Application of Machine Learning Tools for Music Composition

COMP4560

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Introduction

- Generate music sequences using machine learning models.
Introduction

- Mozart’s Musical Dice Game
- Selecting tones randomly and combining them.
- Statistics and probability applied to music.
Markov Chain

- Predict future states based on the current state.
Markov Chain

- Predict future states based on the current state.

- A, B, A, C, B, A, D, D, B, B, C, A

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<thead>
<tr>
<th>C.E</th>
<th>F.E</th>
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<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>1/4</td>
</tr>
<tr>
<td>B</td>
<td>2/4</td>
</tr>
<tr>
<td>C</td>
<td>1/2</td>
</tr>
<tr>
<td>D</td>
<td>1/2</td>
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Markov Model Drawback

- Transition matrix grows exponentially for higher order Markov chains
Recurrent Neural Network

- Output at each timestep is fed back as additional input in the next time step
Recurrent Neural Network

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Recurrent neural network unrolled through time. Image courtesy of Chris Olah.
Recurrent Neural Network Drawback

- vanishing gradient problem
Long Short Term Memory Network

- Variant of RNN
- Capable of learning long term dependencies
- Contain information in a gated cell
Musical Instrument Digital Interface (MIDI)

- Store musical data in the form of MIDI messages
- Pitch, velocity, clock signals
- Up to 16 channels in one MIDI stream
Input data

- Extract guitar chords
- Dictionary for all chords
- Prepare sequences for training
## Input data

0,1,0,2,2,3,1,0  
sequence length - 4

<table>
<thead>
<tr>
<th>Input</th>
<th>Target</th>
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<tbody>
<tr>
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<tr>
<td>1</td>
<td>0</td>
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<tr>
<td>0</td>
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Evaluation

- Subjective
Results

Output sample  https://soundcloud.com/idris-m-m-chatriwala-667629752/lstm-music-1
Thank you!