Methods on Composer Identification Using Markov Chains

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Abstract

Markov chains along with other algorithms have already been used on the identification of music composers. This paper presents a survey on two different types of music coding schemes and the effects of using each one on the precision of the Markov model.

1. Introduction

Artistic fields such as music are widely viewed by the general public as processes intrinsic to humans, where algorithms and machines have little aptitude, but despite public opinion, the field of Computer Music is continually growing in subjects like composer identification and algorithmic composition.

Significant work has been done on composer identification using the idea of Markov Chains[1], this paper does not intend to confirm this idea, but to improve it by changing the way a note is mapped to a state on the Markov Model, using a different coding scheme.

A general view of Markov chains will be presented on section 2, section 3 describes the coding schemes used, section 4 documents the methodology and results are discussed on section 5.

2. Markov chains

A Markov chain can be interpreted as a random walk through a set of states, where the probability of going to a state depends exclusively on the actual state, in fact, a Markov chain is mathematically characterized by its state-transition matrix [1].

In the context of music and considering it a random process, the notes would be the states and the transitions would be probabilities of a note happening after another as in[1].

3. Music Coding Schemes

Two coding schemes were used on this work, the first one represents a music as a sequence of notes, in this scheme, every note is represented as a number and the mathematical difference between two notes is the distance in semitones between them. Giving the value of 20 to the note C, the C major scale would be represented by: 20, 22, 24, 25, 27, 29, 31, 32.

The second coding scheme here proposed for composer identification also represents a music as a sequence of numbers, but these numbers are not notes, but the tonal distance between each note, so the C major scale would be represented by: 0, 2, 2, 1, 2, 2, 2, 1. Note that the sequence always starts with zero, since there is no previous note to create a tonal distance from.

Both these coding schemes were analyzed on the work of Cruz and Vidal[2], but applied to musical style recognition utilizing grammar induction, where the differential scheme got some of the best results, mainly because scales and patterns are better matched on this notation, since on a differential notation every major scale would be considered the same sequence.

4. Methodology

For the experiments of this paper, 156 piano scores were used from 7 different composers:

Albéniz, Haydn, Mozart, Schubert, Schumann, Grieg and Mendelssohn.

The results of this paper were obtained by three different tests, each of them involving four different composers, for each test, a Markov model was created for every author based on half of the music files(the training set) and then, these models were used to try to determinate the original author of the remaining files(the testing set), every time a model predicted its original author correctly, this was considered a positive.

5. Results

Figures 1, 2 and 3 display the results of the tests, where the vertical axis indicate the percentage of positive results, where the algorithm correctly predicted the original composer and the horizontal axis represents the corresponding original author.

After analyzing the results, it can be seen that the difference in coding schemes is leading to different results, although the differential scheme is not always giving the best result, it commonly improves over the sequential scheme.

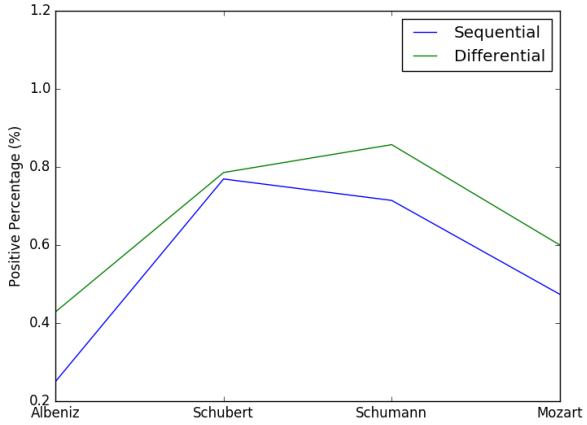

Figure 1: First test

6. Conclusion

There remains many possibilities to be explored on the field of composer identification and music recognition, but the notation appears to be a stepping stone on the improvement of any algorithm dealing with music. This is to be expected, as the only way an algorithm deals with music is through the data we feed it with, and the structure of this data changes the way a algorithm deals with the music. Further work can be developed on the improvement of the coding scheme and its use.

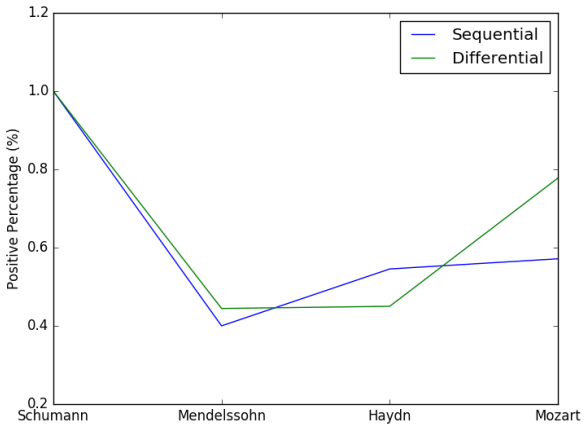

Figure 2: Second test

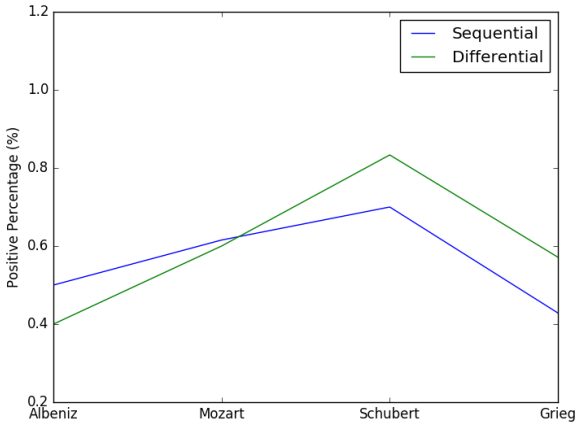

Figure 3: Third test

References

[1] Yi-Wen Liu and Eleanor Selfridge-Field. Modeling music as markov chains: Composer identification, 2002.

[2] Pedro P. Cruz-Alcázar and Enrique Vidal-Ruiz. *Learning regular grammars to model musical style: Comparing different coding schemes*, pages 211–222. Springer Berlin Heidelberg, Berlin, Heidelberg, 1998.