

Chord Progressions in Lutheran Chorales

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Research Question

- Theorists agree that harmony was standardized sometime during the seventeenth century. While this theory is widely accepted, it has not been tested empirically.
- We ask: when and how did this standardization occur? Can we measure the change?
- We analyze chord progressions in 697 chorale settings by three different Lutheran composers: Michael Praetorius (200), Heinrich Schutz (150), and J. S. Bach (347)

Chord Labeling

Psalm 3

Heinrich Schutz

Ach wie groß ist der Fein-de Rott, mein treu - er Gott, die sich wid'r mich em - pö - ret.
Viel sa - gen zu der See - len mein, es könnt nicht sein, daß du ihr Hülff ge - wä - rest.

Am C Dm Em F Dm E Am Am E Am E E Am Em F C Dm7 Bo C

Obtaining Chord Labels

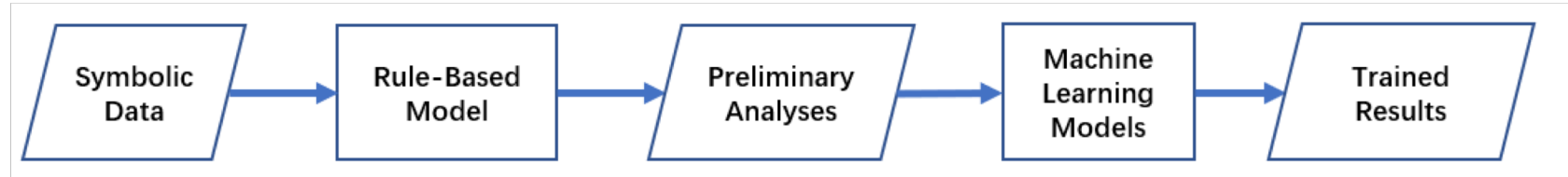
- Three approaches

Approach Name	Strengths	Weaknesses
Manual annotation	<ul style="list-style-type: none">• Nuanced analyses	<ul style="list-style-type: none">• Time consuming to build
Rule-based	<ul style="list-style-type: none">• Automatic• Consistent	<ul style="list-style-type: none">• Inadequate to produce correct analyses for exceptional passages
Machine learning	<ul style="list-style-type: none">• Automatic• Easy to adapt to other genres of music	<ul style="list-style-type: none">• Could be difficult to train and evaluate due to inconsistent manual annotations

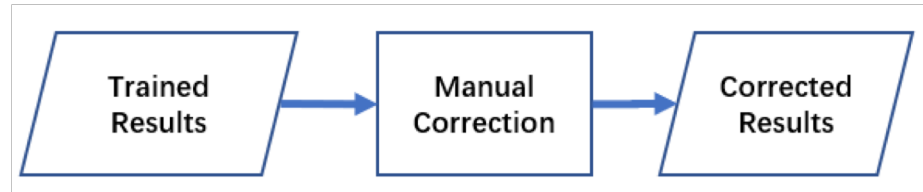
We combine **the strengths** of these approaches to address **the common problems of harmonic analysis** within a single **interactive workflow**.

The Interactive Workflow

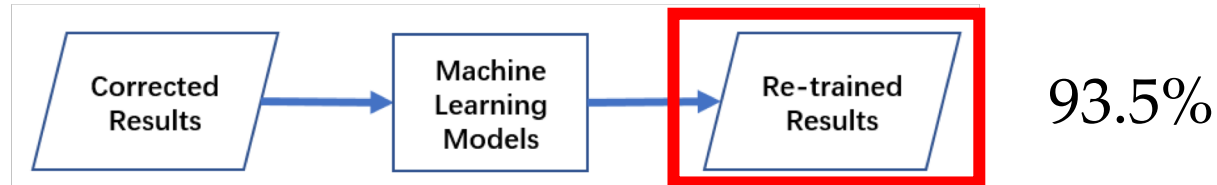
Part 1: Training



Part 2: Manual correction



Part 3: Re-training



N -Grams

- N -grams are chord progressions that are n chords long
- 2-grams are the basic “currency” for this project

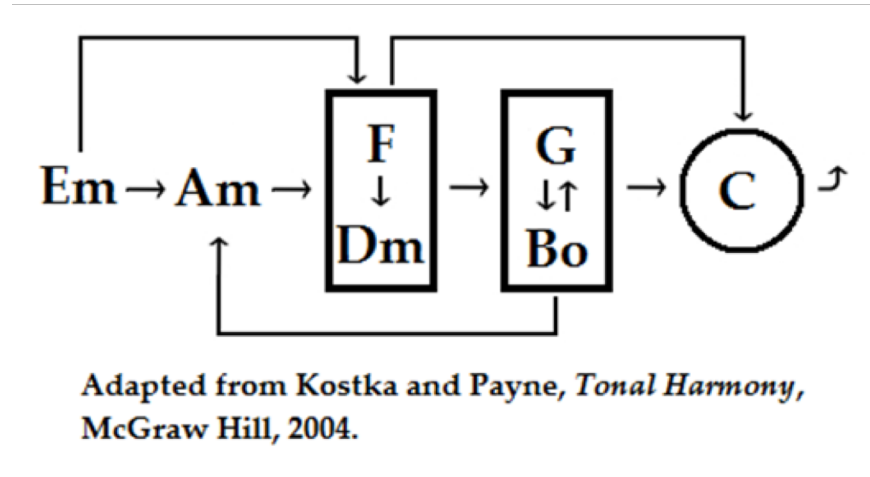
[Am (4) Dm]

