Mode Classification in Renaissance and Baroque Polyphonic music using Dissonance Pitch Class Profiles

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Western Medieval Modes

1.	Dorian	D E F G A B C D
2.	Hypodorian	A B C D E F G A
3.	Phrygian	E F G A B C D E
4.	Hypophrygian	B C D E F G A B
5.	Lydian	F G A B C D E F
6.	Hypolydian	C D E F G A B C
7.	Mixolydian	G A B C D E F G
8.	Hypomixolydian	D E F G A B C D
9.	Aeolian	A B C D E F G A
10.	Hypoaeolian	E F G A B C D E
11.	Ionian	C D E F G A B C
12.	Hypoionian	G A B C D E F G

- Modes originated as a method of organising plainchant.
- They were adopted for polyphonic music in 1400s.
- There were traditionally 8 and then 4 more were added in mid 1500s.
- Modes were determined by the final and the pitch range surrounding the final (authentic vs. plagal modes).

Can dissonant pitch classes serve as reliable mode indicators?

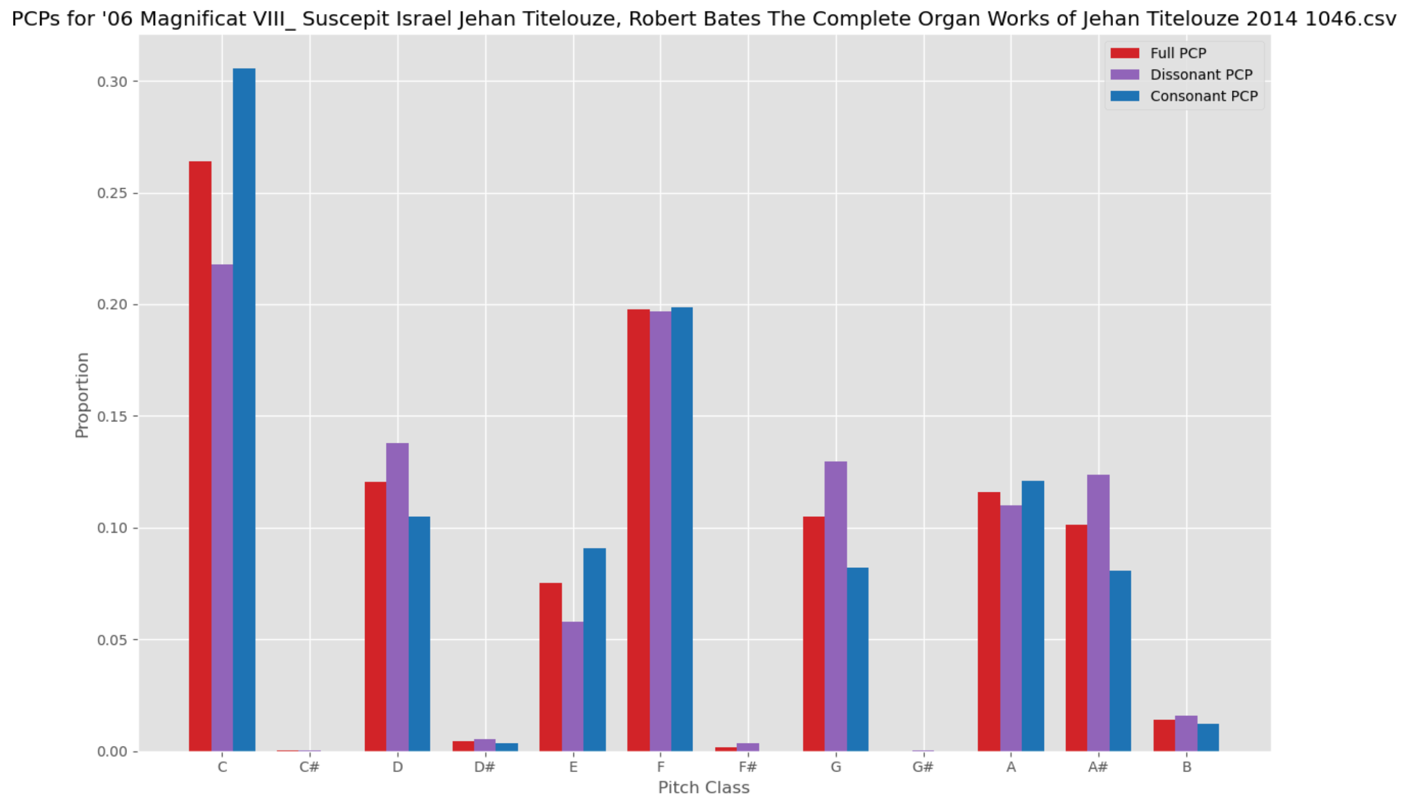
Why dissonant pitch class profiles?

- Pitch class profiles are distinguishing properties of individual modes, although far from perfect.
- The distribution of cadence tones is another property of individual modes.
- We cannot measure cadence tones in audio directly, but we can construct pitch class profiles built from time slices containing dissonances.

