Overview of Research Interests

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Music/Computing (Not) Away Day

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1. Introduction

- "Algorithms for Musical Pattern Recognition and Extraction" (EPSRC grant GR/S17253/02).
- Three broad overlapping areas of interest:

Computational music cognition
Constructing computational models that successfully simulate human musical behaviour.

Music information retrieval
Building efficient and effective systems for managing musical data and, in particular, extracting useful information from it.

Automatic music transcription
Building systems that can generate correct staff notation scores of musical works from recordings of correct performances of these works.

- Over the past few years, I've been working specifically on developing algorithms:

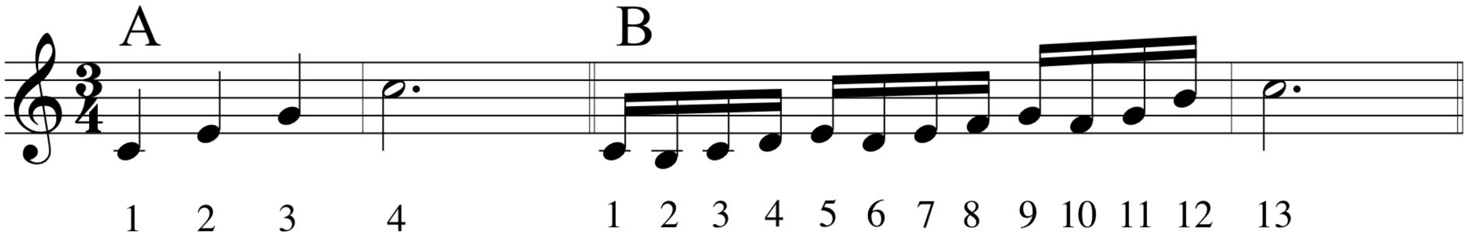
Pattern discovery in polyphonic music
Automatically discovering the perceptually significant and/or analytically interesting repeated patterns in a passage of polyphonic music.

Pitch spelling
Determining the correct pitch name (e.g., C♯, D♭, B𝄪 etc.) for each note in a piano-roll representation of a musical passage.

2. Pattern discovery in polyphonic music

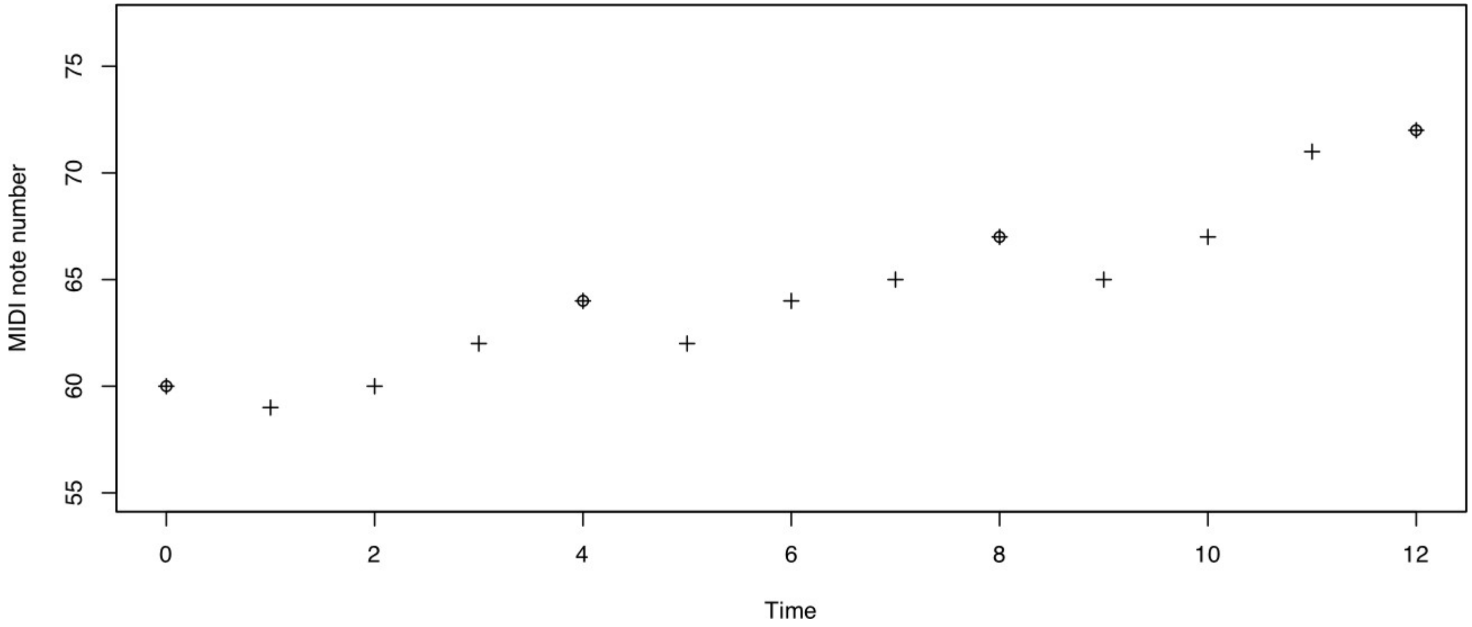
- Fundamental to music analysis and music cognition:
  - Lerdahl and Jackendoff (1983, p. 52): "the importance of parallelism [i.e., repetition] in musical structure cannot be overestimated".
  - Schenker (1954, p. 5): repetition "is the basis of music as an art".
  - Bent and Drabkin (1987, p. 5): "the central analytical act" is "the test for identity".
- Also potentially important for indexing music databases so that information can be retrieved from them more efficiently.

