Digital Musicology 2022
Tutorials

Assignment 1: Meter and time signatures

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Deliverables

- Due date: 23.03, 12h
- Deliverables:
  - **Code:** A Jupyter Notebook
  - **Report:** A short report (max. 2 pages) as a Word document or other text file
- Submission:
  - Each group should create a **private** GitHub repository (shared with the team members and the TAs) where data, code and report will be stored. Make sure your notebook is pushed with all output visible, i.e., in a form whereby we do not need to run the code.

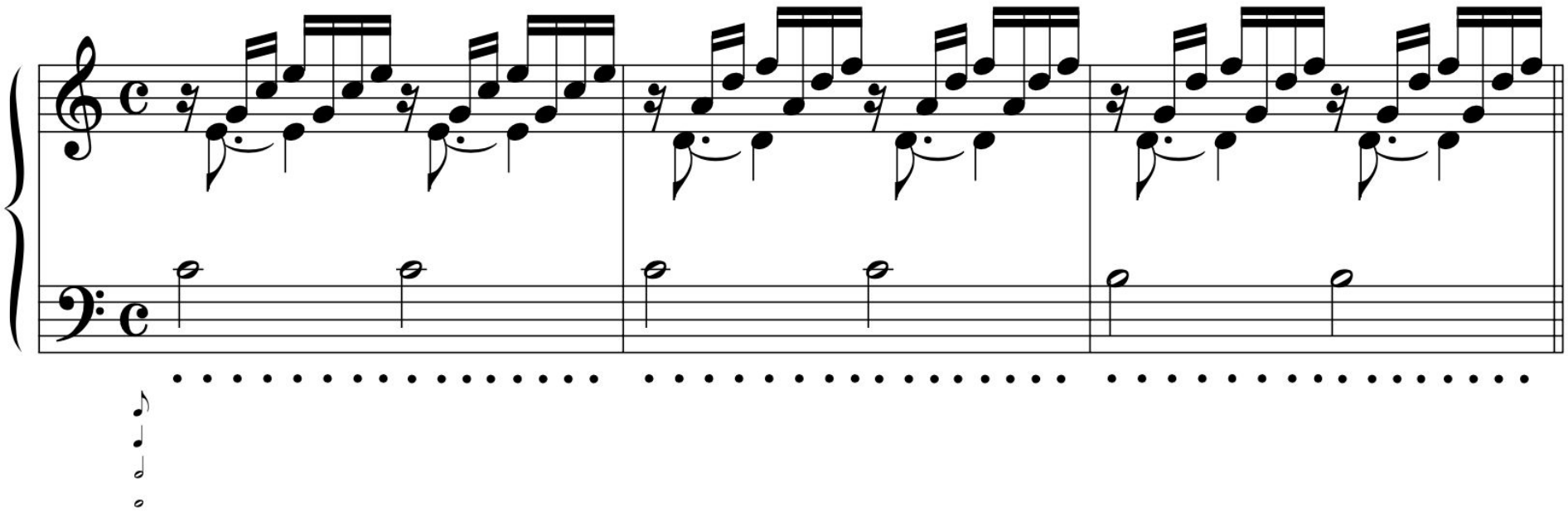
Since this is the first assignment, please make sure to share access to your repository with the TAs (GitHub handles: `GabrieleCecchetti` and `yrammos`) and to send the link by email (gabriele.cecchetti@epfl.ch) at any time before the deadline.

Task

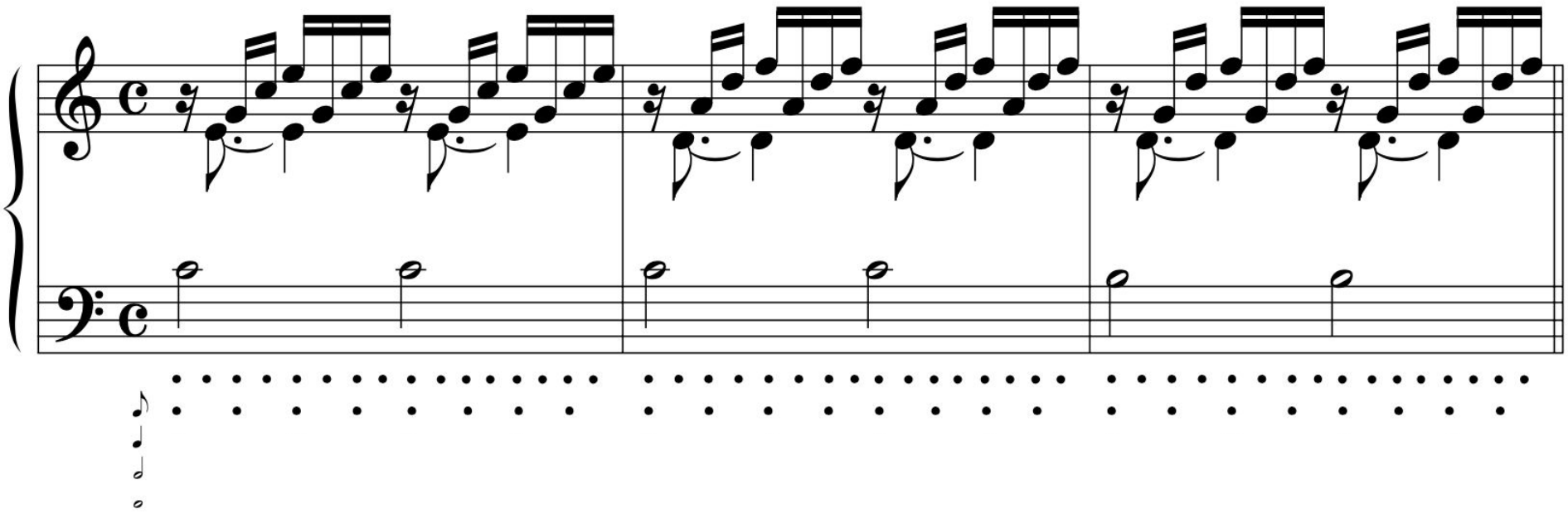
The task for this assignment is to implement a data-driven approach to infer the time signatures from a dataset of symbolically-encoded music. Note that the ground-truth is included in the dataset and can be useful for implementing a supervised classification approach, as well as to evaluate the outcomes.

Try to quantify statistically the effectiveness of the classification. Is the classification equally confident with all pieces? In the report, try to motivate the approach you adopted, discuss why it resulted in the observed outcome (e.g., why did it fail on some specific pieces, or why did it work 100% of the time, or why did it work very poorly), and how it could be improved/generalized.

