Accompaniment Generation

Alexandr Ragulin

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1 Running the program

Full project is uploaded to the github repository: https://github.com/Skril3366/accompaniment-generation.hw. The process of running program is described in the README.md file and dependencies are specified in the requirements.txt file.

1.1 Requirements

- Python 3.10.8 or higher
- mido 1.2.10
- music21 8.1.0
- argparse 1.4.0

1.2 Running the program

The only argument required is path to the midi file. Here is sample command:

```
python3 AlexandrRagulin.py ./resources/babiegirl_mono.mid
```

2 Detected keys

- barbiegirl_mono.mid: C#m
- input1.mid: Dm
- input2.mid: F
- input3.mid: Em

3 Key detection algorithm

For detection key of the song I used Krumhansl-Shmuckler algorithm. It uses statistical analysis of the relative frequencies of the notes.

I've attempted to implement it, however, I didn't manage to find a bug in my implementation, so I decided to stick to one provided by music21 library.

4 Genetic algorithm

My implementation of genetic algorithm generates new population by applying the following procedured to the previous one:

- Crossover

- Mutation

Firstly, an "elite"(ones with the best fitness function) is selected from the population, then the crossover is performed on the best ones(number of elites and number of individuals to crossover may not be the same). Then this two lists of individuals are merged and mutation is performed on them.

4.1 Fitness function

Fitness function consists of 2 parts:

- Vertical fitness
- Horizontal fitness

Vertical fitness is calculated by examining how much dissonant notes are played at the same time.
Horizontal fitness is calculated by:

- Number of dissonant notes played one after another
- Correctness of harmonic movement of the chords
- Penalty for repeating chords (the closer repeated chords, the worse)

Harmonic movement (from one chord to another) is prioritized if it is:

- Dominant $\rightarrow$ tonic
- Subdominant $\rightarrow$ dominant or tonic
- Tonic $\rightarrow$ subdominant or dominant