AI Music Composition using Deep Learning

Introduction

- **AI music composition** has emerged as one of the trending fields in AI creativity research.
- Participants in this field range from tech giants like Google Magenta and Sony CSL, to rising startups such as Jukedeck and Amper.
- Unlike a typical straightforward melody generation approach, here we showcase a chord-based generation approach that is capable to compose pleasant, harmonic music pieces.

Chord-Based Generation Approach

- **Nottingham dataset**
  - Contains over 1000 folk tunes, with both chords and melodies annotated.
  - The data is preprocessed and shifted to the same key (C major) for normalization.

- **McGill Billboard Chord dataset**
  - Contains 891 Billboard chart top hits songs, with the chord progressions annotated.
  - The key of each sample is shifted to the same key (C major) for normalization.

Model

- **Chord Generator**
  - All chord samples are segmented into sequences of 9 chords.
  - The first 8 chords are fed into the model to generate the next chord.
  - The generated chord is combined with the first 7 chords as input for the next time step until we reach the number of chords needed.

- **ChordToNoteGenerator**
  - We use a seq2seq model for chord-to-note generation.
  - The chords are encoded into ids and fed into the note generator network
  - The network outputs a tensor that shows the probability of notes at each time step.
  - Taking the argmax of the probabilities at each time step yields a melody piano roll.

Data

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Results

- Surprisingly, the visualization of the chord embeddings learnt in Chord Generator, after dimensionality reduction using Principal Component Analysis (PCA), highly resembles the major Circle of Fifths.

- A two-tier evaluation is done as followed:
  - **Tier 1**: Baseline - Musical Turing Test
  - **Tier 2**: Comprehensive evaluation with metrics as below -

<table>
<thead>
<tr>
<th>Objective Evaluation</th>
<th>Subjective Evaluation</th>
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<tbody>
<tr>
<td>Outlier chords / notes</td>
<td>5-point Likert scale rating in terms of harmony, rhythm, musical structure, coherency and overall rating</td>
</tr>
<tr>
<td>Excessive repeat of chords / notes</td>
<td>Riemann’s functional harmony</td>
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<tr>
<td>Riemann’s functional harmony</td>
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</tbody>
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Conclusion

- A chord-based generation method could ensure the melody generated to be more pleasing and harmonic.
- Our chord model is able to learn meaningful representations from the dataset that resembles with music theory, which aids the process of music composition.