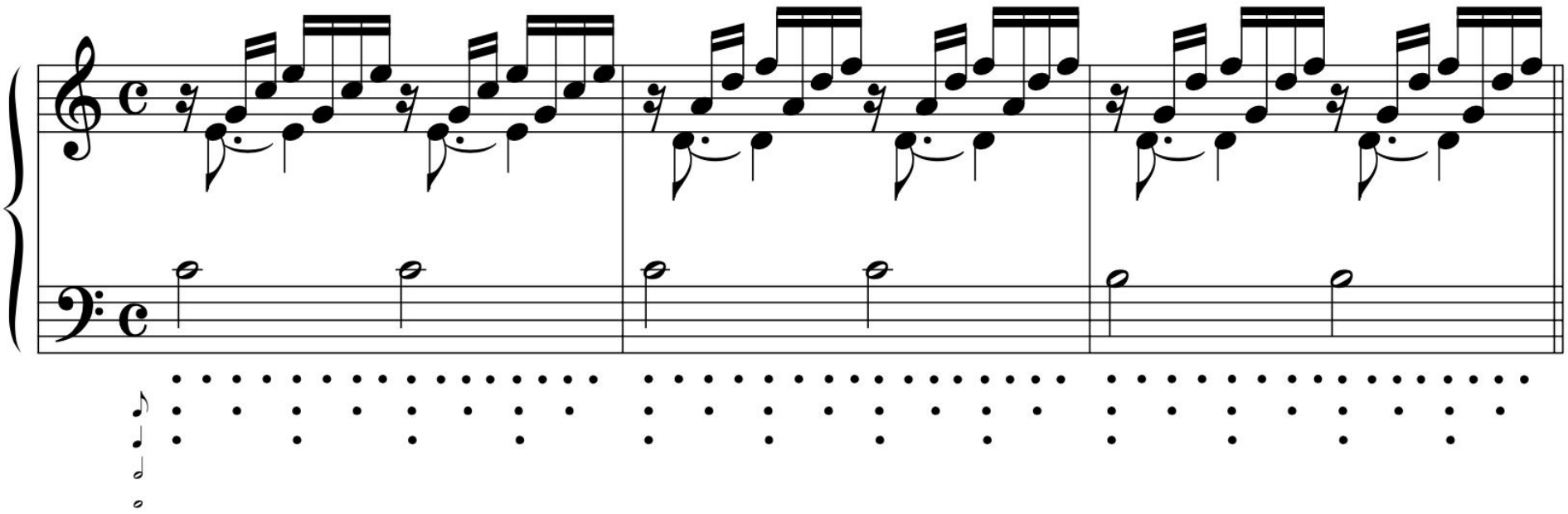
Meter is about periodicities



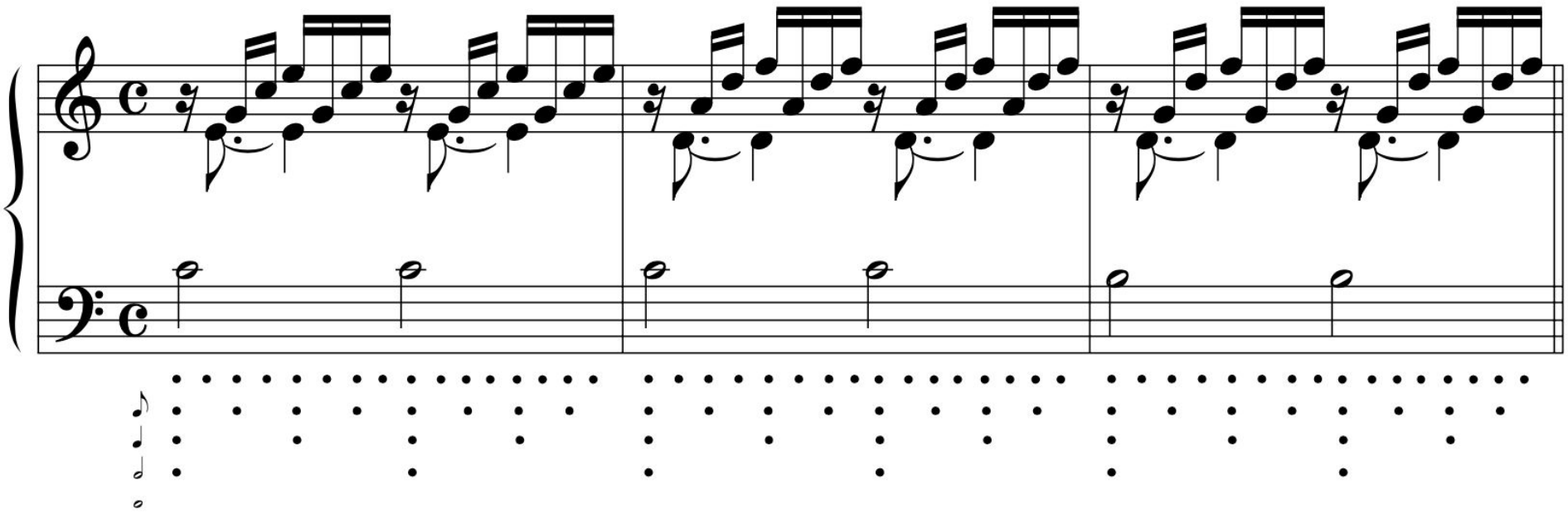
Meter is about periodicities



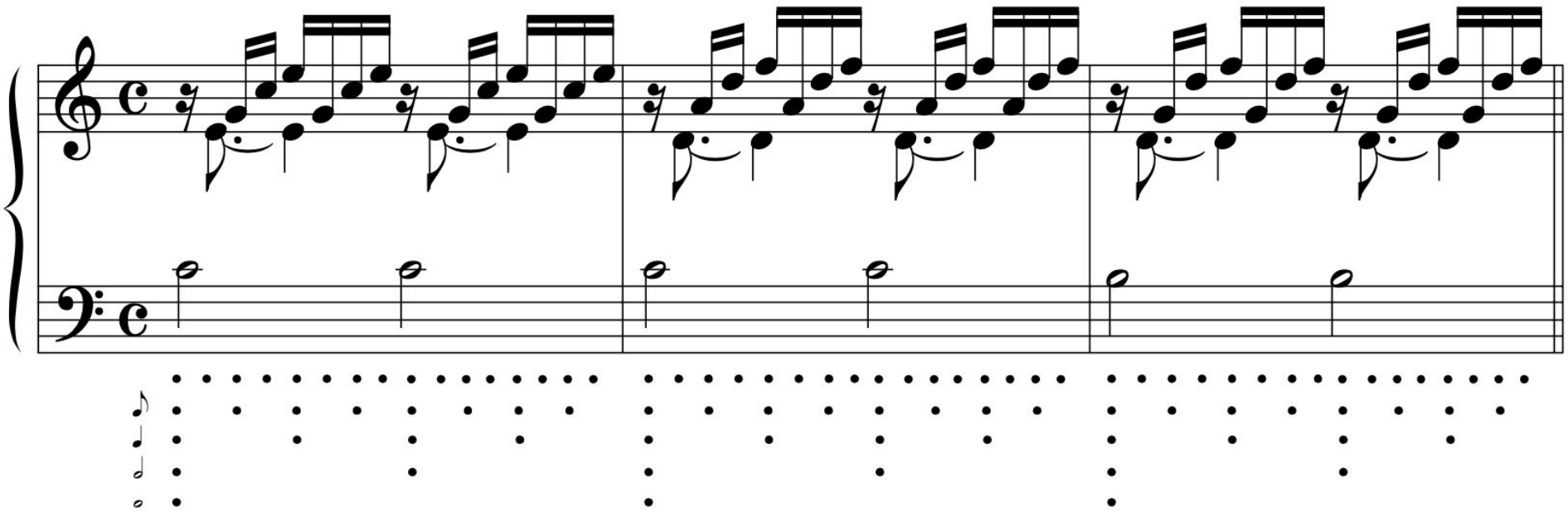
Meter is about periodicities



Meter is about periodicities



Meter is about periodicities



Meter is about (hierarchically nested) periodicities

- The beat is a periodic pattern
- The bar is a repeating group of beats (duple/triple/quadruple):
  ⇒ The bar is a periodic structure whose period is a multiple of the period of the beat
- The periodicity of the beat can be subdivided in two (simple) or three (compound) parts:
  ⇒ The subdivision of the beat is also a periodic structure, whose period is a sub-multiple of the period of the beat
- Bars can also be grouped into groups of bars (hypermeter)
  ⇒ Repeating groups of bar are also a periodic structure, whose period is a multiple of the period of the bar

