Planning genetic algorithms to compose music

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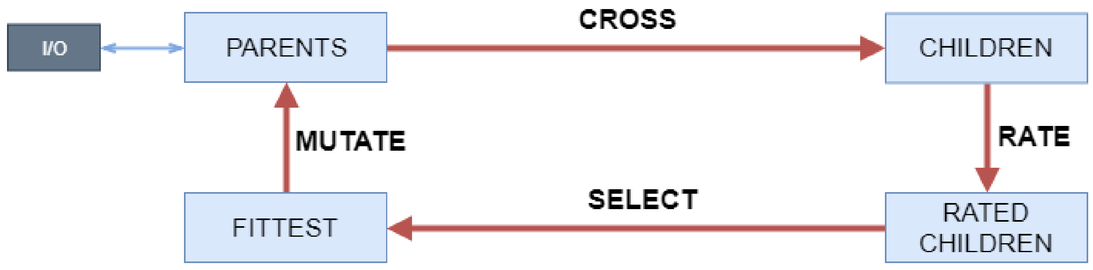
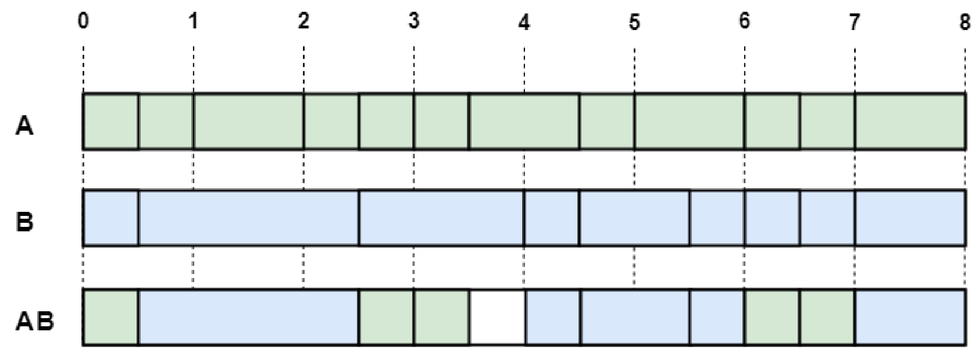
Introduction

We **simulated** a nature where **songs try to survive** with one another by using the principle behind the **genetic algorithm**. The genetic algorithm takes a number of **parents**, **crosses** them with each other and **selects** the **best results**. Crossing two songs will result in a combination of both of them in a random structure. Rating them is based on a **predefined theory** or a set of rules. Mutations are both **planned and random**.

Application Structure

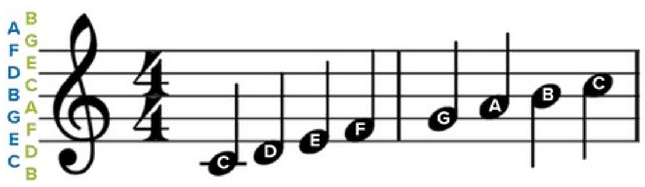


Crossover

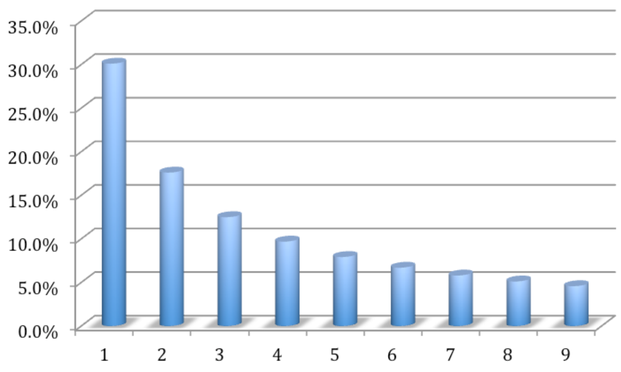


Rating

Based on the scale that the song tend to follow



Zipf's law distance scores for Pitches and Intervals



Neighbour pitch score: counting the wrong intervals

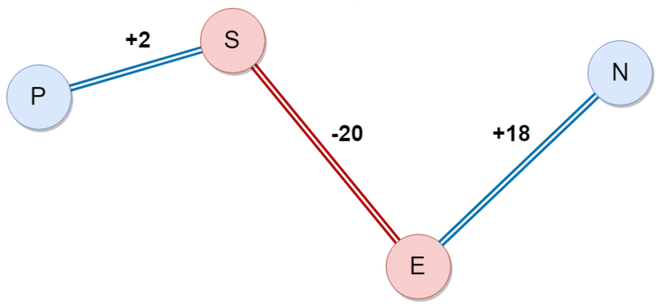


Figure 1: In this case, the note with label E is going to be transposed upwards.