Data and Methods

The dataset [4] used in this project contained Multiple-F0 pitch extractions [5] of audio recordings from 86 of the 475 classified modal cycles 1 detailed in Frans Wiering's 'The Language of the Modes' [1]. These were polyphonic works from the Renaissance and Baroque period.

Each piece was analyzed at every pitch-extraction timestamp and divided into two subsets: passages containing dissonant intervals and those that didn't . From these, three pitch class profiles (PCPs) were generated for each piece: a 'Dissonant PCP', a 'Consonant PCP', and a full-piece PCP. To account for tuning discrepancies and transpositions, all PCPs were normalized to a final of C.



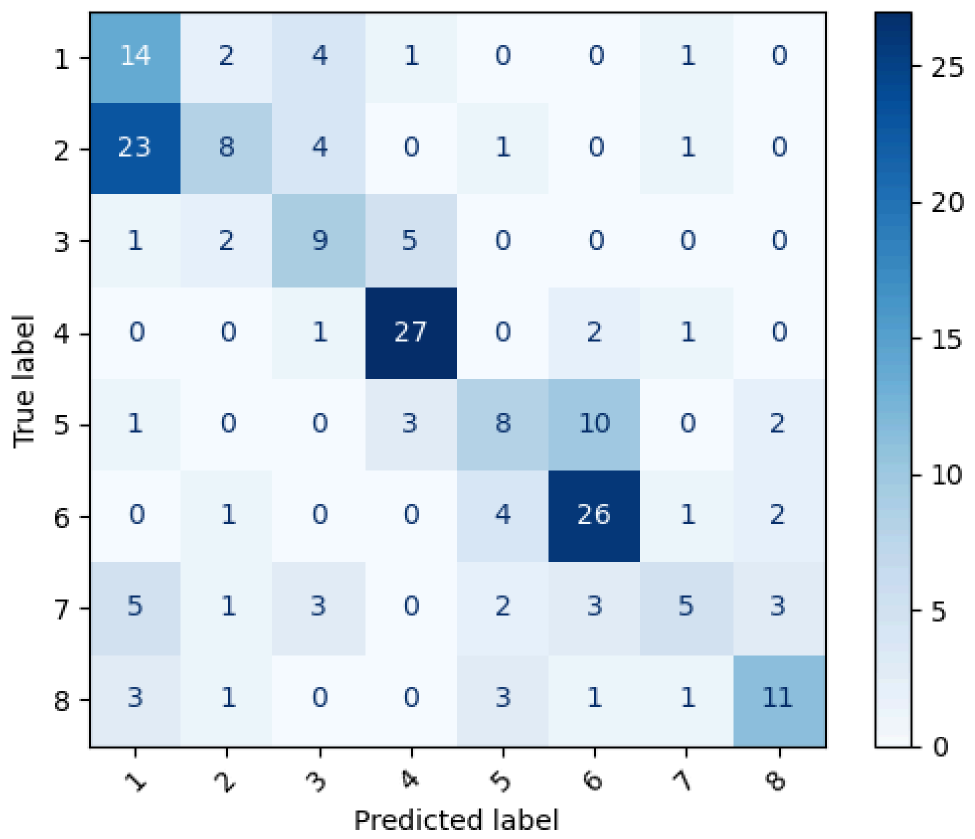
Dissonant, Consonant and full-piece PCPs for a piece in the dataset

Results

Features	SVM	Random Forest	GMM
Full PCP	0.45	0.51	0.42
Dissonant PCP	0.40	0.49	0.38
Consonant PCP	0.45	0.55	0.36
Full + Diss PCP	0.39	0.56	–
Full + Cons PCP	0.41	0.54	–
Diss + Cons PCP	0.41	0.55	–
All PCPs	0.42	0.52	–

3 different ML models were tested and against a variety of different input data. Similar results were found across all input data and models suggesting that Dissonant PCPs did not offer a robust advantage over standard (full-piece) PCPs.

The confusion matrices (pictured right) highlighted that the majority of the misclassifications (for both the 'Dissonant PCPs' and full-piece PCPs) occurred between modes within the same modal family, namely between modes 1, 2 and 5, 6. This is not surprising considering modes within the modal family share the same final and tone-semitone patterns [1].



Confusion Matrix of Random Forest 'Dissonant PCP'Model

Conclusion and Future Directions

2 conclusions can be drawn from this project:

- The 'Dissonant PCPs' created were not able to properly capture cadence tones. It is unclear how appropriate the use of cadence tones for modal classification is. Different methods for identifying cadence tones in a piece need to be explored.
- The 'Dissonant PCPs' were able to capture cadence tones. However, the cadence tones did not provide any more information beyond what a full-piece PCP could provide. Perhaps cadence tones alone aren't enough to distinguish between modes and more structural aspects of cadences need to be incorporated (e.g. rolling-window PCPs [7] or consecutive dyad-distributions [6]).

References:

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