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Markovian Analysis

Abstract

This document contains a short essay answering questions about the process of generating a markov melody. It also contains count, probability, and distribution matrices for Beethoven's Ode to Joy and Turk's March, as well as their generated counterparts.

For this assignment, we attempted to capture the essence of two famous musical pieces through analyzing their transition patterns. Those two pieces were Beethoven's "Ode to Joy", and Turk's "March." The melodies are quite different, the former being rising and falling often, while the latter often holds on the same repeated note. March also seems to hold its notes for longer, when compared to Ode to Joy. The state transition probability matrix for Ode to Joy, which represents the probability of transitioning to and from any given notes, seems to capture some sort of essence of the musical piece, though while the real song can flow and doesn't have strange breakpoints, the fake can often sound disjointed. The same could be said for the generated march. I think the generated tune sounds much more like something Beethoven or Turk might write than random notes, since it significantly raises the probability that given a note, the next note would be a note Beethoven or Turk themselves would be comfortable choosing. The method used to generate these melodies is a markov process, where the next state in a chain of events, or in this case notes, can be generated without any knowledge of past notes. These processes are used for things such as music generation or gambling. I have not yet generated the MP3 files for these melodies, but I will try to get it done tomorrow with JFugue. JFugue is a

knowledge representation, as it contains the mappings of textual notes to audible tones. In JFugue, many conventions are present, such as the ordering of notes, the placement of spaces, or the addition of H or Q after a letter to indicate its duration. Improvisation is a term used to describe when something is composed on the spot, without the aid of preparation. I think that the method that I used to generate the melody would not be considered improvisational, since it's a word primarily used to describe humans. Machines are capable of processing specific subsets of information far faster than humans, which takes quite a bit away from the weight of the word.

- Note that I did accidentally use the opposite random values that were given.

Beethoven melody:

E	DQ.	CI	CH	E	F	E	D	C	C	D	E	F
E	F	E	D	C	D	E	D	C	C	D	E	D

Turk melody:

C	D	D	CH	C	C	C	D	D	D
D	G	FH	DH	E	E	D	D	D	D
CH	C	C	C	C	C	G	E	C	G

Beethoven:

Count matrix

	E	F	G	C	D	EQ.	DI	DH	DQ.	CI	CH	TOTAL
E	2	2	0	0	3	1	0	0	1	0	0	9
F	2	0	2	0	0	0	0	0	0	0	0	4
G	0	2	1	0	0	0	0	0	0	0	0	3
C	0	0	0	2	2	0	0	0	0	0	0	4
D	2	0	0	2	0	0	0	0	0	0	0	4
EQ.	0	0	0	0	0	0	1	0	0	0	0	1
DI	0	0	0	0	0	0	0	1	0	0	0	1
DH	1	0	0	0	0	0	0	0	0	0	0	1
DQ.	0	0	0	0	0	0	0	0	0	1	0	1
CI	0	0	0	0	0	0	0	0	0	0	1	1
CH	1	0	0	0	0	0	0	0	0	0	0	1

	E	F	G	C	D	EQ.	DI	DH	DQ.	CI	CH	TOTAL
E	0.2222222222	0.2222222222	0	0	0.3333333333	0.1111111111	0	0	0.1111111111	0	0	1
F	0.5	0	0.5	0	0	0	0	0	0	0	0	1
G	0	0.6666666667	0.3333333333	0	0	0	0	0	0	0	0	1
C	0	0	0	0.5	0.5	0	0	0	0	0	0	1
D	0.5	0	0	0.5	0	0	0	0	0	0	0	1
EQ.	0	0	0	0	0	0	1	0	0	0	0	1
DI	0	0	0	0	0	0	0	1	0	0	0	1
DH	1	0	0	0	0	0	0	0	0	0	0	1
DQ.	0	0	0	0	0	0	0	0	0	1	0	1
CI	0	0	0	0	0	0	0	0	0	0	1	1
CH	1	0	0	0	0	0	0	0	0	0	0	1

Distribution matrix

	E	F	G	C	D	EQ.	DI	DH	DQ.	CI	CH	TOTAL
E	0.2222222222	0.44444444	0.444444444	0.4444444444	0.7777777777	0.8888888889	0.888888888	0.8888888889	1	1	1	1
F	0.5	0.5	1	1	1	1	1	1	1	1	1	1
G	0	0.6666666667	1	1	1	1	1	1	1	1	1	1
C	0	0	0	0.5	1	1	1	1	1	1	1	1
D	0.5	0.5	0.5	1	1	1	1	1	1	1	1	1
EQ.	0	0	0	0	0	0	1	0	0	0	0	1
DI	0	0	0	0	0	0	0	1	1	1	1	1
DH	1	1	1	1	1	1	1	1	1	1	1	1
DQ.	0	0	0	0	0	0	0	0	0	1	1	1
CI	0	0	0	0	0	0	0	0	0	0	1	1
CH	1	1	1	1	1	1	1	1	1	1	1	1

Turk:

Count matrix

	C	G	EH	CH	D	FH	DH	E	TOTAL
C	2	1			1				4
G			1			1		1	3
EH				1					1
CH	1			1	1				3
D		2		1	5				8
FH							1		1
DH								1	1
E		1			1			3	5

probability matrix

	C	G	EH	CH	D	FH	DH	E	TOTAL
C	0.5	0.25	0	0	0.25	0	0	0	1
G	0	0	0.3333333333	0	0	0.3333333333	0	0.3333333333	1
EH	0	0	0	1	0	0	0	0	1
CH	0.3333333333	0	0	0.3333333333	0.3333333333	0	0	0	1
D	0	0.25	0	0.125	0.625	0	0	0	1
FH	0	0	0	0	0	0	1	0	1
DH	0	0	0	0	0	0	0	1	1
E	0.2	0	0	0	0.2	0	0	0.6	1

Distribution matrix

	C	G	EH	CH	D	FH	DH	E	TOTAL
C	0.5	0.75	0.75	0.75	1	1	1	1	1
G	0	0	0.3333333333	0.333333333	0.3333333333	0.6666666667	0.6666666666	1	1
EH	0	0	0	1	1	1	1	1	1
CH	0.3333333333	0.3333333333	0.3333333333	0.6666666667	1	1	1	1	1
D	0	0.25	0.25	0.375	1	1	1	1	1
FH	0	0	0	0	0	0	1	1	1
DH	0	0	0	0	0	0	0	1	1
E	0.2	0.2	0.2	0.2	0.4	0.4	0.4	1	1