3. Representing music as strings



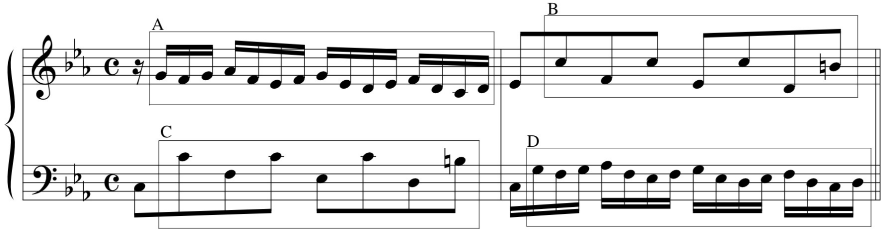
- Before 2000, most approaches to repetition discovery in music were based on the assumption that the music to be analysed is represented in the form of strings.
- You need to use 9 insertions to transform $A = \langle 60, 64, 67, 72 \rangle$ into $B = \langle 60, 59, 60, 62, 64, 62, 64, 65, 67, 65, 67, 71, 72 \rangle$.
- However, A and B are undoubtedly closely related in the sense that B is clearly an elaboration of A.
- If you allow two patterns to count as a match when their edit distance is as high as 9, then you will get many spurious matches.

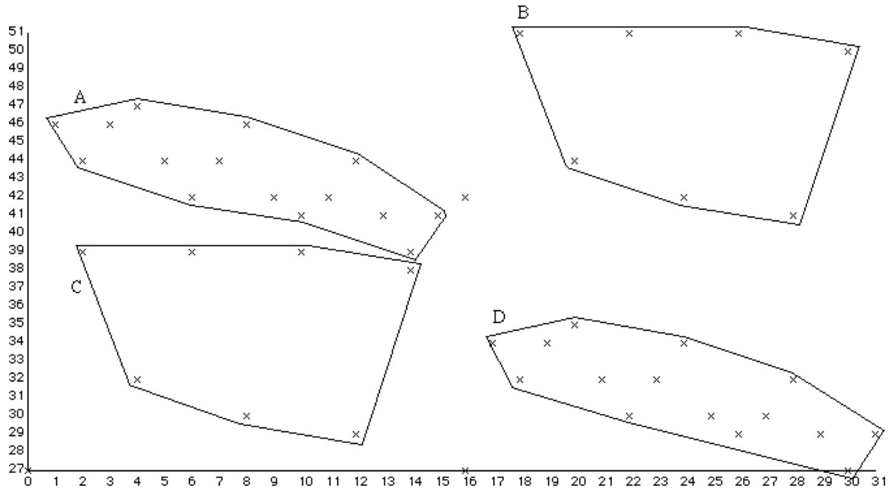
4. Representing music as multidimensional datasets



- Developed algorithms based on the assumption that the music to be analysed was represented as a set of points in a multidimensional space.
- Some musically closely related patterns that are separated by large edit-distances in the string-based approach are related by simple geometric transformations and so are easier to find without getting spurious matches when represented as sets of points.