Types of meter

- Type of beat: are beats subdivided in two (simple) or three (compound) parts?
  ⇒ [! Bars can also contain both types of beats: these are called “odd meters” (e.g., 5/8) !]
- Quantity of beats: how many beats per bar? (duple/triple/quadruple)

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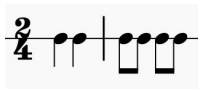
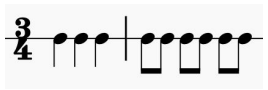
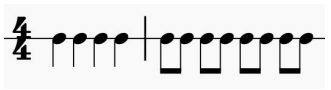
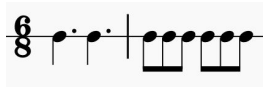
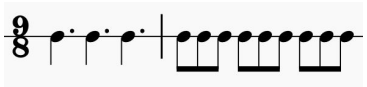
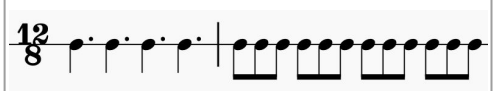
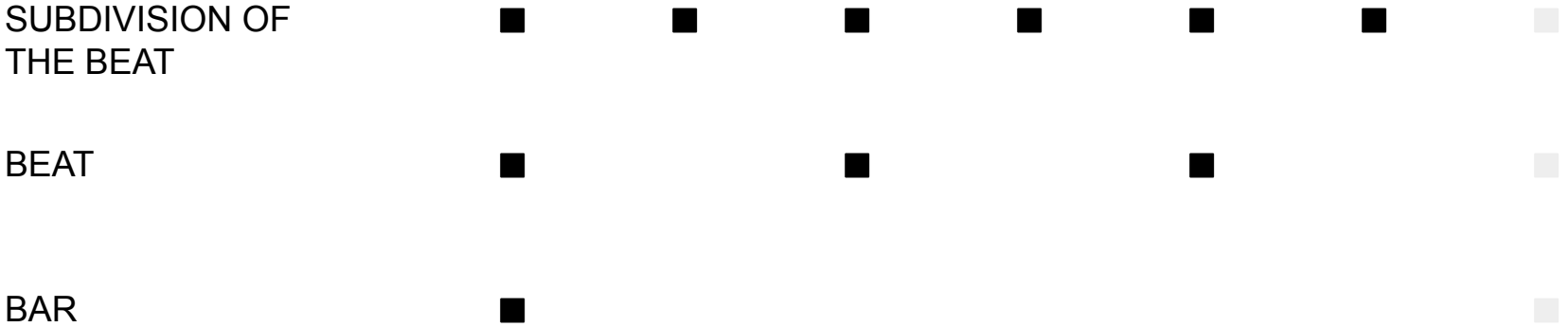
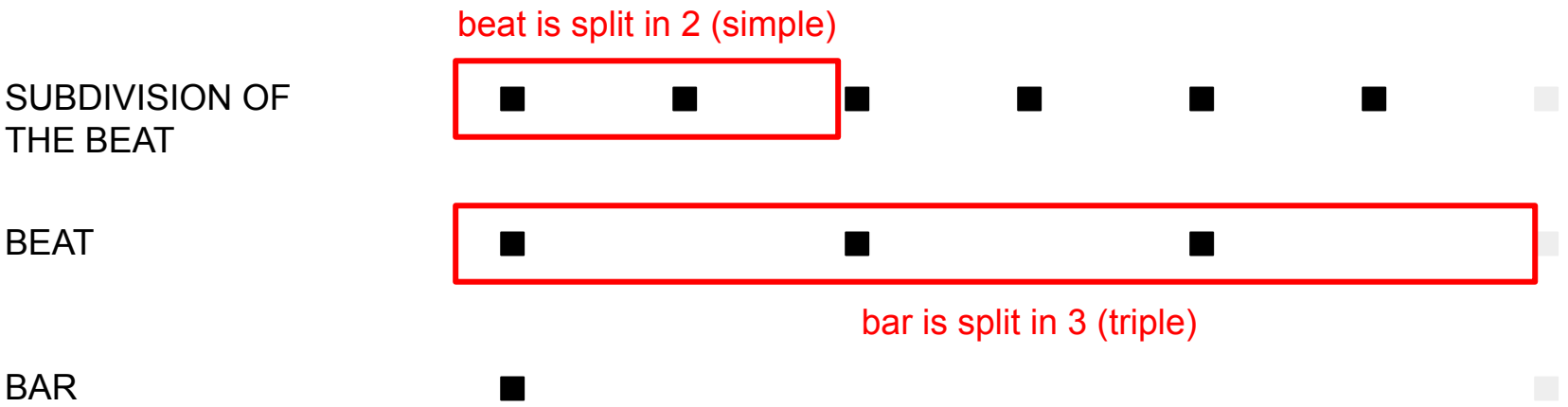
SIMPLE	2 	3 	4 
COMPOUND	6 	9 	12 

