Consonant & Dissonant Musical Sonorities: A Statistical Approach

(STATS/CSE 780 course project)

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Outline

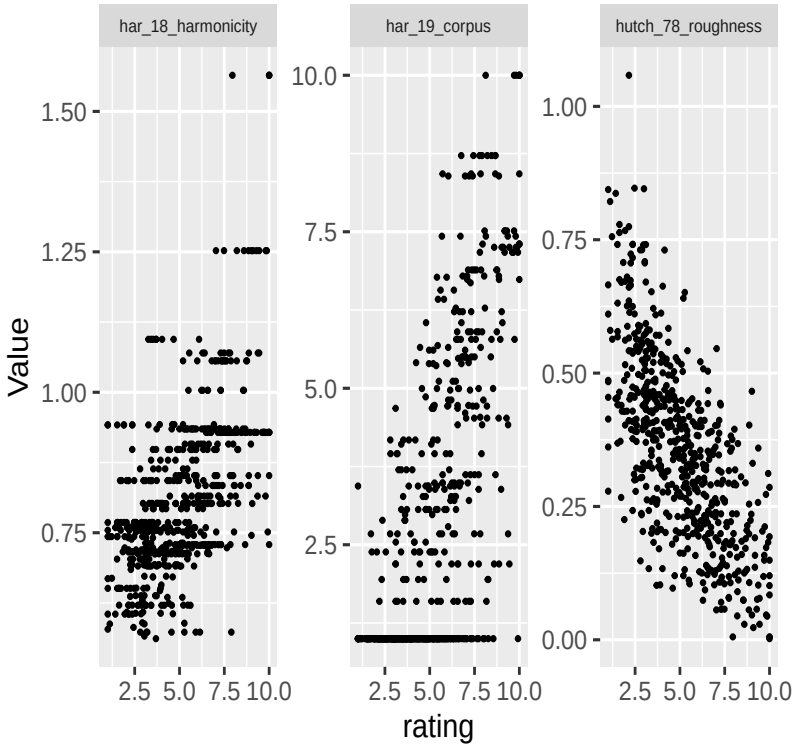
- Motivation
- Dataset
- Methods
- Results
- Discussion

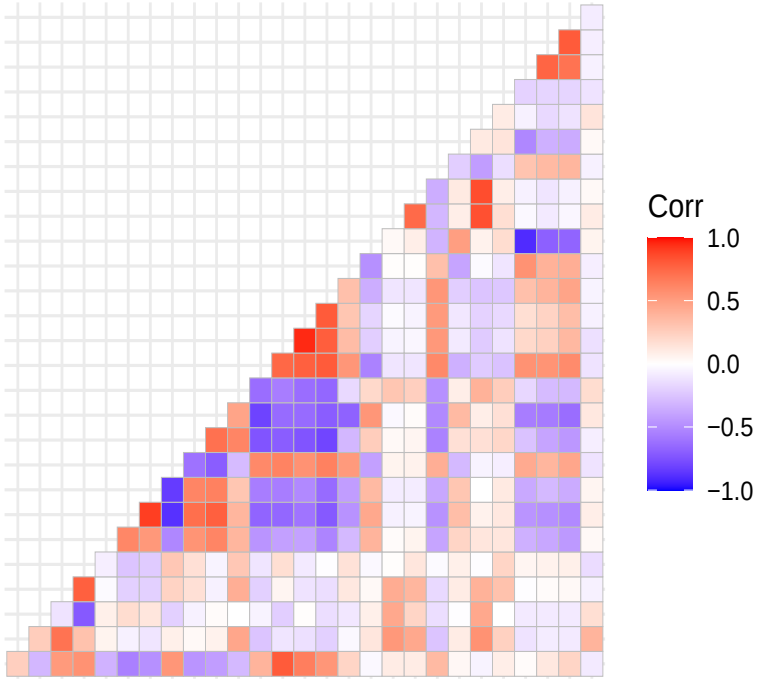
Motivation

- How can we better understand musical consonance and dissonance?
- Why is this important?
  - Classification and reccomendation systems
  - Pedagogy, theory, and practice
  - Not just music! Auditory perception more generally
- Harrison and Pearce (2020), Eerola and Lahdelma (2021)
  - Aggregated datasets and models
  - Exploratory correlational analysis
- Goals:
  - Which theories are consistent with behavioural data?
  - Improve the state-of-the-art model using statistical methods

Data

- Eerola and Lahdelma (2021)
  - Nine human rating experiments
  - 3 ratings, 8 metadata, 3 unknown, 29 features