[C (4) F]

[C (4) F]

Directed Progressions

- Which progressions appear in only one direction?
- Which progressions work forwards *and* backwards?
- If a chorale is more “tonal,” certain progressions will appear more often in one direction than the other



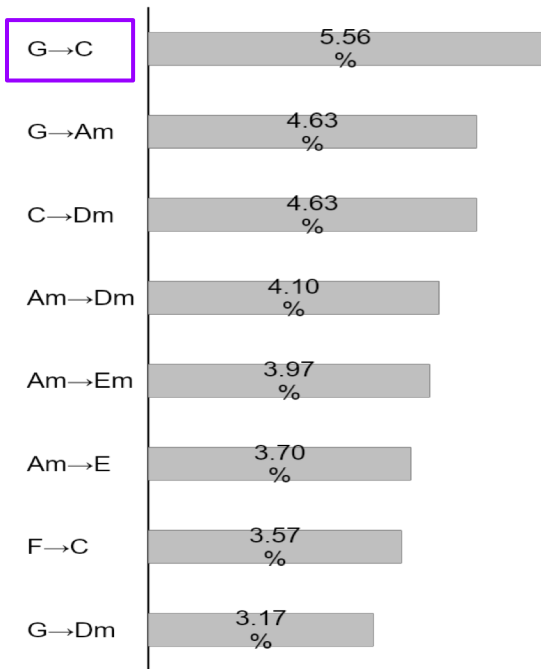
Preliminary Results

- A minor or A(♯) pieces for all three composers:
 - 40 pieces by Bach
 - 10 pieces by Schutz
 - 18 pieces by Praetorius
- Most common progressions (top 8 for each composer)
- Retrogrades of each progression to show directionality

Top Eight 2-grams

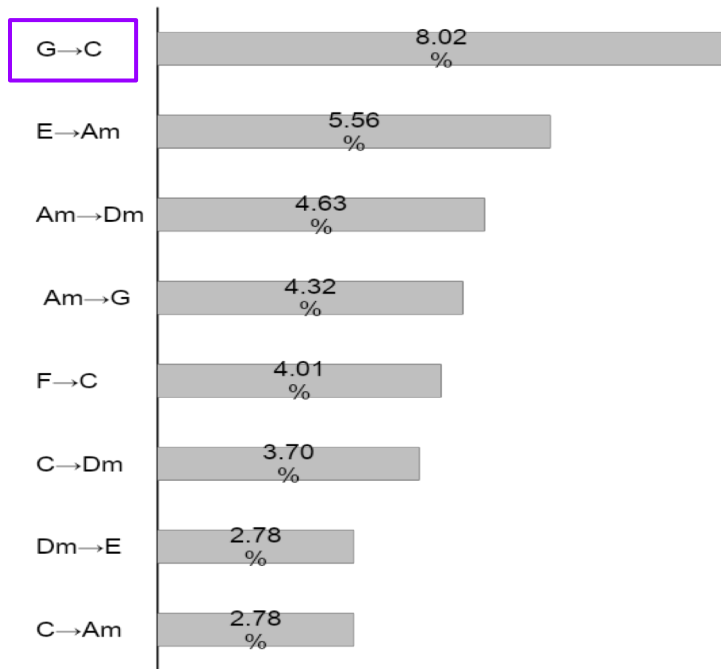
Praetorius: A(h)

Percentage of total 2-grams



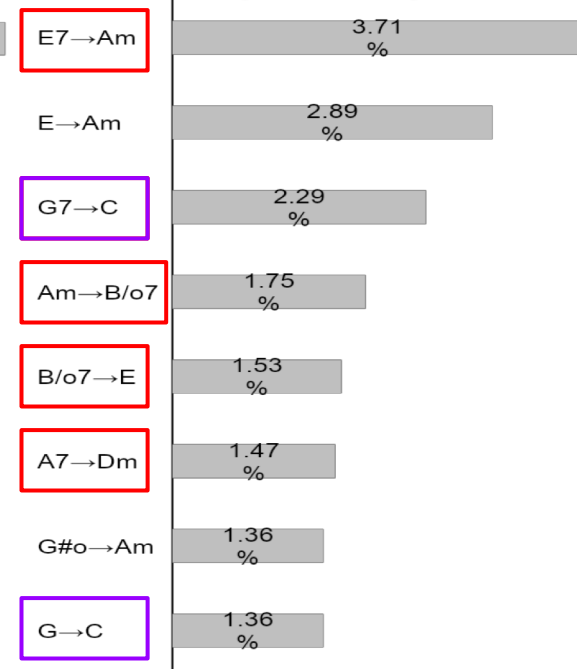
Schutz: A(h)

