

Algorithmic Composition Through Training and Evolution

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1. Introduction

The project's goal is to compose music based off of midi files that the system has heard. The composer is driven by a genetic algorithm and uses a fitness function to critique the songs made.

2. Objectives

- Implement a MIDI system that reads and plays MIDI files in an understandable form of music.

MIDI uses hexadecimal commands:

```
0xFF 03 A5 80
0x90 3A 40
0x80 3A 00
```

A system is needed to make MIDI more understandable:



- Gather data from MIDI files that will evaluate the fitness of songs during the evolution process.

- Note Transitions and Harmonies
- Note Durations and Pauses
- Instruments and Note Range
- Scale, Tempo, and More..

The genetic algorithm critiques a song based on whether it conforms to the training data.

3. Methods

Finding a song's scale is key, different scales play differently and note data should never have different scales.

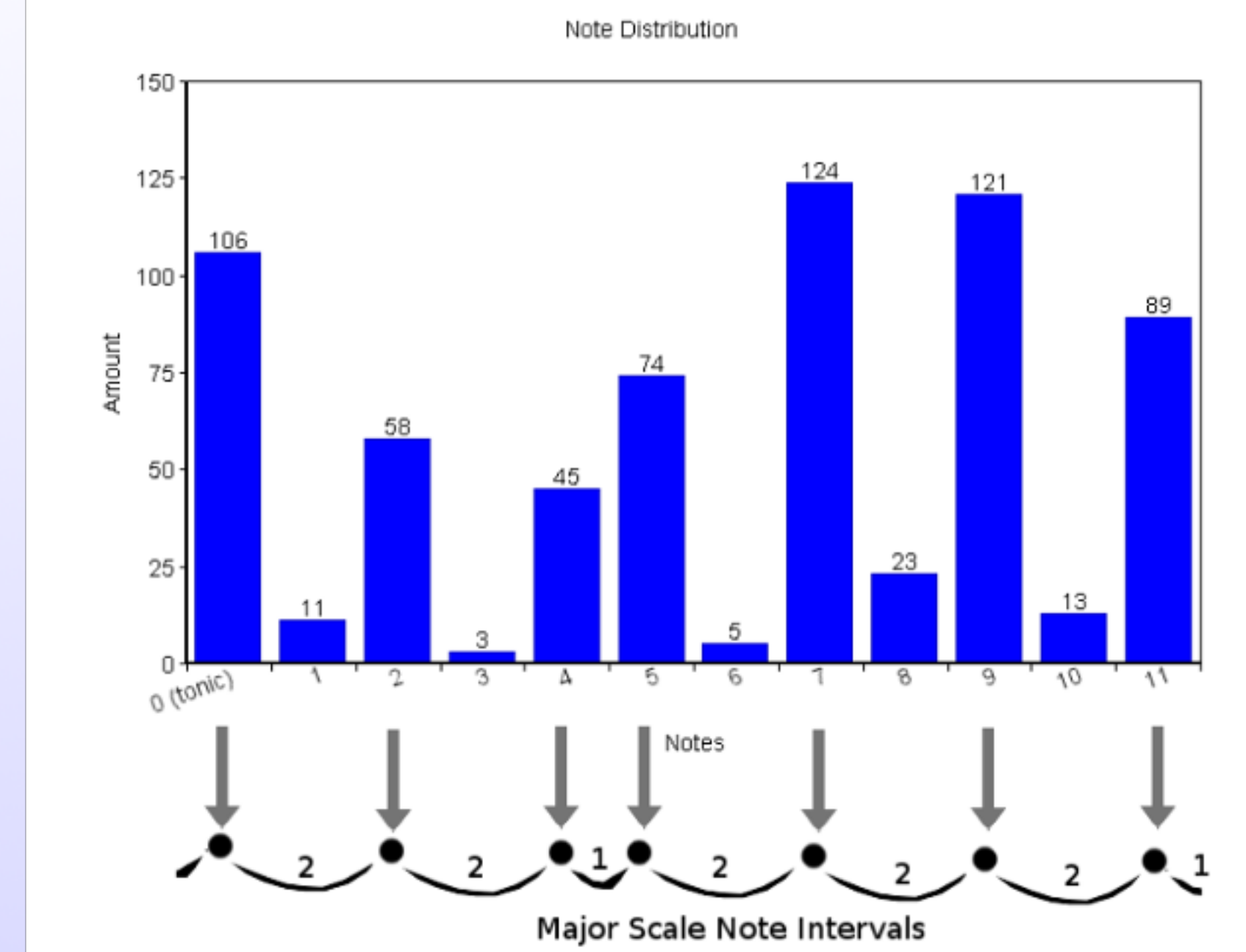
The MIDI system also saves a song's time division and tempo. These are other factors that should be similar when taking rhythm data. Mixing note durations and pauses should all be done with songs that have the same tempo.

The GA(Genetic Algorithm)

The GA starts with a user selected number of individuals in the population. The GA creates a completely random series of notes and then evaluates fitness based off of training data. The individuals with higher fitness are probabilistically chosen for future generations.

Each individual chosen for future generations goes through mutations, crossover, or simple reproduction.