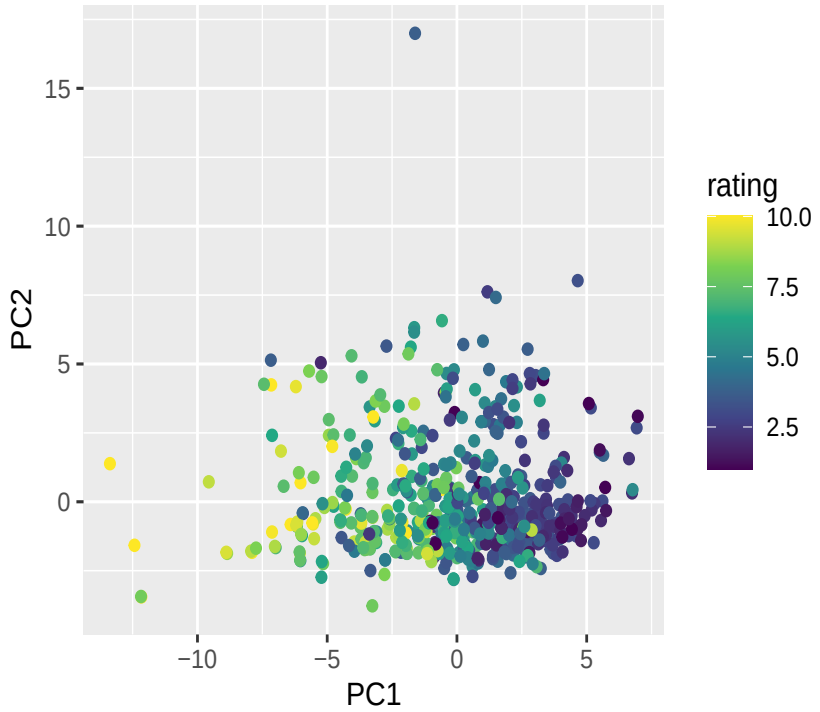


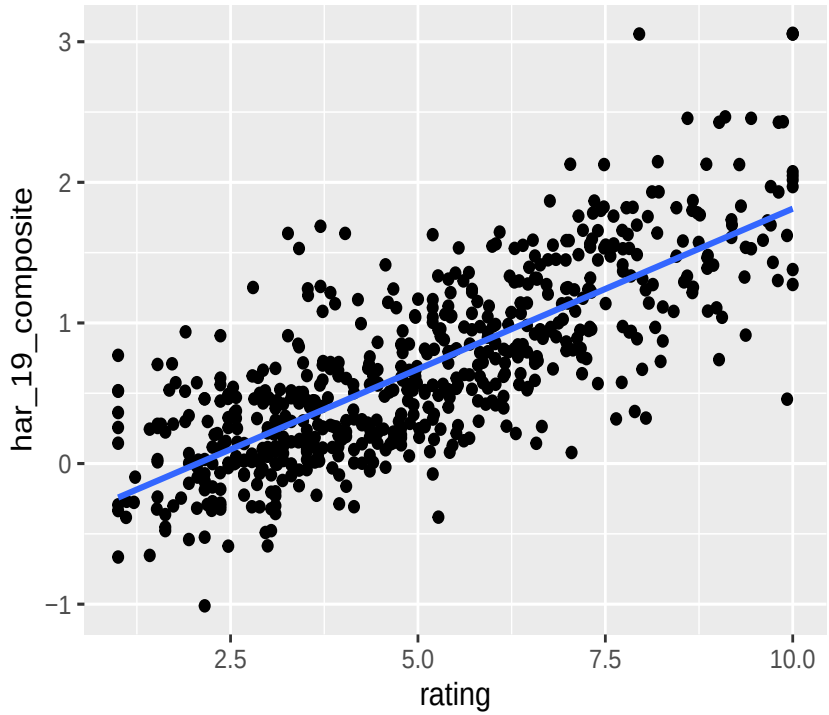
	rating	chord_size	har_18_harmonicity	har_19_composite	hutch_78_roughness	sharpness
1	10	3	0.93	2.02	0.12	0.81
2	7.84	4	0.73	1.33	0.22	0.89
3	7.48	3	1.06	1.82	0.18	0.79

Methods

- Multiple Linear Regression with Forward Stepwise Selection
  - Bayesian Information Criterion
- Principal Component Analysis
  - Scaling of features
  - Multiple Linear Regression on first 4 components
- 50/50 training set split
  - Testing: how similar are model predictions to actual human ratings?
  - Comparison between models and to state-of-the-art model

Results





	Feature	Coefficient
1	(Intercept)	8.41
2	chord_size	0.45
3	stolz_15_periodicity	1.04
4	bowl_18_min_freq_dist	0.00
5	jl_12_tonal	−0.11
6	keyclar	1.33
7	spirreg	−0.03
8	CorpJazz	−0.10

	Model	Mean Error	Standard Deviation
1	Linear Reg.	1.10	0.87
2	PCA Linear Reg.	0.93	0.75
3	Harrison 2020	1.12	0.88

Discussion

- What have we learned about the features?
  - Same features as Harrison and Pearce (2020)
  - A better sense of what's useful and what's not
- Model
  - Curse of Dimensionality: too many features!
  - Is redudancy helpful?
  - Is linear regression the right approach?
- Interpretability
  - PCA can help clarify the complexity of this dataset
- Stability
  - Human subjective ratings = noise
  - Distributions not observations
  - Training model on corpus instead or ratings

Thank You!

All materials and analyses are fully reproducible at:
https://github.com/konradswierczek/STATS780

References

Eerola, Tuomas, and Imre Lahdelma. 2021. "The Anatomy of Consonance/Dissonance: Evaluating Acoustic and Cultural Predictors Across Multiple Datasets with Chords." *Music & Science* 4: 20592043211030471.

Harrison, Peter, and Marcus T Pearce. 2020. "Simultaneous Consonance in Music Perception and Composition." *Psychological Review* 127 (2): 216.