Percentage of total 2-grams



Bach: Am

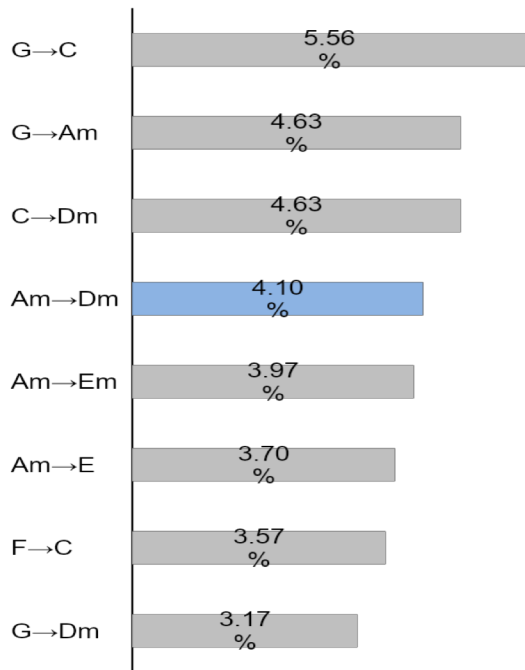
Percentage of total 2-grams



Top Eight 2-grams

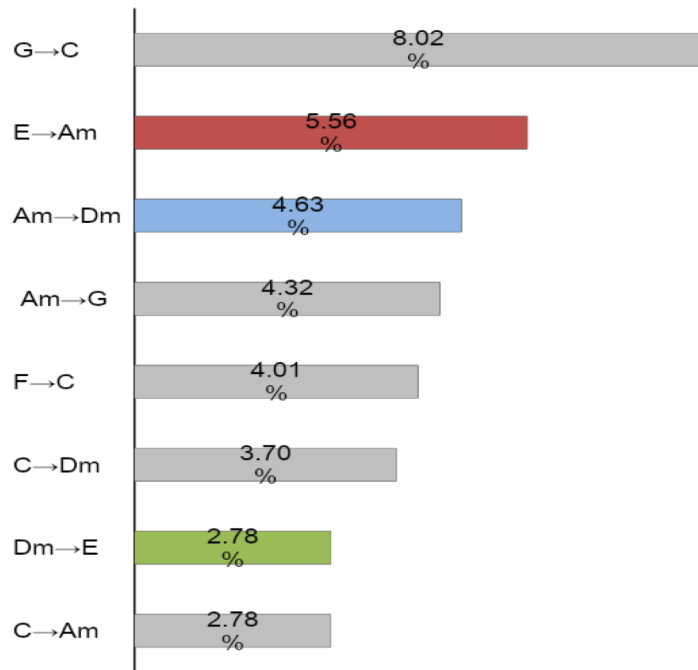
Praetorius: A(h)

Percentage of total 2-grams



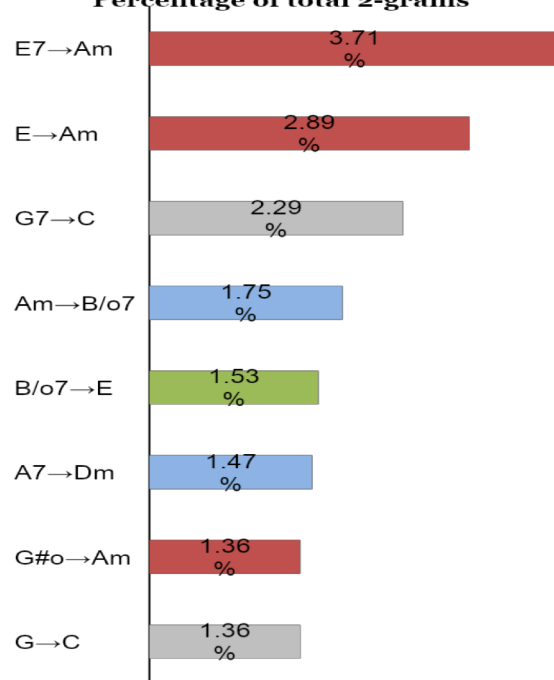
Schutz: A(h)

