Musical style recognition a quantitative approach

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Aim

- Of many musical compositions the composer is unknown
- Explore the possibilities of using machine learning tools for composer attribution

Contents

- Stylometry
- Machine learning
- Experimental results
  - setup
  - results
- Conclusions / future research

Authorship attribution

- Who wrote this text?
- Quantitative evidence: stylometry

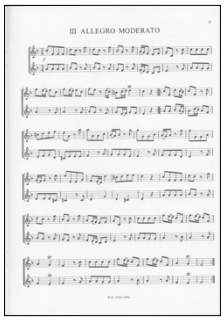
Music

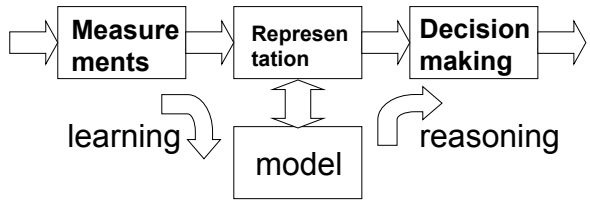
- Can we do the same for music?
- Not much research yet
- What do we have to do?
  - make dataset with undoubted compositions
  - define style markers
  - perform measurements
  - apply machine learning algorithms
  - examine the performance

Machine learning

- aims
  - extract knowledge from examples
  - classify unknown objects
- comparable to human perception
- how?
  - learn from examples.
  - Automatic generation of a model.

Machine learning





learning

model

reasoning

Datasets

I. All five composers

II. J.S. Bach, Telemann, Handel

III. J.S. Bach, {Telemann, Handel}

IV. J.S. Bach, all others

V. Telemann, Handel

VI. Mozart, Haydn

VII. {Telemann, Handel}, {Mozart, Haydn}

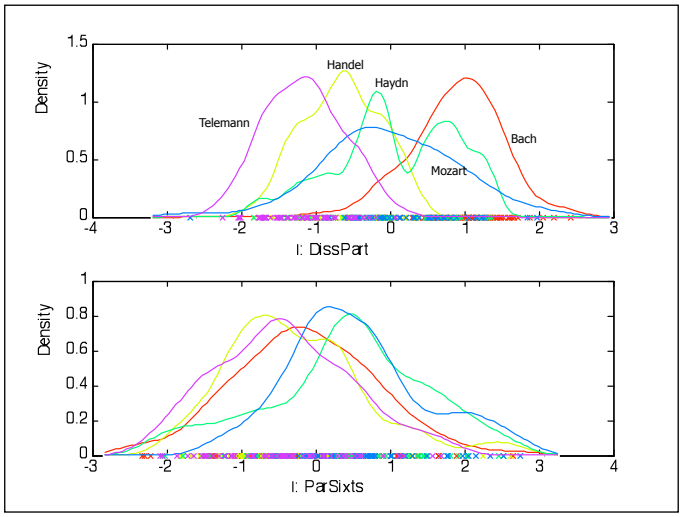
Style markers

- Characteristics of counterpoint
  - intervals between voices
  - parallels
- Other characteristics:
  - ‘stability’ of the rhythm
  - amount of dissonant sonorities

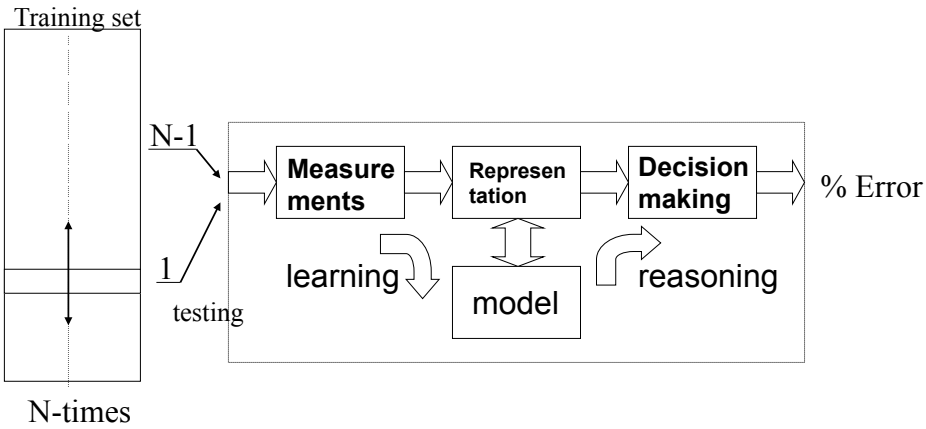
Analysis

- Feature reduction
- Apply learning-algorithms
  - Nearest neighbor
  - decision tree (c4.5)
- error estimation