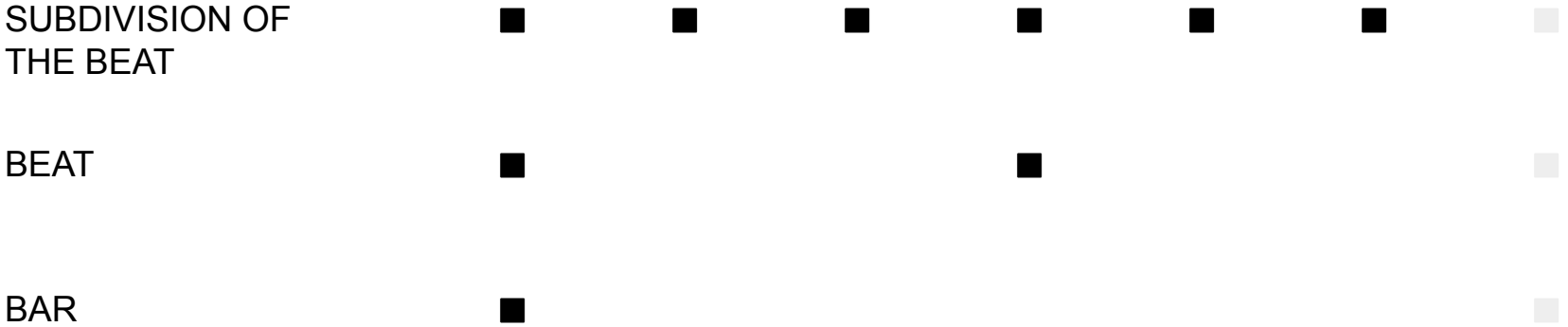
Time signatures and metrical grid: 3/4



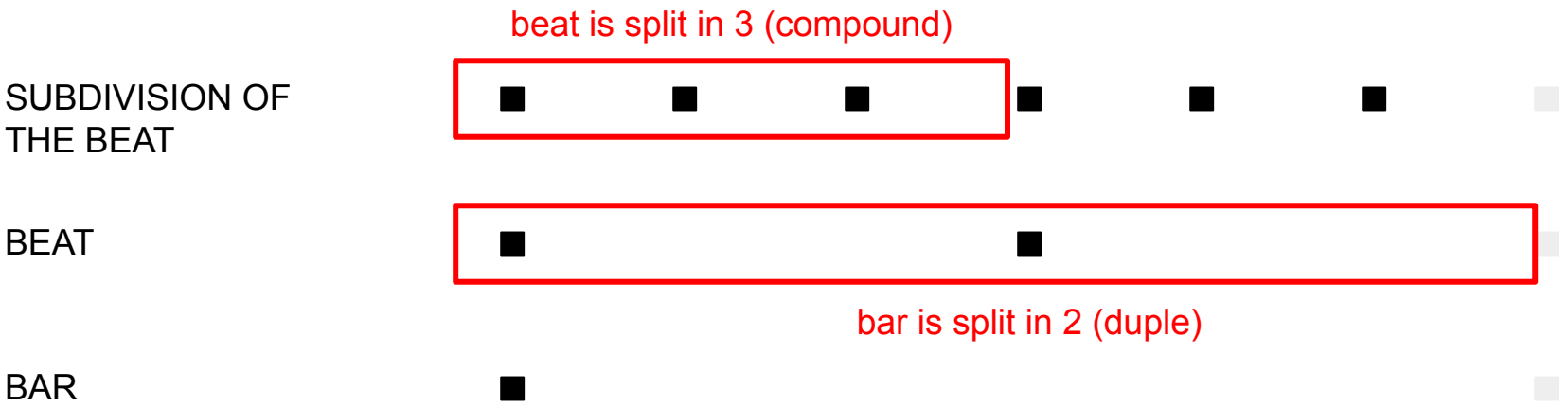
Time signatures and metrical grid: 3/4



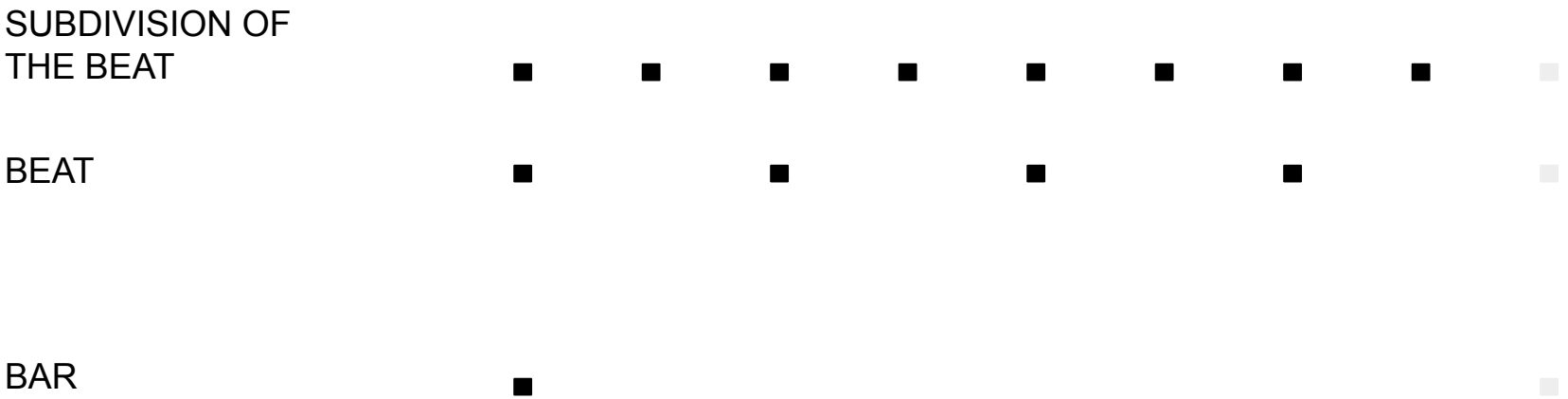
Time signatures and metrical grid: 6/8



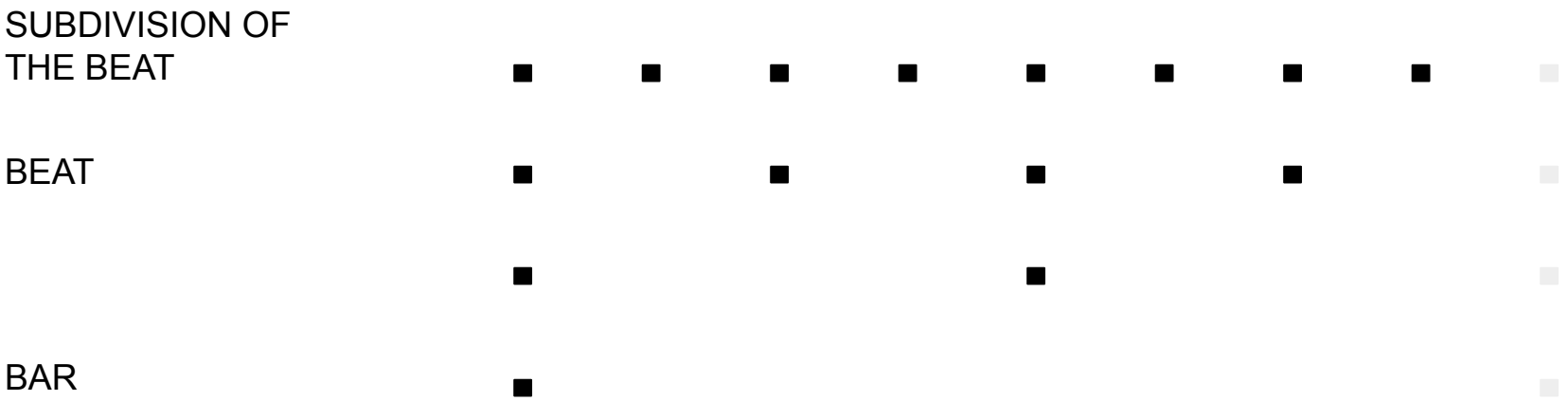
Time signatures and metrical grid: 6/8



Time signatures and metrical grid: 4/4

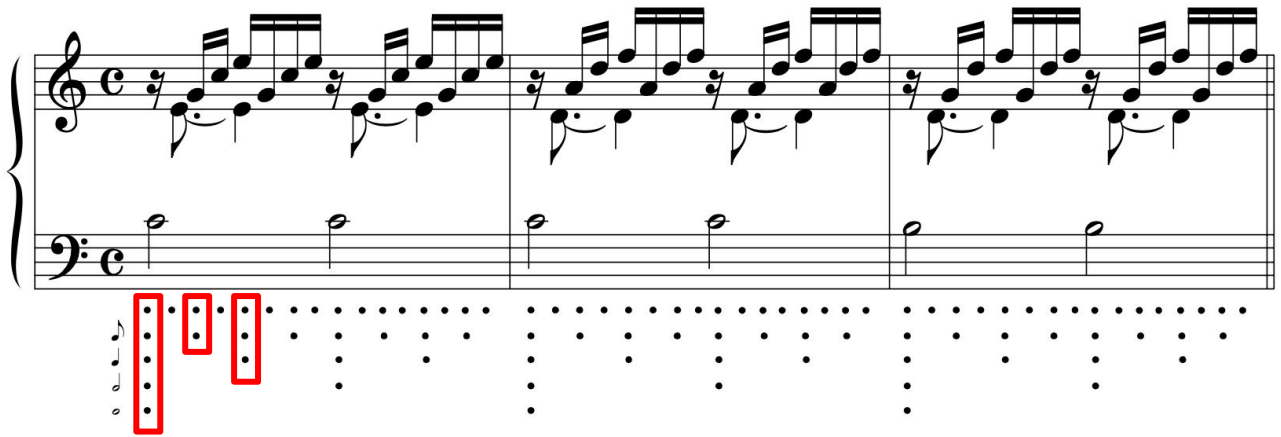


Time signatures and metrical grid: 4/4



Meter is about weight (accent)

