

# Thesis Midterm Report

Music Style Analysis Between Haydn, Mozart and Beethoven :  
an Artificial Intelligence Recognition Approach

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# Music Style Analysis

- Summarization of music styles of musicians comes from research and analyze of researchers.



Beethoven: dramatic and belligerence, sorrowful.



Mozart: expresses relaxing and pleasant mood, romantic and splendid.

\*The summarization here is not comprehensive and authority, just for demonstration.

# Music Style Analysis

- Can we analyze the music in a computational way?
- What kind of feature may imply music styles?
- Can different music structures lead to different feeling of music?
- Will the conclusion of computational analyze correspond with the traditional viewpoint and classical theory (IR-Model)?

# Three Classical Musicians

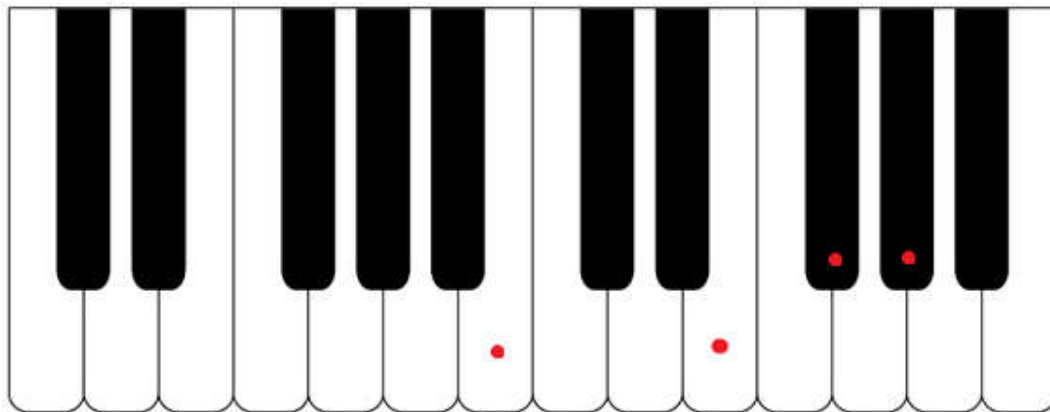
- Our research based on following three musicians
  - Joseph Haydn
  - Ludwig van Beethoven
  - Wolfgang Amadeus Mozart
- They have similarities and differences
  - Same era
  - Teaching and friend relationship
  - Different personalities and experiences

# Features

- Previous study shows that melodic interval implying music style and characteristics of music.
- Two adjacent melodic intervals form a bigram.



G#<sup>4</sup>, E<sup>4</sup>, F#<sup>4</sup>, B<sup>3</sup>

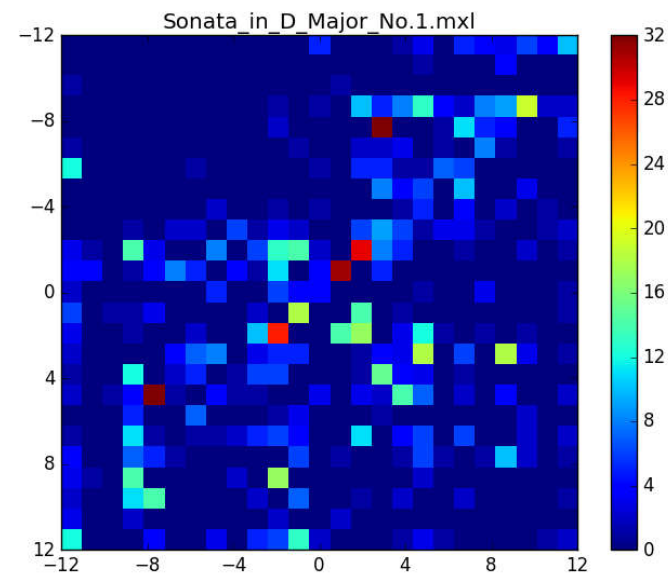
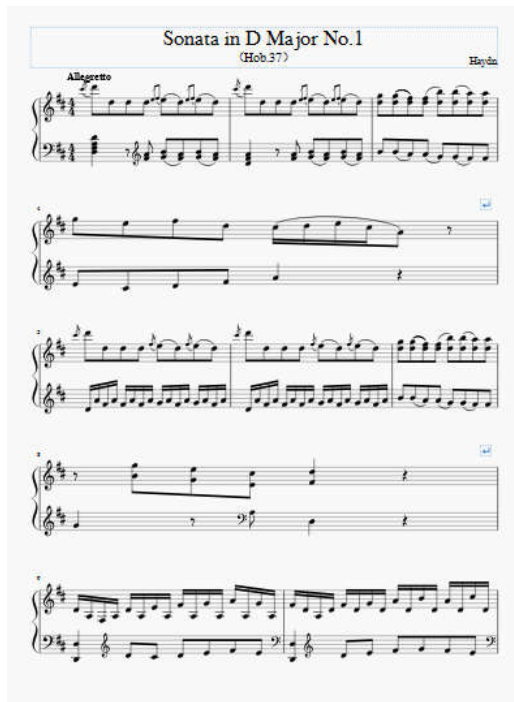