Melody based scores:

$$MelodyDirection(x) = \frac{Number\ of\ upwards\ intervals}{Total\ number\ of\ intervals}$$

$$DirectionStability(x) = \frac{Number\ of\ direction\ changes}{Total\ number\ of\ intervals}$$

$$UniquePitches(x) = \frac{Number\ of\ uniques\ pitches}{Total\ number\ of\ pitches}$$

Measure relations & repetition scores

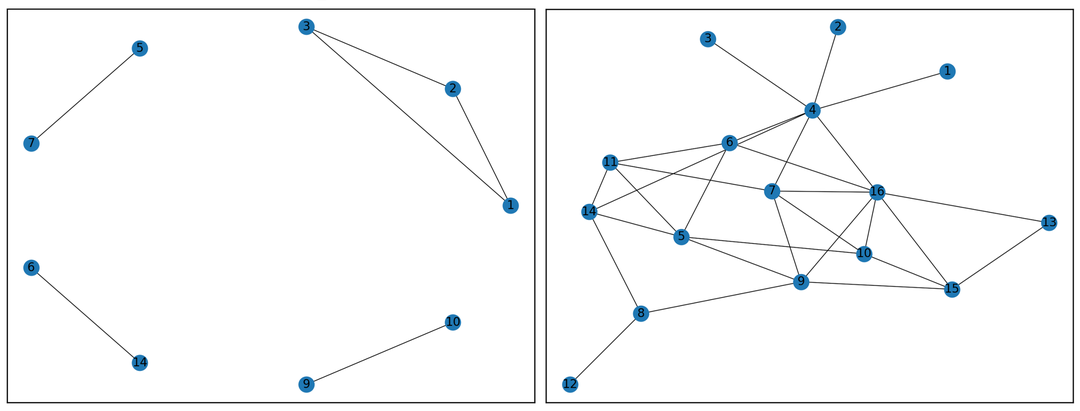


Figure 2: The measures of the Godfather theme song represented on a graph with every node being a measure and every edge being the relation between them. The first represents graph the measures with the strong relations, the second with normal

Master-based measure structure sub-raters: types, offsets, durations, pitches and intervals.

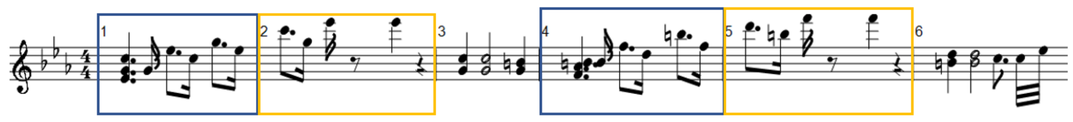
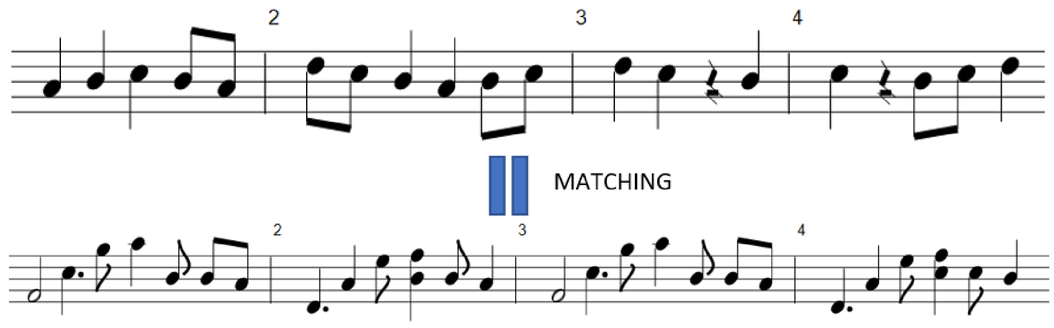


Figure 3: The first 6 measures of Beethoven Op.10 No.1

Master-based absolute sub-raters



Total Rating:

