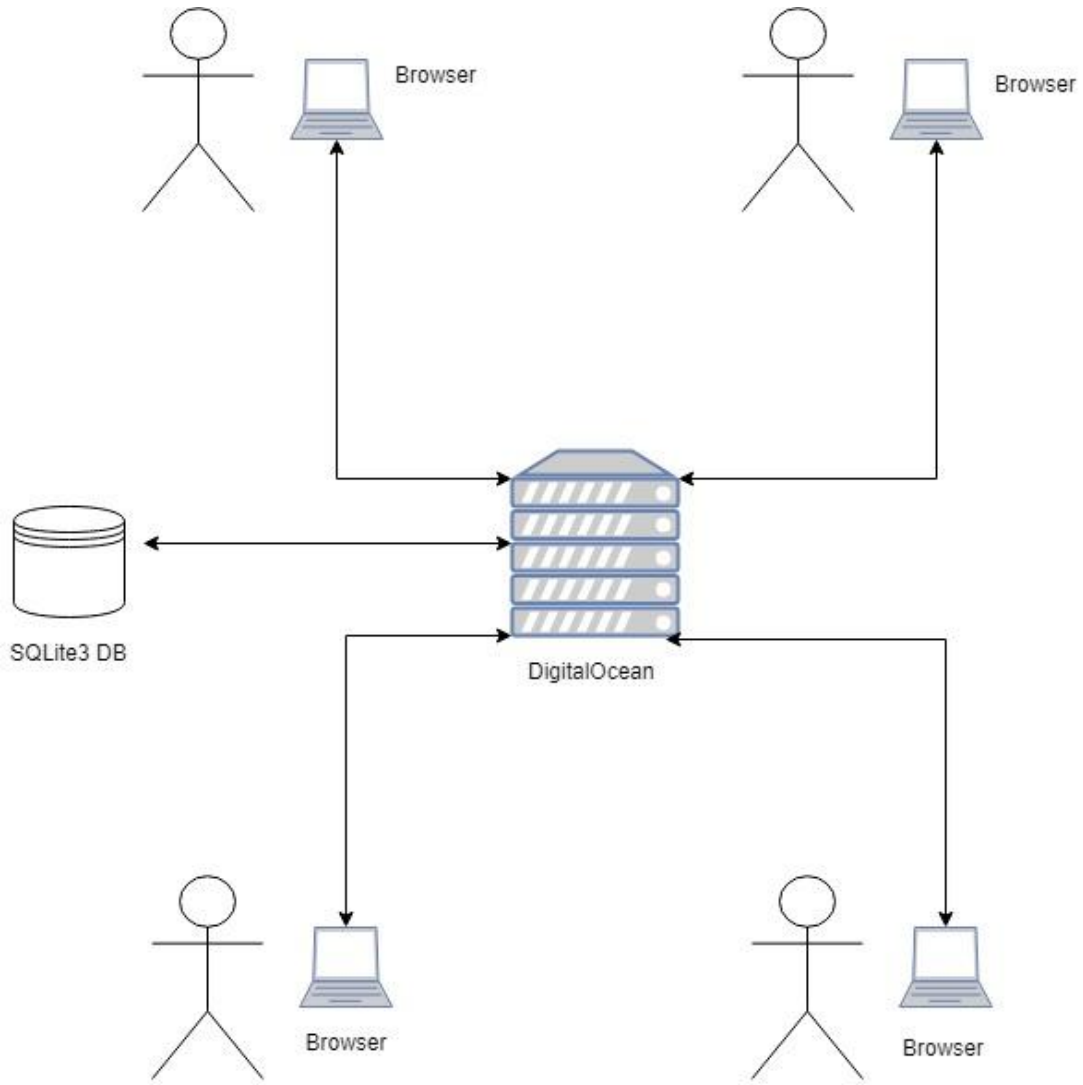
Use Case Diagram


Log in to open a project
Upload midi file
Enter a melody on a piano roll
View Generated Output
Download Output
Visitor

Activity Diagram


Homepage
Log In
Upload MIDI File
Enter Chord Progression onto Piano Roll
Process
Generate Harmony and Drums
Download Harmony MIDI File

