An Evolutionary Algorithm to Evolve Music

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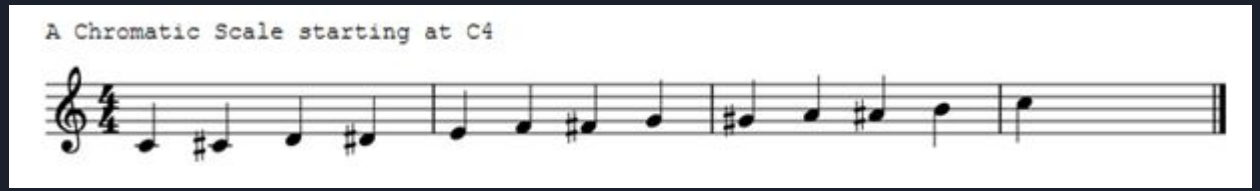
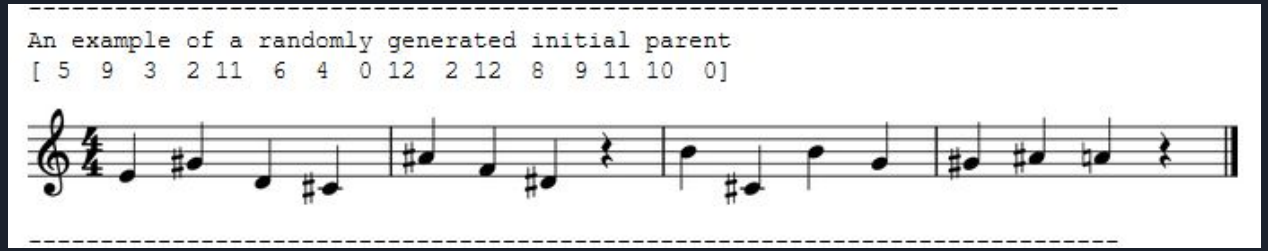
A Quick Introduction

- I created an evolutionary algorithm to evolve music
- Algorithm Overview:
  - Generates an initial population of random music compositions
  - Genes based on chromatic scale between C4 and C5
  - Mutates genome and calculates fitness
  - Fitness is based on fitness function I made and user input via interactive evolution
  - Utilizes simple tournament selection to remove least fit individuals
  - Returns top performing compositions after X generations



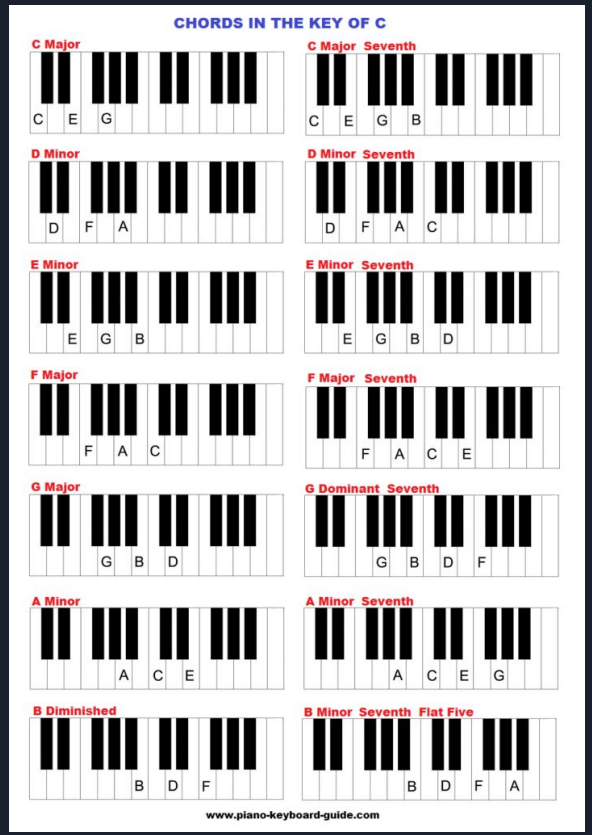
The genome

- 4 measures, 16 beats
- Notes ordered from 0-13
  - 0 is a rest
  - 1 corresponded to C4, 2 to C#
  - Increased by half steps