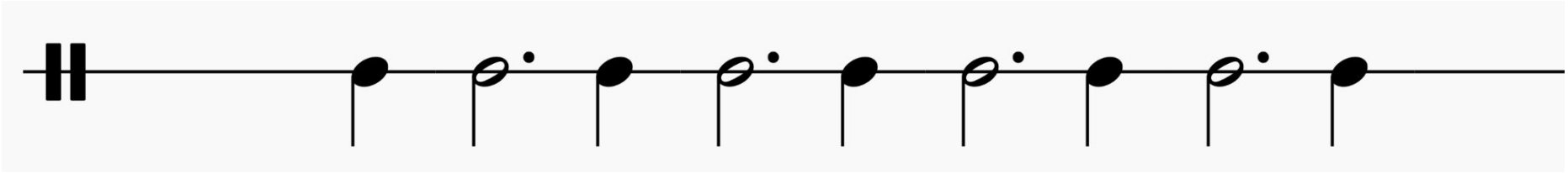
- Points in time where many periodicities overlap have stronger **metrical weight** (accent)



Meter is about weight (accent)

- Points in time where many periodicities overlap have stronger **metrical weight** (accent)
- This weight is construed by the mind of the listener or introduced explicitly in the performance…
- however, traces of the metrical weight can often be recognized in the score

Meter is about weight



Meter is about weight

- Longer IOIs/durations are more likely to be associated with stronger metrical beats

$$w(t) \sim \sum_{n|onset(n)=t} d(n)$$

- Different metrical grids might favour certain patterns of IOI/durations

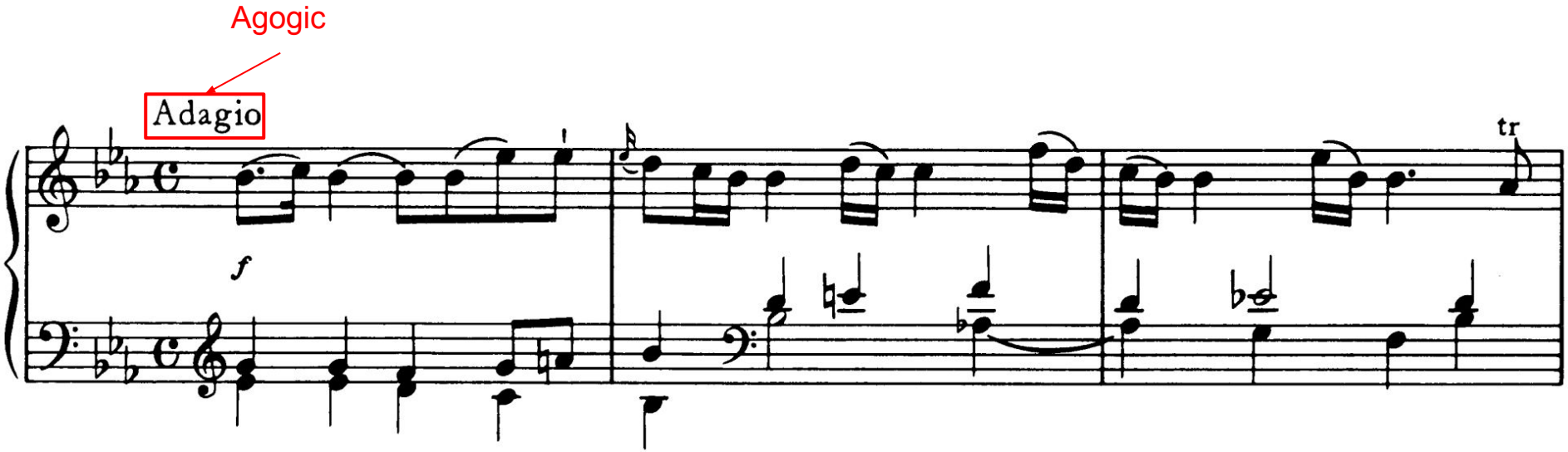
(Some) possible approaches

- Extract particularly common rhythmic patterns and consider the distribution across different time signatures
  - ⇒ Are some rhythmic patterns particularly distinctive of a certain time signature?
- Estimate the metrical grid (e.g., through the sum/average durations for each onset) and compare the metrical grid among pieces
  - ⇒ (Unsupervised) clustering: which pieces have more similar metrical grids? Do the clusters correspond to the ground-truth?
- Estimate the metrical grid and “extract” the most salient periodicities (e.g., through autocorrelation or DFT)
  - ⇒ (Supervised) classification: what periodicities are more informative to infer the time signatures?

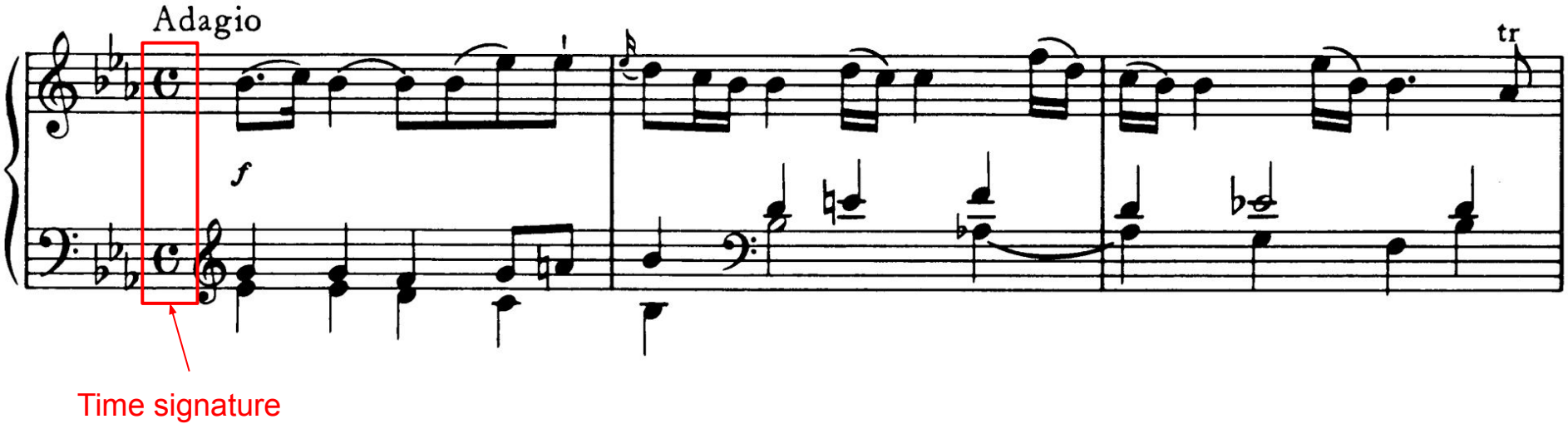
- How are you going to deal with ties and gracenotes?
- Are you going to bin the onsets or use them as they occur in the music?
- Are you dealing with staves and voices jointly or separately?

From the score to the dataset

The score



The score



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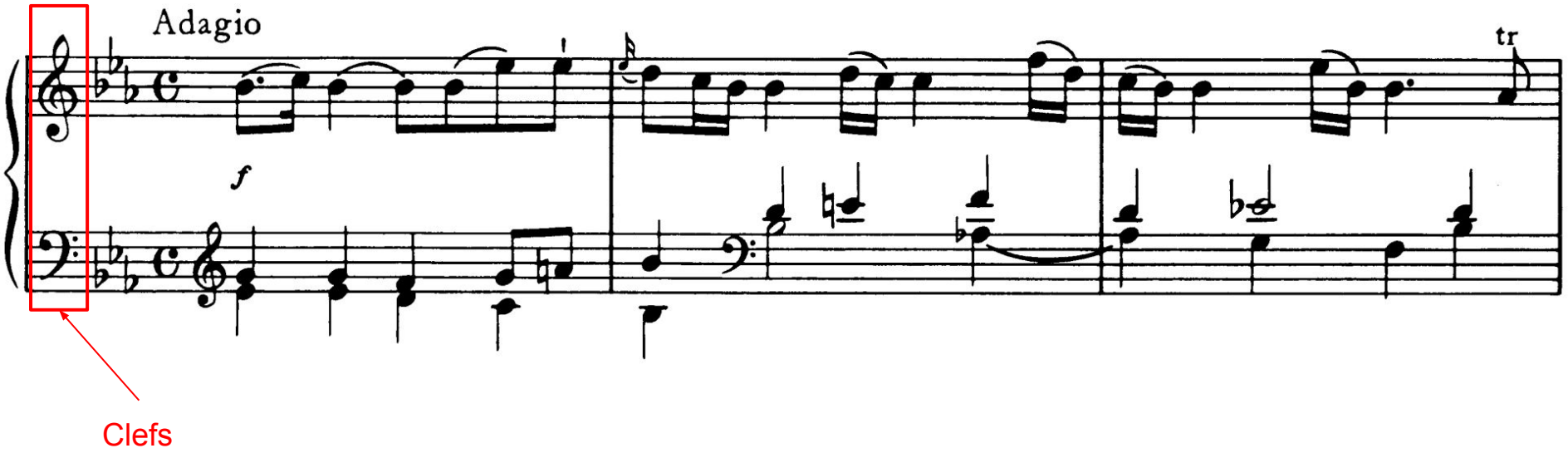