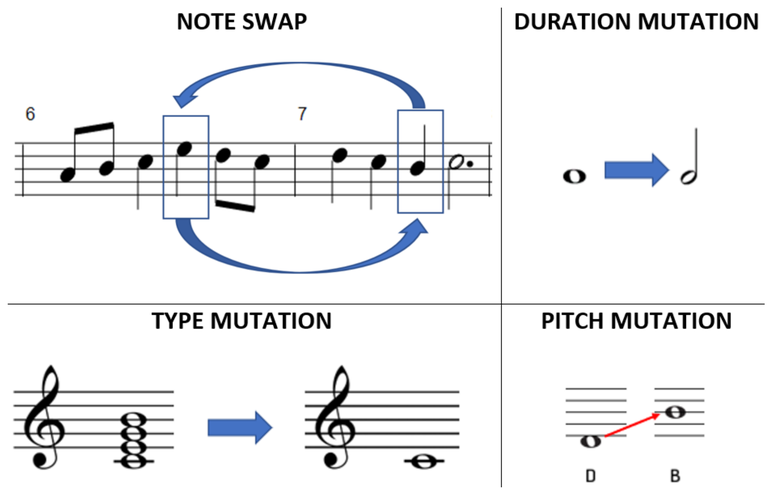
$$R(x) = \sum_{S=1}^{n} S_{score} * S_{weight}$$ **(with S as sub-rater)**

Mutations

Measure mutations: planned and random

1. **replacing** measures with others,
2. **mixing** elements of two measures and
3. **swapping** the location of two measures

Element mutations:



Results

First, the total rating of the fittest song will **decrease exponentially**. After a while it **stagnates around a fixed point** waiting for a **mutation** to have positive effect on its value.

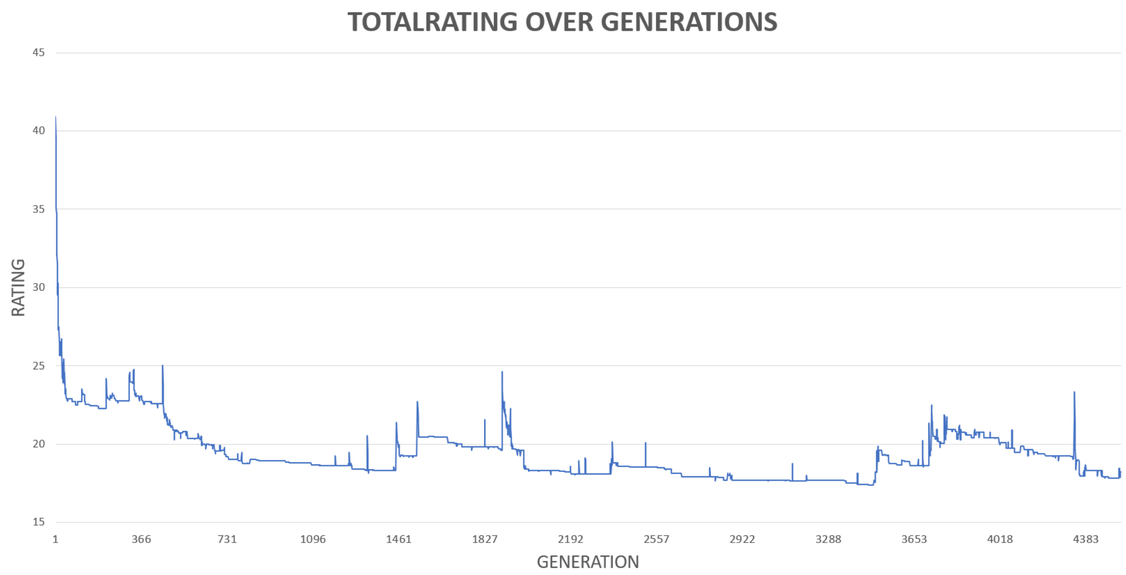


Figure 4: Totalrating of the fittest song per generation plotted over 4531 generations

Conclusions

- **Strategic planning** can help improving the execution **speed**.
- Correct configuration of the **weights** is key for successful results.
- **More dimensions and layers** can be involved in the rating and mutation process. The **more data** we can extract, the **closer** the results can be to the master.
- Composing music with a genetic algorithm can be **effective** with the **necessary tools**.