Finding the tonic note:



Before Crossover



After Crossover



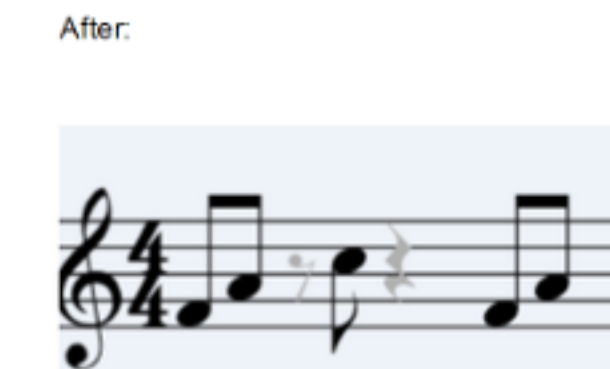
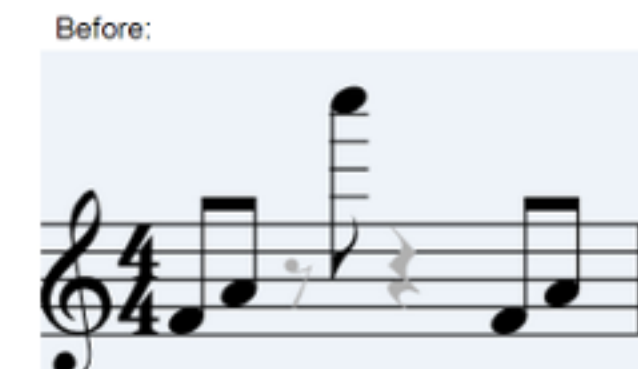
Key Mutation



Duration Mutation



Jump Mutation



4. Results

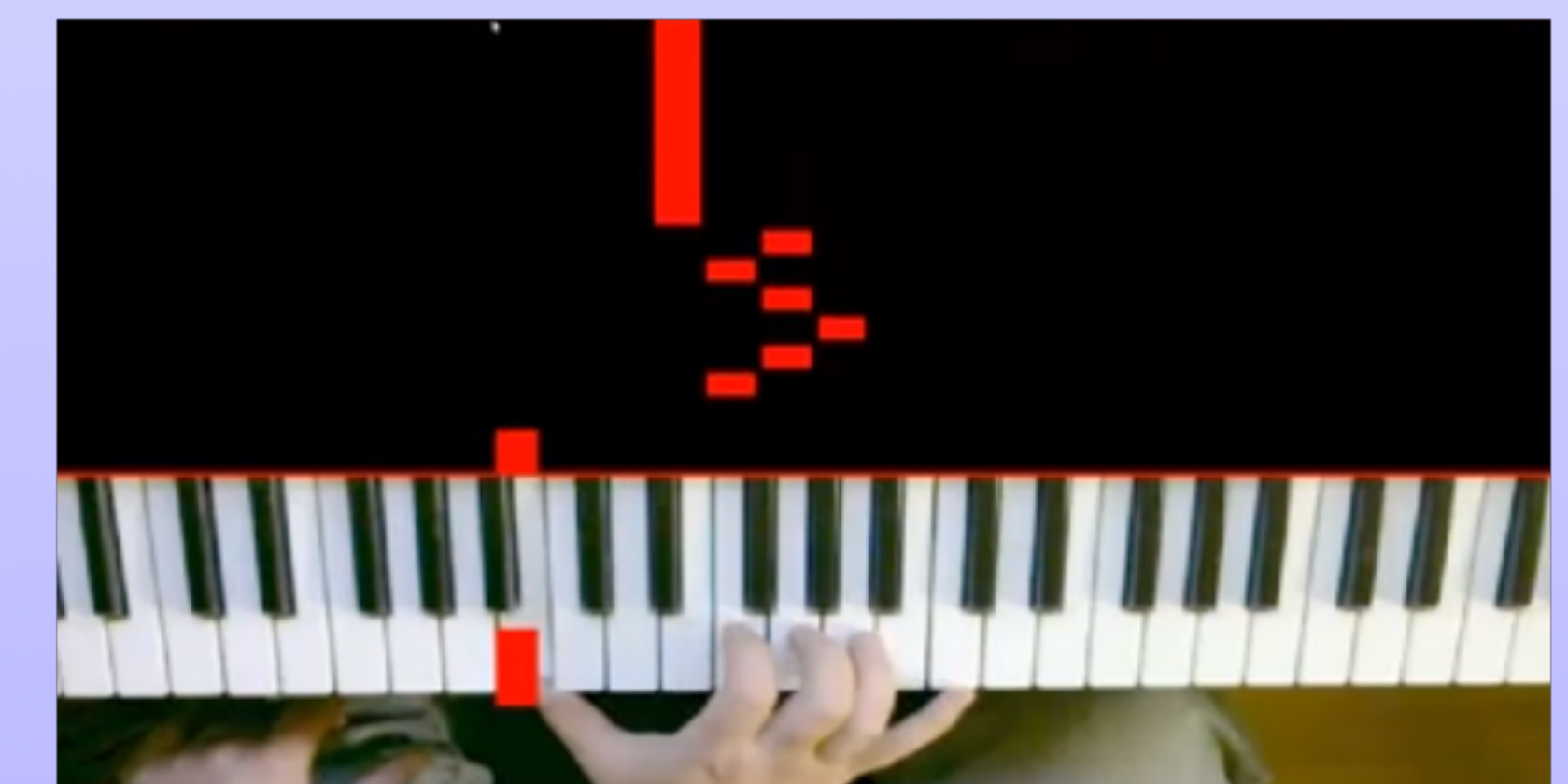
The first version of the application did not make anything terribly amazing. After much refactoring the music generated had noticeable structure and rhythm. It even produced decent note movements.

Though the application did not succeed in the way that I had hoped, my experience with the MIDI protocol has been invaluable.

5. Discussion

MIDI is an amazing thing! For a protocol created back in 1983 it's fast and simple. I really enjoyed this project and want to continue my career in musical application systems.

Currently I am working on a piano tutor that uses a camera to algorithmically determine where keys on a piano are. Once keys have been determined any MIDI file can be played with an augmented view while showing notes as they are played in the MIDI file.



Demos are Available!

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