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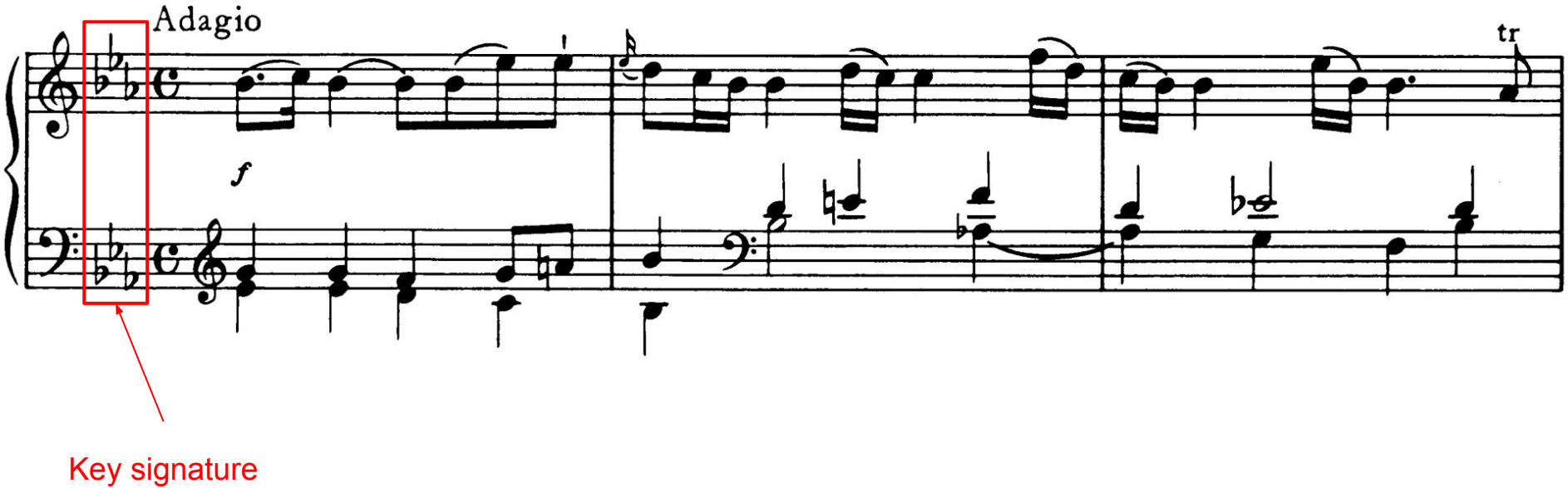

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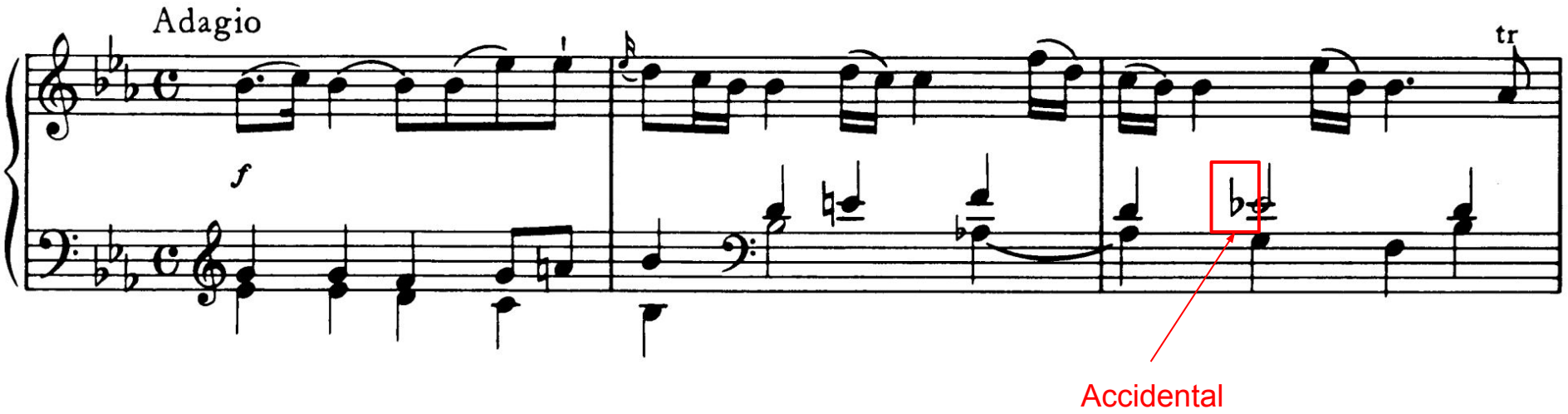

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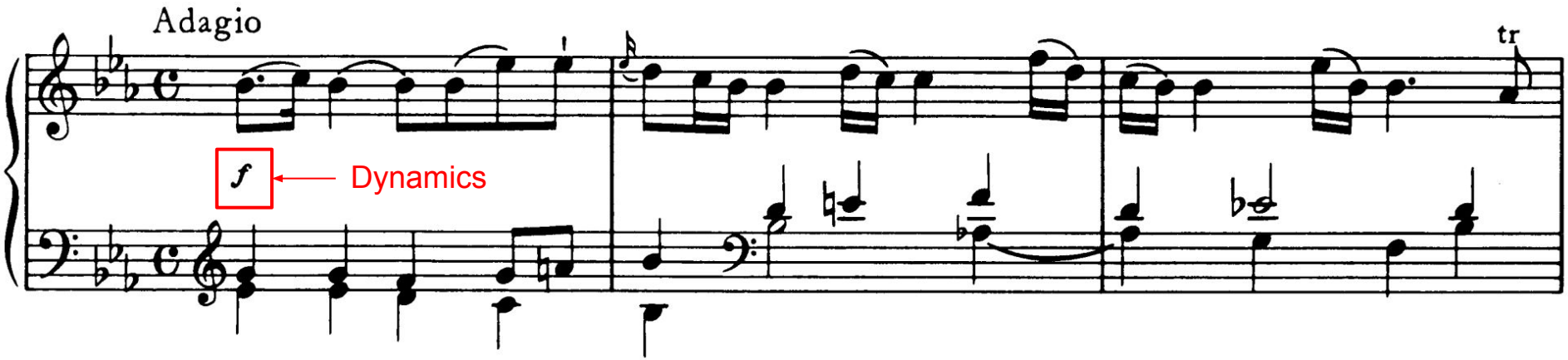