-4, +2, -7

(-4, +2), (+2, -7)

# Features

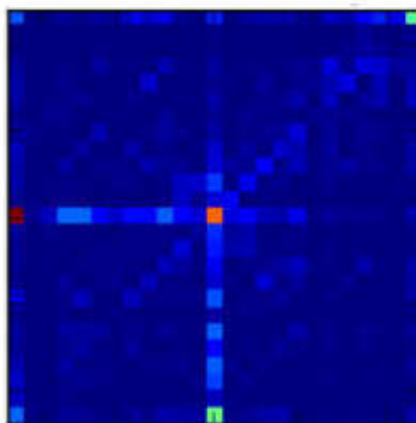
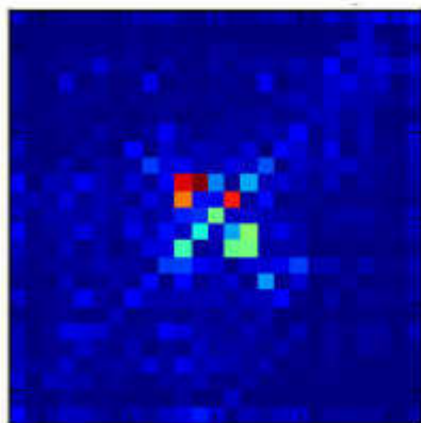
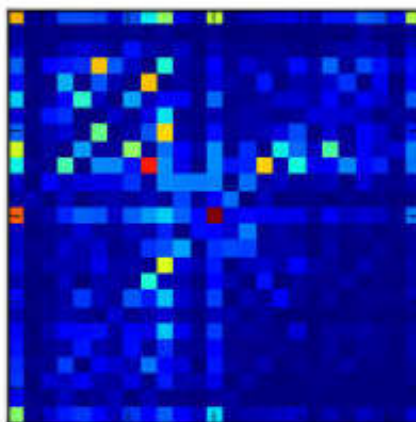
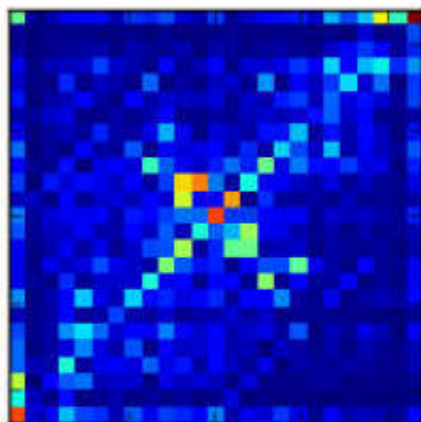
- Counting the bigrams that not exceeding one octave, a piece of music can be represented as a matrix of 25x25.



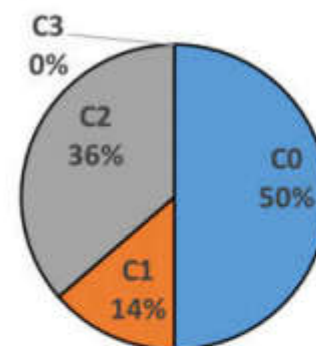
# Clustering Analysis

- Why clustering?
  - Finding representative styles.
  - Different styles of one musician.
  - Similar styles of different musicians.
- After normalize\* and vectorize the feature matrices, we use k-Means clustering on the corpus.
- We find that 4 is a optimal number of clusters.