Architectural Design

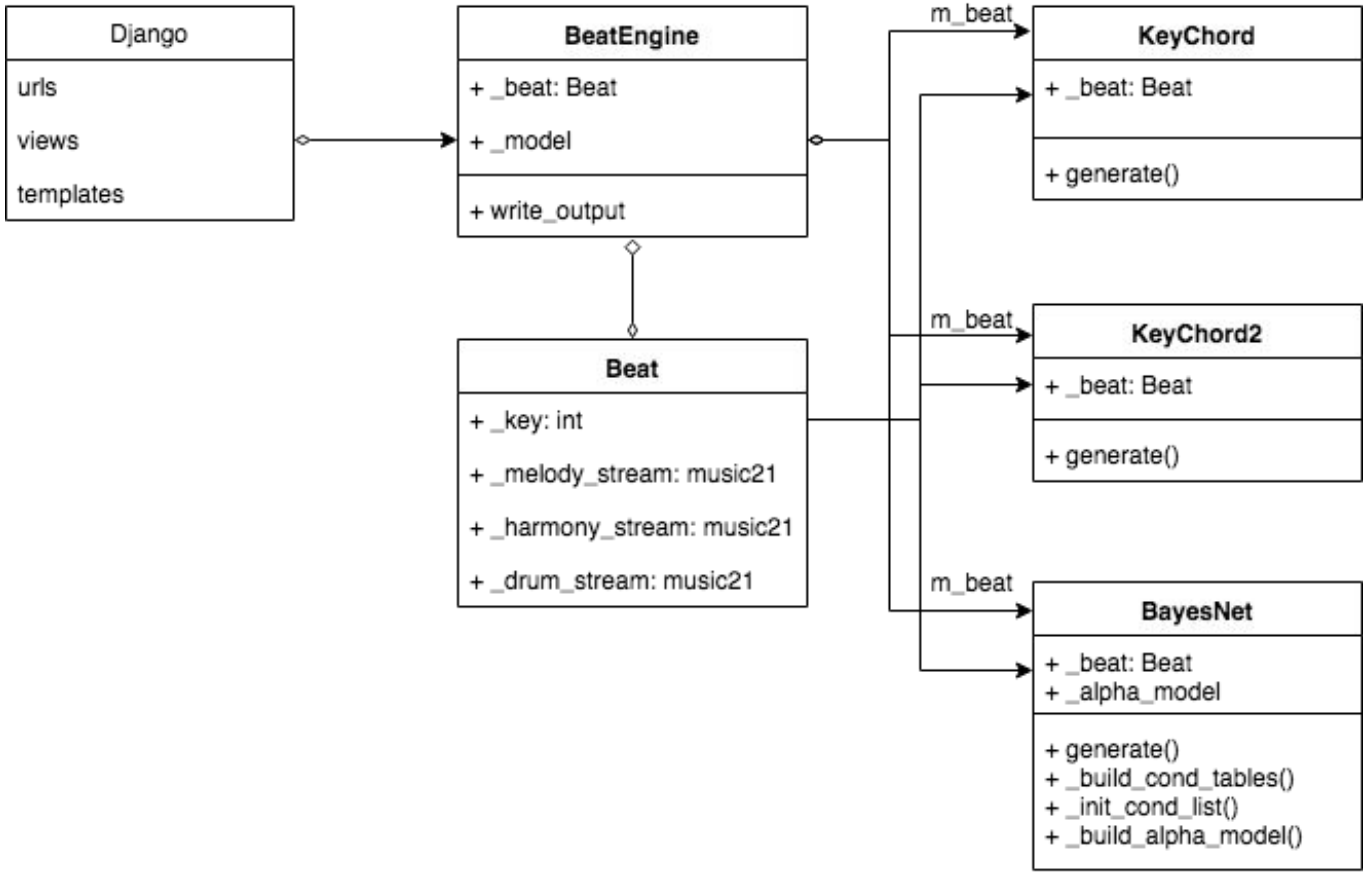

Browser
Browser
SQLite3 DB
DigitalOcean
Browser
Browser

Production Server

DigitalOcean Standard Droplet

- Django
- Gunicorn - WSGI
- Nginx
- Let's Encrypt
- UFW
- Ubuntu 16.04.6 x64

System Design


Django
urls
views
templates
BeatEngine
+ _beat: Beat
+ _model
+ write_output
Beat
+ _key: int
+ _melody_stream: music21
+ _harmony_stream: music21
+ _drum_stream: music21
m_beat
KeyChord
+ _beat: Beat
+ generate()
m_beat
KeyChord2
+ _beat: Beat
+ generate()
m_beat
BayesNet
+ _beat: Beat
+ _alpha_model
+ generate()
+ _build_cond_tables()
+ _init_cond_list()
+ _build_alpha_model()

Technologies Used and Rationale

Technologies Used and Rationale

Frameworks

- React
- Django

Technologies Used and Rationale

Packages

- Mido
- Music21
- Pomegranate
- Tone.js
- MIDI.js

Technologies Used and Rationale

Databases

- SQLite3 DB

Harmonization Algorithms

Harmonization Algorithm

KeyChord

- = Initial Expert System
- = Finds the Key
- = Chordify Notes from Melody

Harmonization Algorithm

KeyChord2

= Improved Expert System

C Major = [C, D, E, F, G, A, B]
[
[C, D, E, F, G, A, B] -> C Major
[D, E, F, G, A, B, C] -> D Minor
[E, F, G, A, B, C, D] -> E Minor
[F, G, A, B, C, D, E] -> F Major
[G, A, B, C, D, E, F] -> G Major
[A, B, C, D, E, F, G] -> A Minor
[B, C, D, E, F, G, A] -> B Diminished
]