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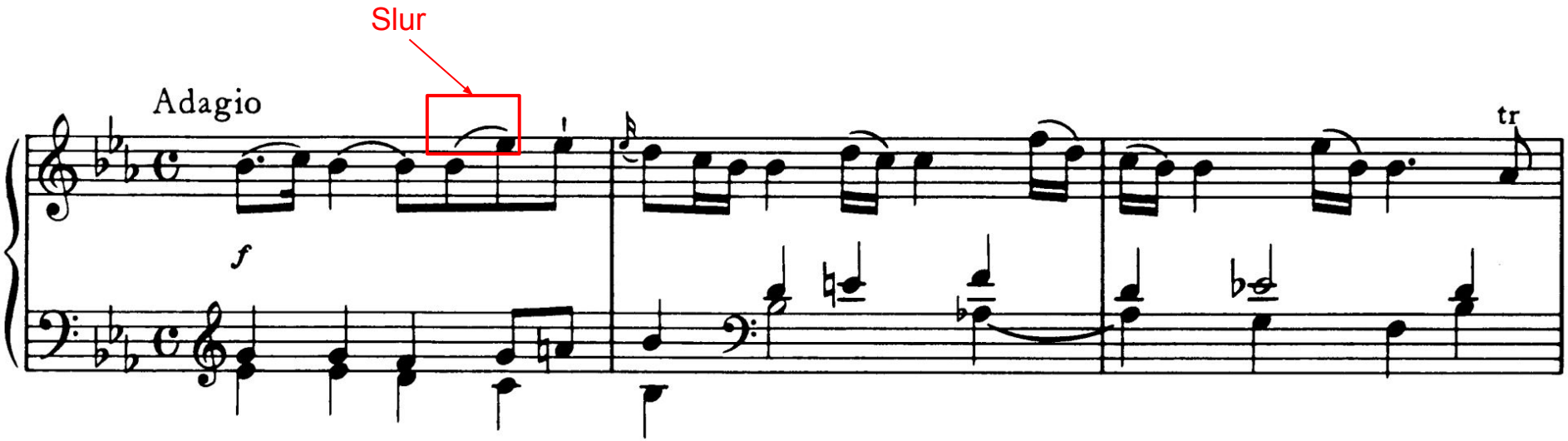

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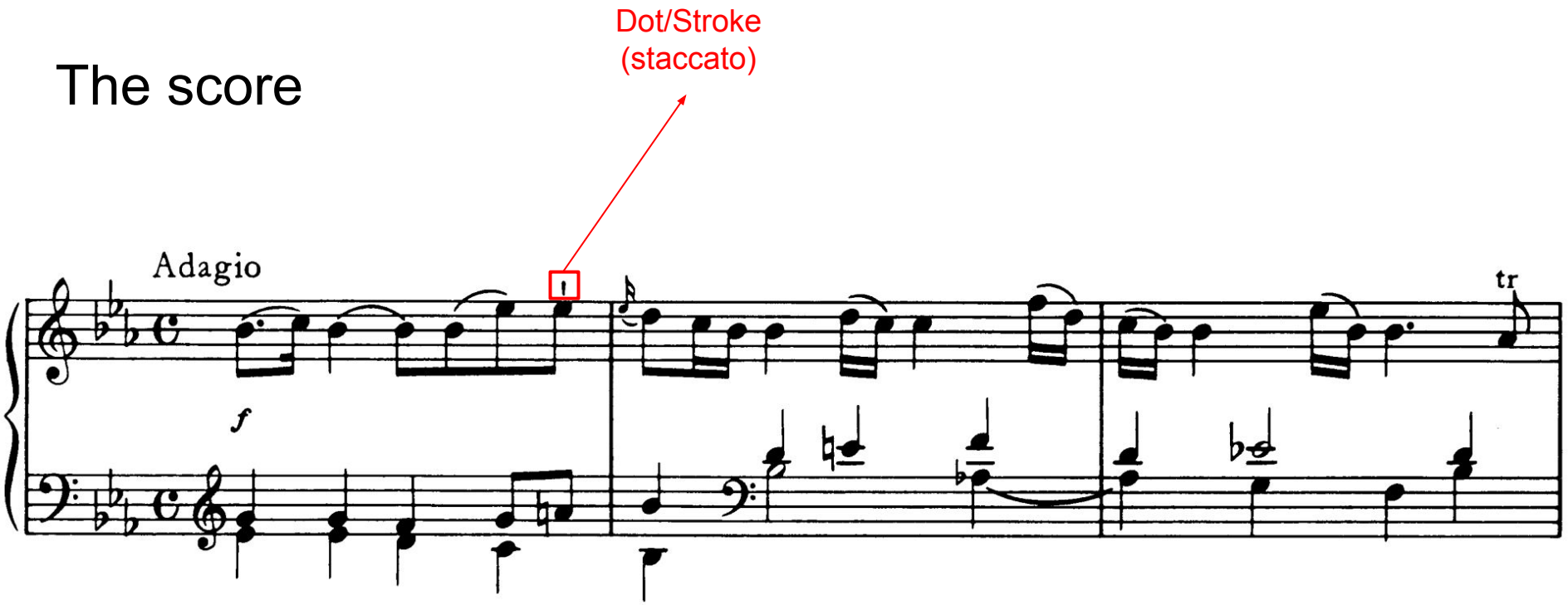

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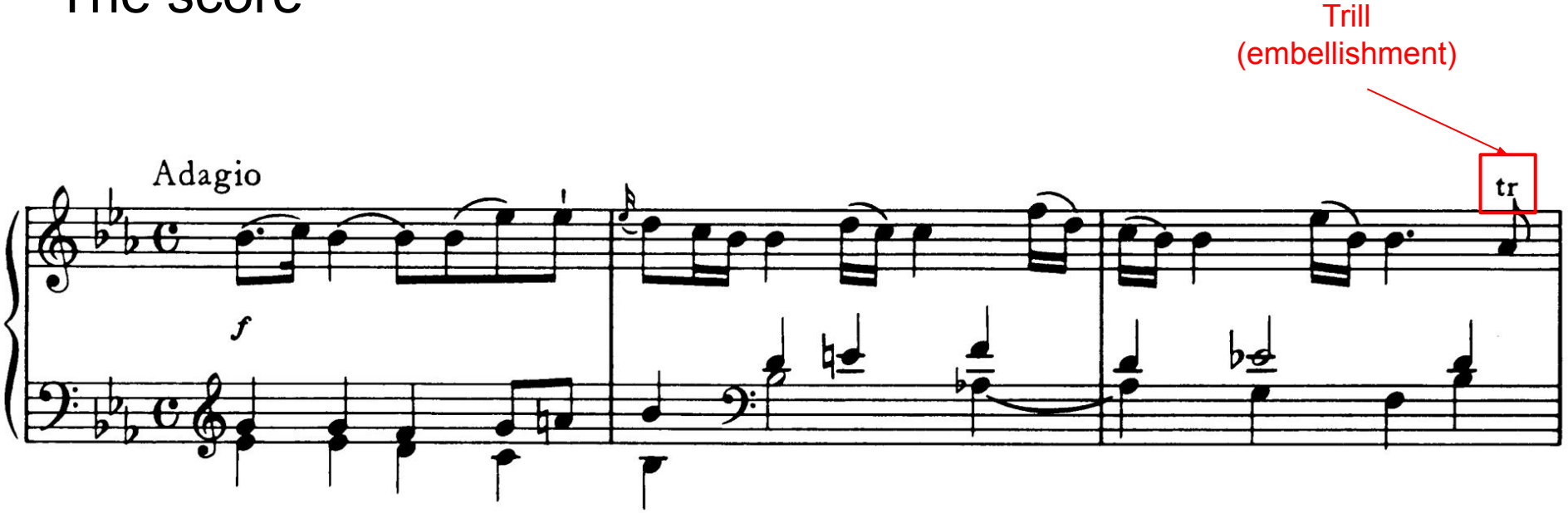