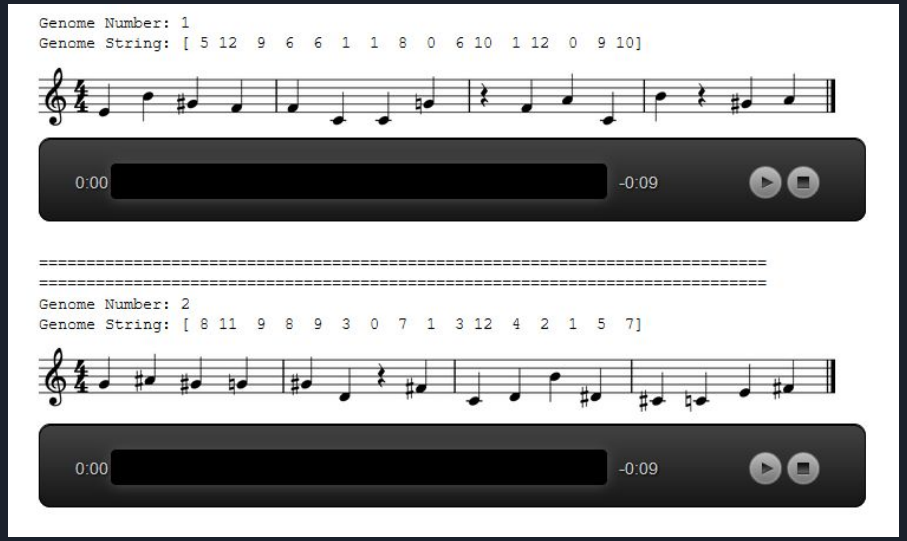
The Fitness Function

- Tested for 3 main criteria
  - Similarity to 14 C major chords
    - Examples are C major (CEG, [1,5,8,13]), D minor (DFA, [3,6,10]), or E minor (EGB, [5,8,12])
    - Calculated hamming distance between a single measure and the chord notes to quantify similarities
  - Repetitions within each measure or between two measures
    - More repetition signifies higher fitness
  - Increasing/decreasing over different steps
    - For example, increasing by 1 half step over 3 notes would probably sound worse than increasing by 2 half steps, or a whole step, over 3 notes.
    - C -> C# -> D vs C -> D -> E