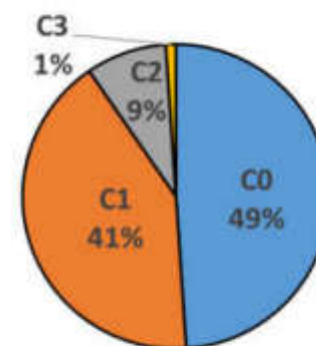
# Clustering Analysis



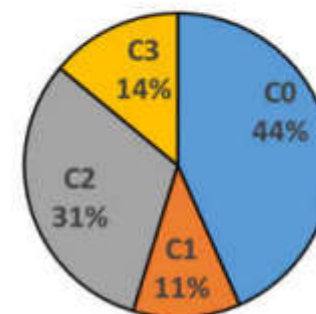
Haydn



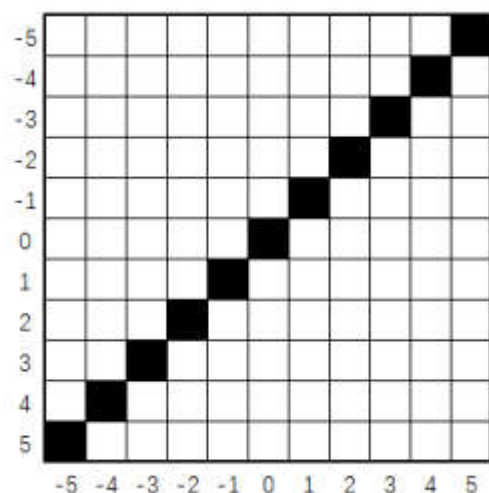
Mozart



Beethoven

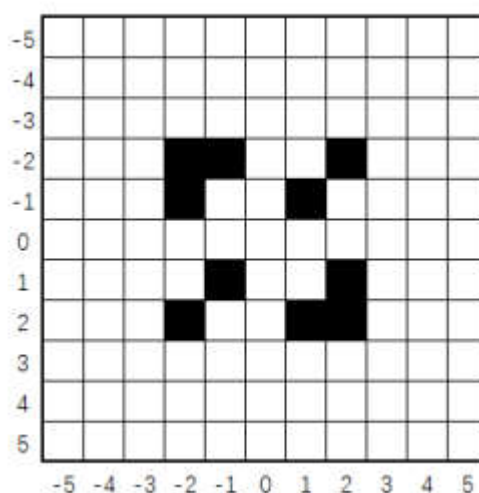


# Major melodic interval structures



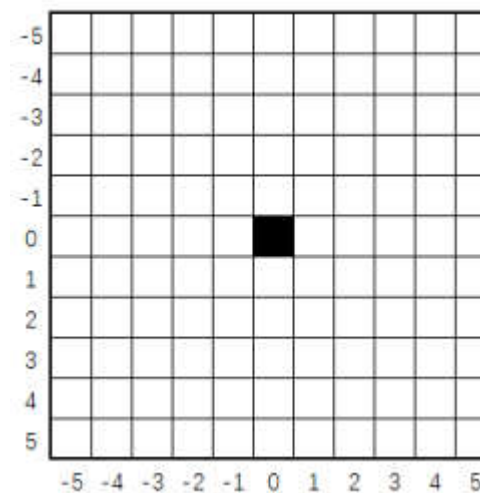
The first and the third tone are the same.

Embodied the melodic expectation of IR model, evidenced the melodic progress of musicians' pieces meets the psychological expectation of people.



Playing three adjacent tone in diatonic scale.

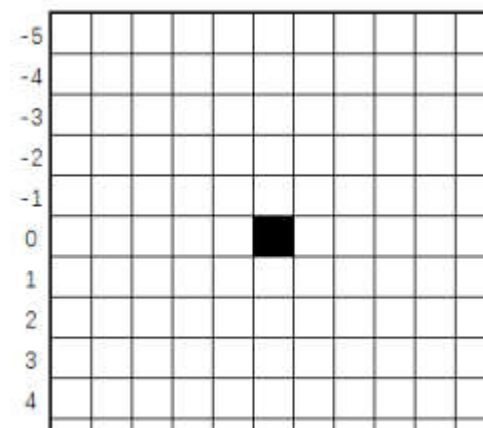
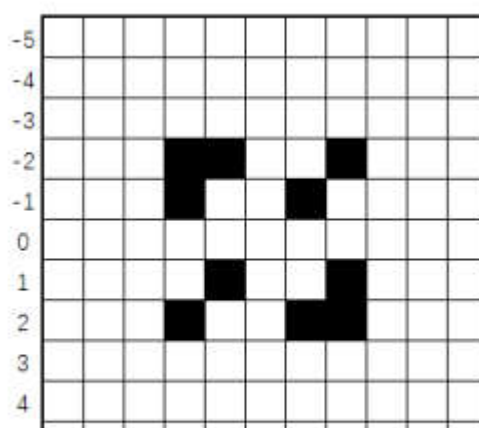
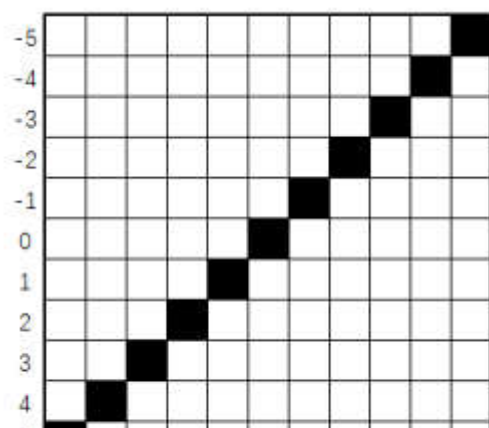
Goes more gently, and expresses relaxing and pleasant mood, which is correspond to Mozart's music style.



The same tune repeat for more than three times.

Appear primarily in Beethoven's, expressing a dramatic and belligerence music style.

# Major melodic interval structures



Computational analysis results meet the traditional viewpoint.

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# Conclusion

- Present an analytical approach that, based on I-R model of music expectation and machine learning techniques, recovers a set of factors that identifies different music styles between Haydn, Mozart and Beethoven.
- Four different clusters which represent different patterns in music composition are shown by data-driven principles of melodic expectation.

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Thank you.

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- Ru Wen, **Zheng Xie**, Kai Chen, Ruoxuan Guo, Kuan Xu, Wenmin Huang, Jiyuan Tian, and Jiang Wu.  
*Music Style Analysis Between Haydn, Mozart and Beethoven : an Artificial Intelligence Recognition Approach.*  
**In Review** of The International Society of Music Information Retrieval (ISMIR'16).