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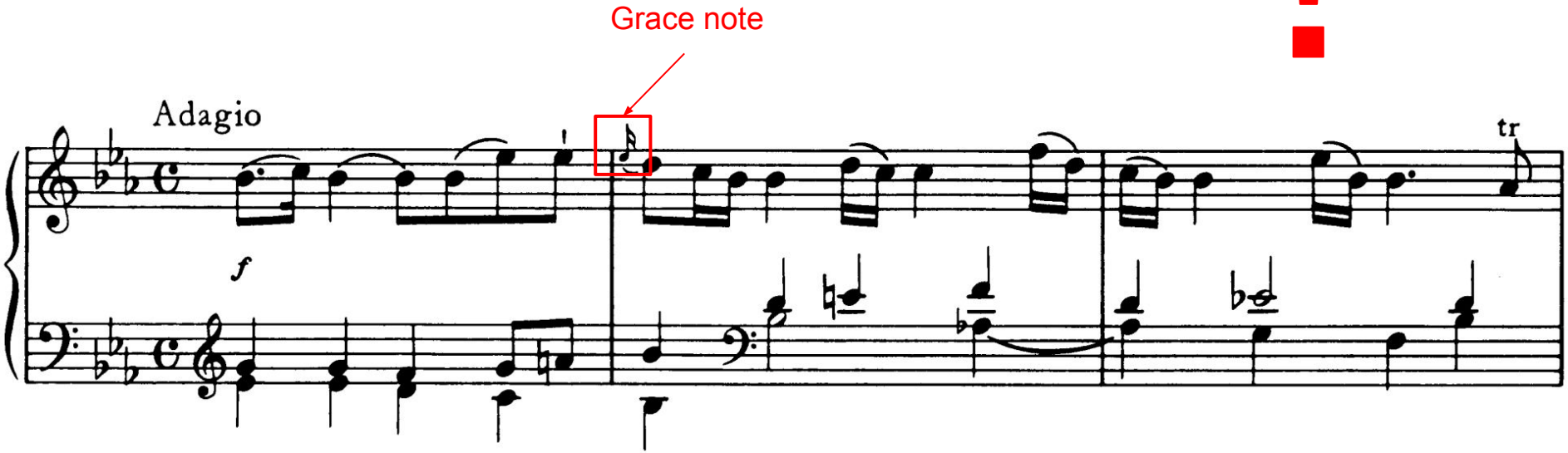

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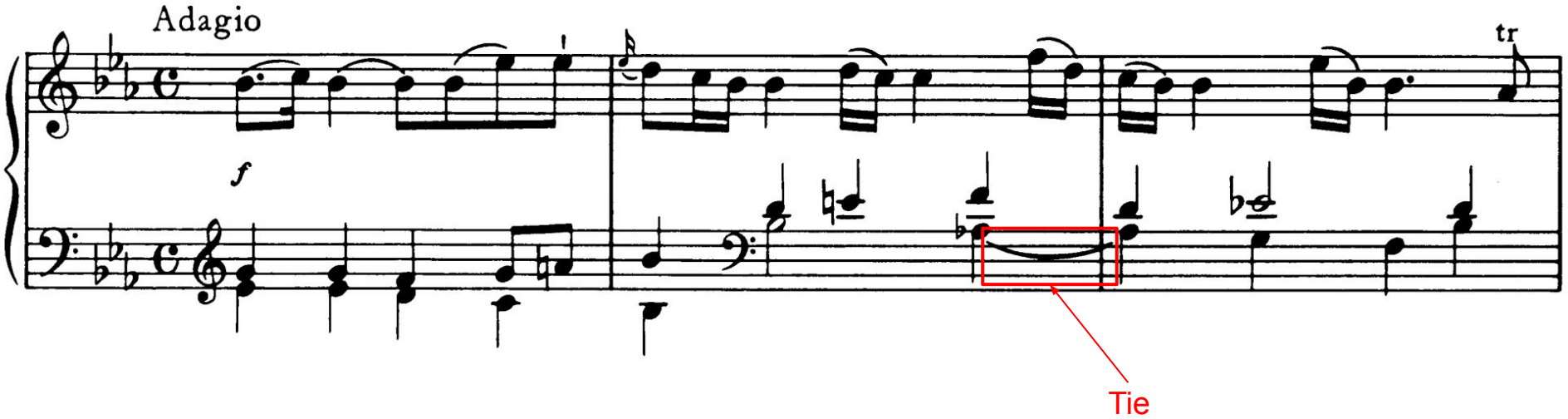

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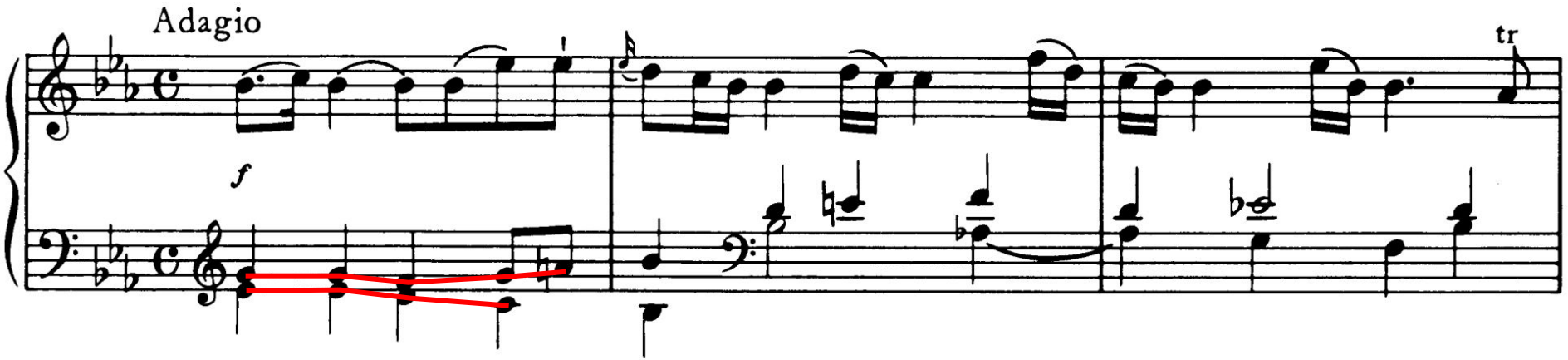
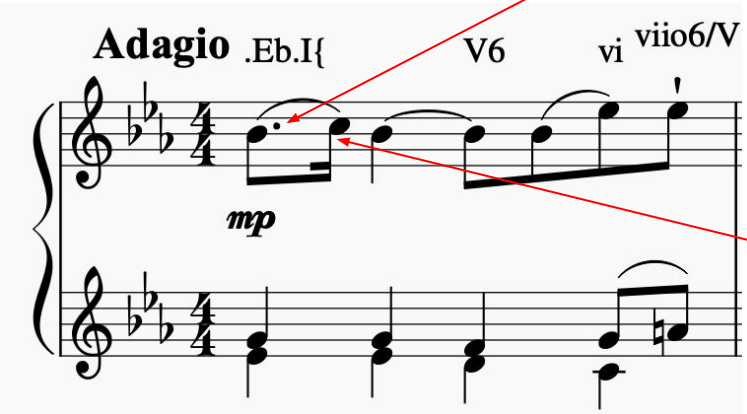


two voices in the same staff

From score to XML

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https://github.com/DCMLab/DM2022Assignments