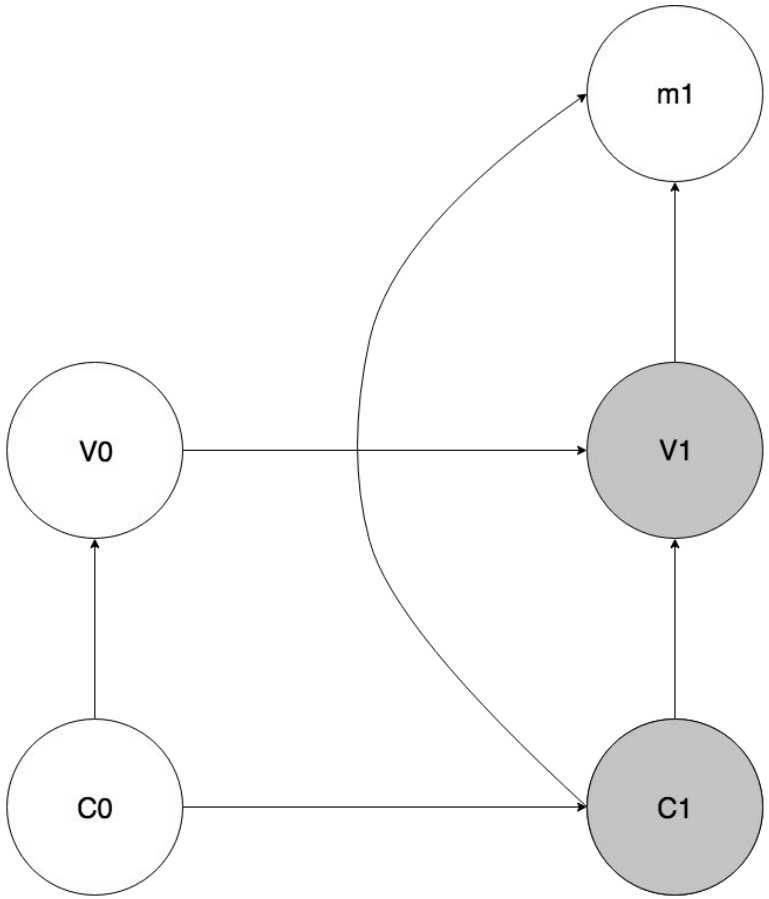
Harmonization Algorithm

DrumBeat

- Generates an Acoustic Bass Beat
- Quarter Note Beat
- Add Variation:
  - 20% chance of dropping the bass note

Harmonization Algorithm

Bayes Net



Expert System Vs. Machine Learning

- = Expert system is a rabbit hole
- = Probabilistic models need lots of data
- = Hybrid approach

Testing

Testing Done

= Unit Test
= White Box

Testing Needed

= Black Box
= Stress Testing

Project Demo

www.TheOriginalBeat.com

Obstacles Encountered

Objective

Web based harmonizing, layering, and inspiration for electronic music producers

Obstacles Encountered

- Lack of percussive pitches in Music21
- Bayes net debugging
- Production server setup
- Integrating IFrames
- Managing API's

Future Features

Future Features

- Allow Input from external MIDI Device
- Add Drum SoundFonts
- Save and Load Multiple Projects
- Larger Dataset for Bayes Net Algorithm
- Improve Implementation of Digital Keyboard

Credit and Thanks

Open Source Products

- Google Creative Lab Piano Roll
- react-piano
- SoundFontProvider

Research Papers

- Kitahara, Tetsuro. 2017. “Music Generation Using Bayesian Networks.” *Machine Learning and Knowledge Discovery in Databases Lecture Notes in Computer Science*, 368–372. doi:10.1007/978-3-319-71273-4_33.

Questions

Current Solutions

- Jukedeck: No control, Not Co-Creative
- Mubert: No Input, Not Co-Creative
- Humtap: Not Customizable
- Arpeggiators: Not unique
- DAW's: Complicated

BayesNet Details

- = Forward backwards algorithm

Key Determination

= Midi Meta Message
= music21.analysis.discrete
= Krumhansl

Parameters of Generation Engine

- **Input: N Bars of a Melody**
  - Midi of Piano/Synth input
  - N bar mononote melody
  - N bar melody
- **Output:**
  - Piano/Synth/Bass
  - 3 Tracks
  - N bars per track of harmonized midi
- **Stretch Goal Output:**
  - Bassline
  - Drumline
  - Structured Sections

UI Design and Implementation

- WebMidi standard - Google Chrome supported
- On Screen Piano React Component - modified
- Piano Roll React Component
- WebSockets to stream and load songs faster

TODO:
Everybody memorize slides more,
Practice with clicker,
Practice standing up,
Don't look at screen
Keep hands still, or interacting gestures
Make eye contact with

Questions:

-How long do we have is it a hard cap?

-Any additional slides we should put at the end in case people ask questions? Research??

-What is the attire?