

Musical Representations For LSTMs that Learns Polskas!

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[Github link](#) to Parser Code

Introduction:

In this project a text parser was implemented for creating musical representations that were suitable for representing Polskas, and old style of swedish folk music, in a good way for LSTMs to learn them. A secondary task was to identify a suitable Polska musical data set.

Purpose:

For an LSTM to learn Polskas a good sequential representation is necessary. There are many to choose from such as MIDI and ABC-notation. For example a small vocabulary (unique tokens) is often preferable since it could make it easier for the LSTMs to learn abstract relationships. A representation can and is often modified to make it more suitable for the music it is representing and therefore a custom parser is often needed. To train the LSTM, a suitable dataset is needed that musically accurately represents Polskas.

Method:

To determine the suitability of Polskas the work of swedish scholar Magnus Gustafsson[4] was studied. Establishing basic facts about Polskas proved crucial for the final design of the notation used:

- Polskas seemed to be defined mainly by a single voicing melody, i.e chords can essentially be disregarded when initially conceiving a Polska piece. This means it can be notated simply by using single notes
- Polskas are essentially always in $\frac{3}{4}$ meter.
- Polskas have many different names and many very similar styles. A big issue when searching for Polskas is that it is nearly always intermixed with Polonaise pieces. According to Magnus Gustafsson, however, Polskas and Polonaises are virtually indistinguishable.

The parser was built on top of the already existing FolkRNN parser. The parser used ABC notation which seemed suitable because, based on the works of [2] and [3]. These two different representations can be modified in different ways to reduce their vocabulary, but particularly due to the timing offset increasing vocabulary size in [3] made ABC notation a more logical choice. Also, the FolkRNN implementation is already made for learning folk music.

```
[L:1/16]
[M:3/4]
[K:GMaj]
G2AcB2ABG4|d2egf2efd4|G2AcB2ABG4|d2egf2efd4|a2a2g2g2f2f2|efe^cd8:| |:g
2fed4|g2f2efd4|B2ABc2AcB2G2|ABAFG8:|
```

Image 2: The parsed ABC-notation produced by the Folk RNN.

Some improvements were attempted to make the FolkRNN parser more suitable for Polskas and more compact in general:

- Based on the information provided by Gustafsson[4] a Polska is almost essentially always played in a $\frac{3}{4}$ meter, which means that the meter tokens are redundant. These were therefore removed.
- Also, having the notes projected in many different keys increases the number of unique tokens. Transposing all musical pieces to a single scale, in this case C-major, should decrease the number of note-tokens from 12 (chromatic scale) down to 7 (any diatonic scale). The idea was that an enduring musical pattern would still distinguish pieces from different scales.
- All sharps were also replaced with flat notes, since these are equivalent from a sonic standpoint.

For implementing the parser, processed data from the FolkRNN parser was used.

Results:

Polska List:

The Polska ABC-notation dataset on the folkwiki [5] web page seems suitable based on visual inspection. The list is mixed with Polonaise pieces in particular, but according to Gustafsson [4] this does not seem substantially consequential.

Parser:

The results from the parser can be seen in image 1. The parser transposes all notes to the correct scale by always going downwards on the chromatic scale, i.e a transposed piece is always played with darker notes than the original piece. The meter sign is also removed and there are no sharp notes.

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Original:

[L:1/8]
[K:GMin]
A c A A | G > A F A | F 2 > D 2 | B, > D G B | B d e e | d > d c A | G A B A | B > B B G | B > G G, B,

Transposed:

[L:1/8]
[K:GMin]
B D B B | a' > B G B | G 2 > E' 2 | B, > E' a' _D | _D E _G _G | E > E D B | a' B _D B | _D > _D _D a'

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Original:

[L:1/8]
[K:GMin]
d | d > _G G A B 2 A G | B c /2 B /2 A _G G 3 d | d > c d =e f 2 d d | B > A B c d 3 A | B > B d d c 2

Transposed:

[L:1/8]
[K:GMin]
E | E > _A' a' B _D 2 B a' | _D D /2 _D /2 B _A' a' 3 E | E > D E =e G 2 E E | _D > B _D D E 3 B | _D >

```

Image 1: The parser in action. It removes the meter token all together, converts any sharp notes to flat notes and transposes the piece to C-major.

Some problems exist with this implementation. Firstly, due to time constraints the removal of natural notes (e.g =B) was missed. These are not transposed, but can be by simply removing the natural sign (this seems to be used when a note is out of the scale) and simply be replaced by the standard note (e.g =B to B). Secondly, some pieces are either transposed unnecessarily (but correctly) and extremely low. An example is A minor, which is actually the same scale as C-Major, but due to its tonic being lower it is transposed down an octave. Transposing the notes does not either seem to have an impact on the vocabulary size since, occasionally non-diatonic notes are used which are outside the scale, so flat-notes tend to appear either way.

The implementation can be found here:

https://github.com/Acander/Project_Music_Informatics_DT2470/tree/main/Music_Informatics_Project

Future Work:

To properly evaluate the suitability of this representation the actual selected Polska dataset should have been transposed and tested on a LSTM network and the results compared with the original paper [2] to determine the suitability. The effectiveness could have been tested by simply measuring how well the network predicted the sequence of character tokens.

References:

1. FolkRNN parser - <https://github.com/ztime/polska>
2. FolkRNN paper - <http://kth.diva-portal.org/smash/record.jsf?pid=diva2%3A1303669&dswid=-2824>
3. How to Generate Music using a LSTM Neural Network in Keras - <https://towardsdatascience.com/how-to-generate-music-using-a-lstm-neural-network-in-keras-68786834d4c5>
4. “Polskans Historia”, Magnus Gustafsson, 2016, ISBN: 9789188473097
5. Folkwiki dataset: <http://www.folkwiki.se/L/%c3%a5ttypen/Polska>