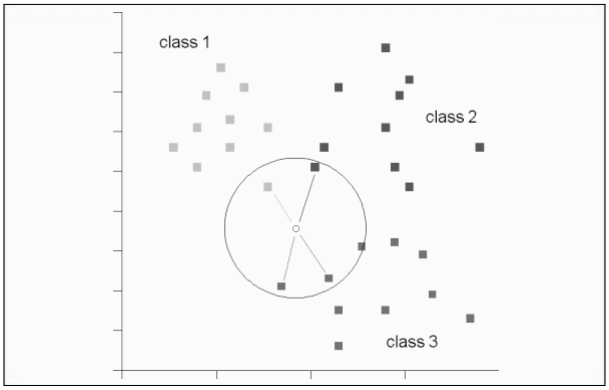
Feature reduction



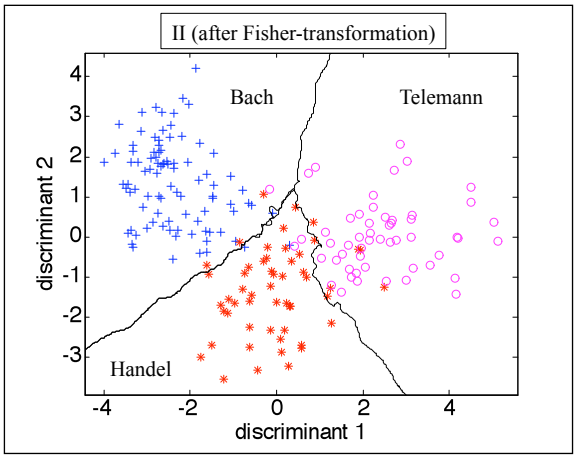
Leave-one-out error estimation



Nearest Neighbor I



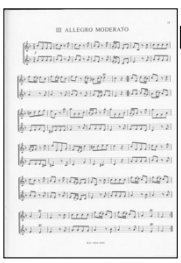
Nearest Neighbor II



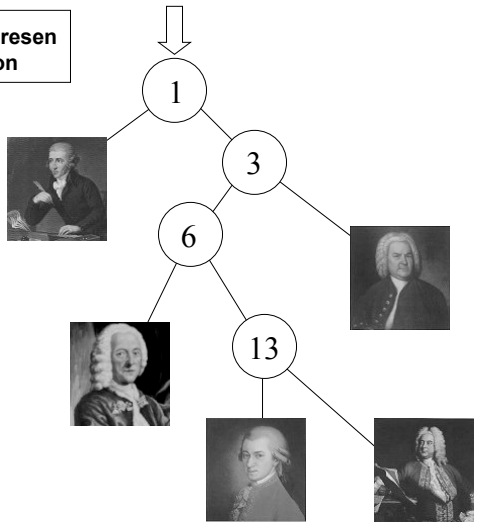
Nearest Neighbor III

	Dataset	*k*	*loo-error*
I	B, T, HI, Hy, M	15	0.1993
II	B, T, HI	17	0.0704
III	B, {T, HI}	15	0.0481
IV	B, {T, HI, Hy, M}	15	0.0599
V	T, HI	9	0.0841
VI	M, Hy	7	0.2056
VII	{M, Hy}, {HI, T}	11	0.0654

Decitiontree I

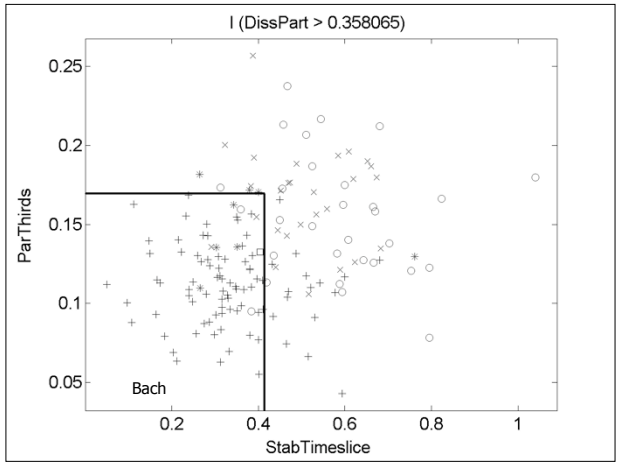


Measure ments → **Represen tation**

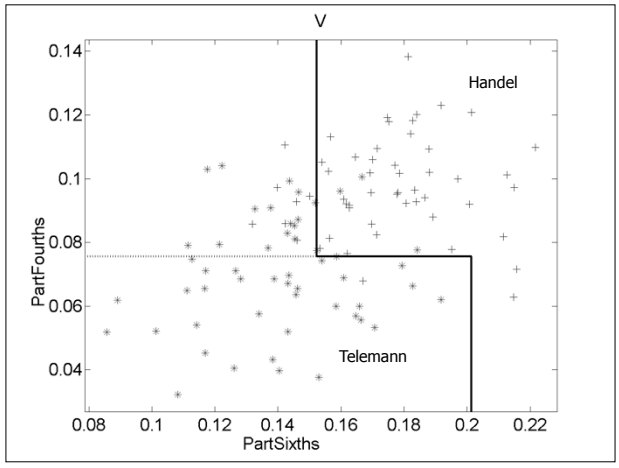


Decision tree design
(here C4.5)

Decisiontree II



Decisiontree III



Some conclusions

- With this set of style markers it is very well possible to separate the personal styles represented in the dataset.
- Characteristics of each style can be discovered.
- Can be a valuable addition to ‘traditional’ composer attribution.

Future research

- Theory for obtaining style markers
- Apply to more specific problems
- Trace development of style in time