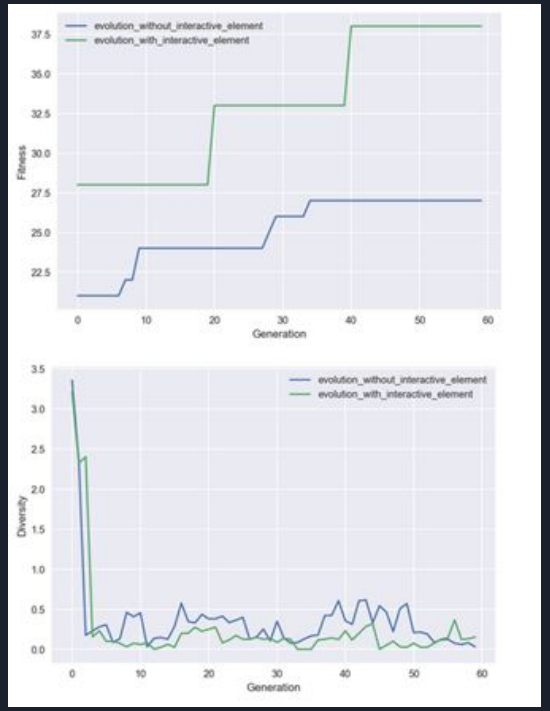


Interactive Evolution

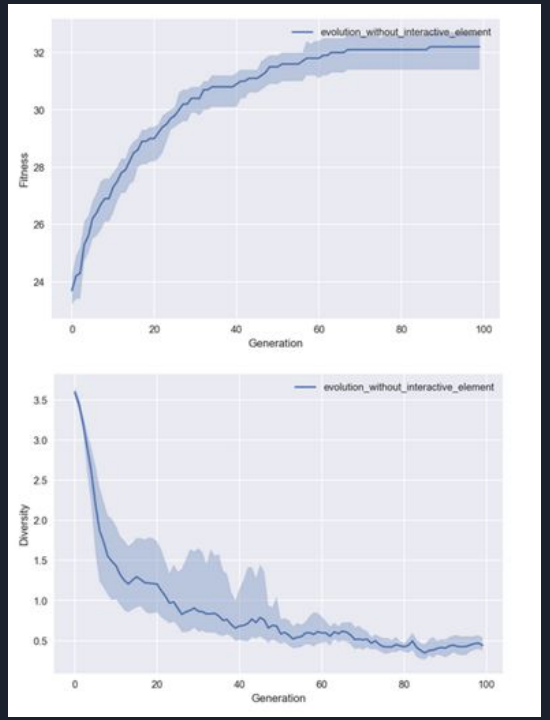
- In terms of music, my fitness function is super handwavey. Is it possible to quantify how good a composition sounds based on fancy math and algorithms alone? Prob not lol
- Enter interactive evolution
  - Every X generations, the user could pick which compositions sounded the best
  - I found every 10 generations to work well
  - Also lower parents/children
  - The most enjoyed compositions would be awarded a large amount of fitness



Results



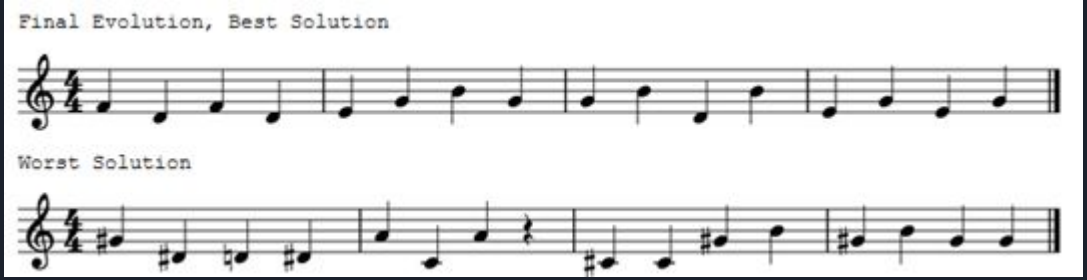
Fitness and Diversity with and without the interactive evolution. 1 run, 5 parents/children, 60 generations.



Fitness and Diversity over time without interactive evolution. 10 runs, 50 parents/children, 100 generations.

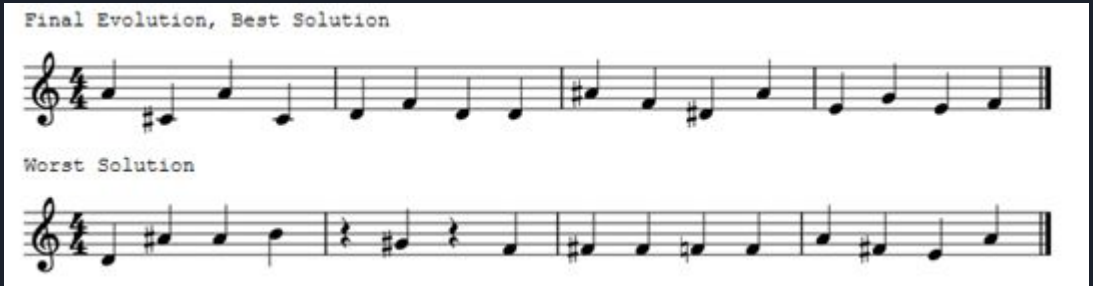
Without interactive evolution ->

- More repetition, less half steps



With interactive evolution ->

- Some repetition, more half steps



Live Demo

I could not figure out how to export mp3s of my compositions, so I have the live demo. Doesn't feature the written composition part since music21 was weird with mac….

enjoy!

Thanks! Any questions?

Me getting ready for piano class (circa 2021, colorized)