Percentage of total 2-grams



Bach: Am

Percentage of total 2-grams



T→PD

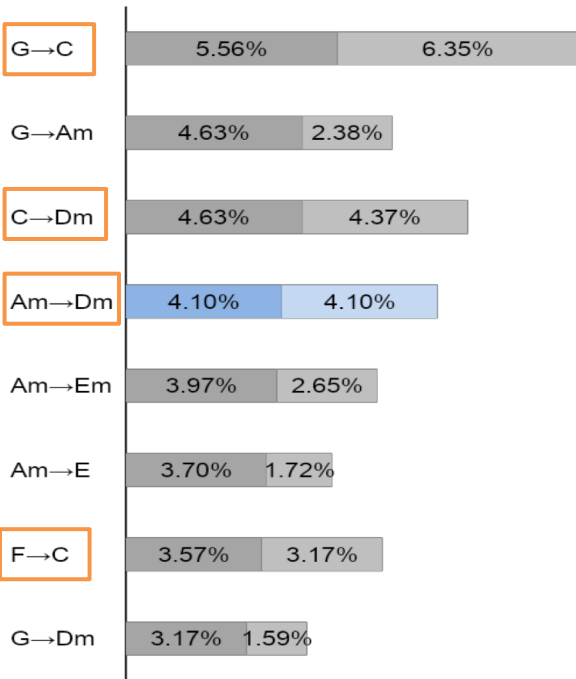
PD→D

D→T

Top Eight 2-grams with Retrogrades

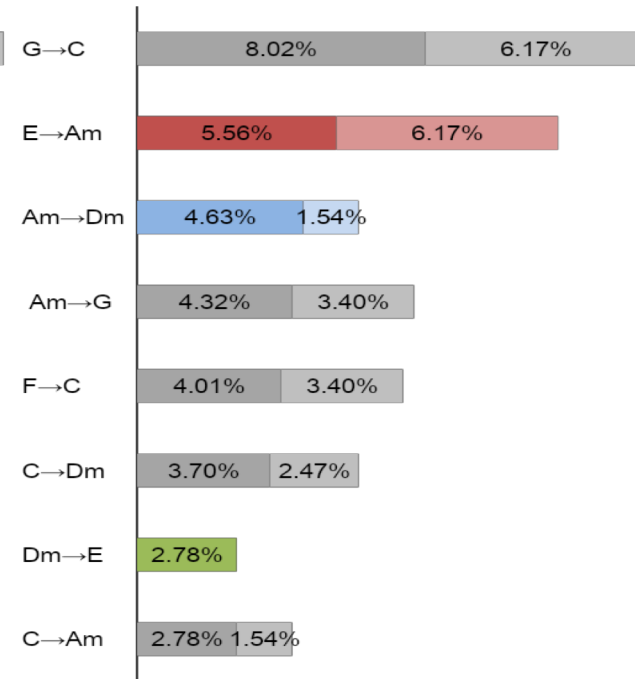
Praetorius: A(h)

Percentage of total 2-grams



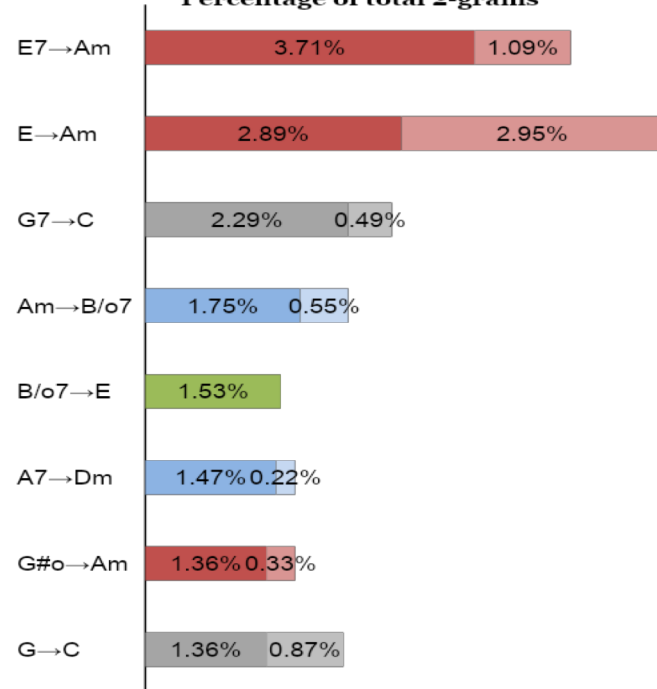
Schutz: A(h)

Percentage of total 2-grams



Bach: Am

Percentage of total 2-grams



T→PD

PD→D

D→T

Next Steps

- Think more about keys and how to divide the corpus (final and signature vs. key... are these apples and oranges?)
- Other specific musical features:
 - Search for final chords of phrases (most common cadences)
 - “Melodic” search (top note of each slice) for recurring melodic snippets

Thank you!

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