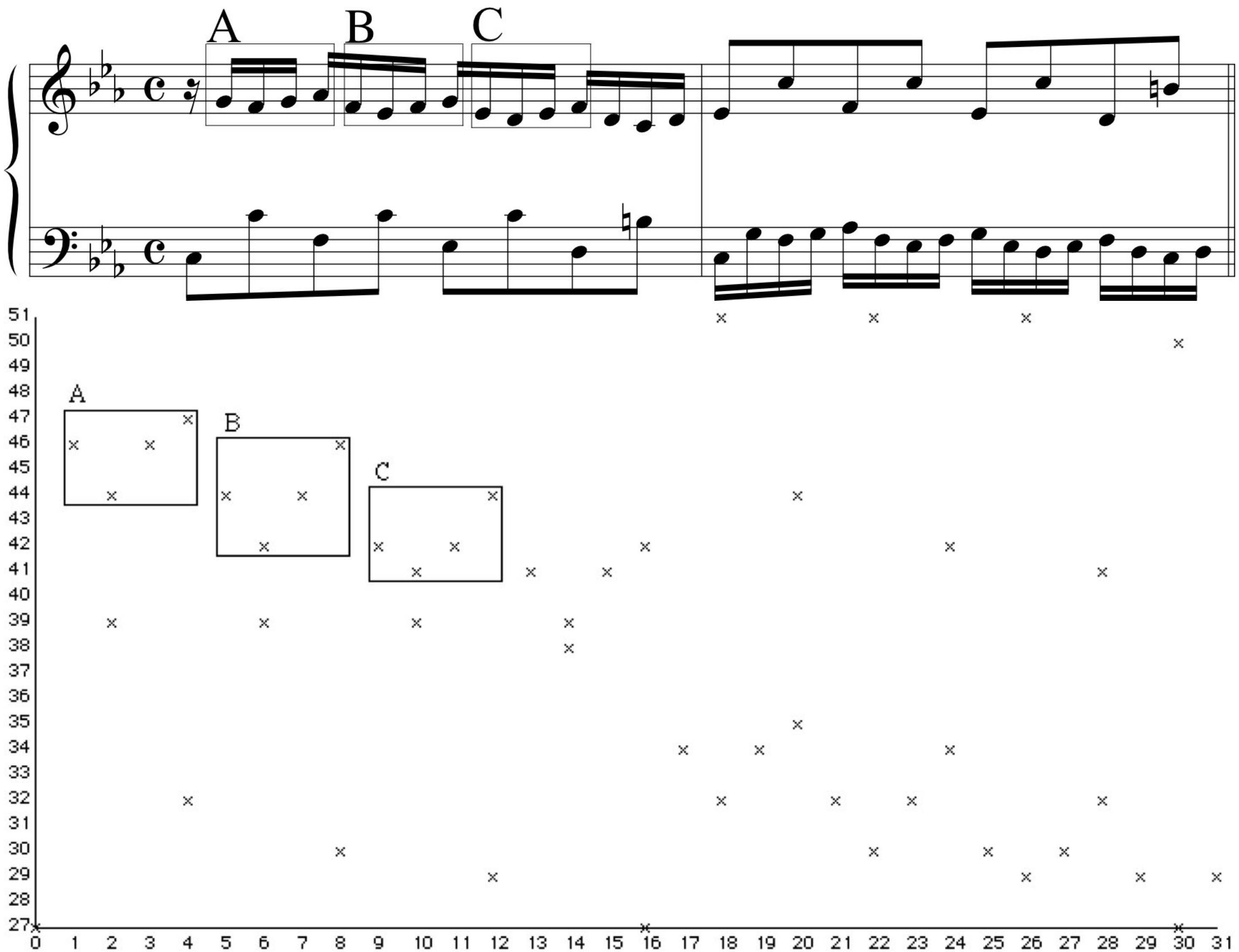
5. Processing polyphonic music using multidimensional datasets



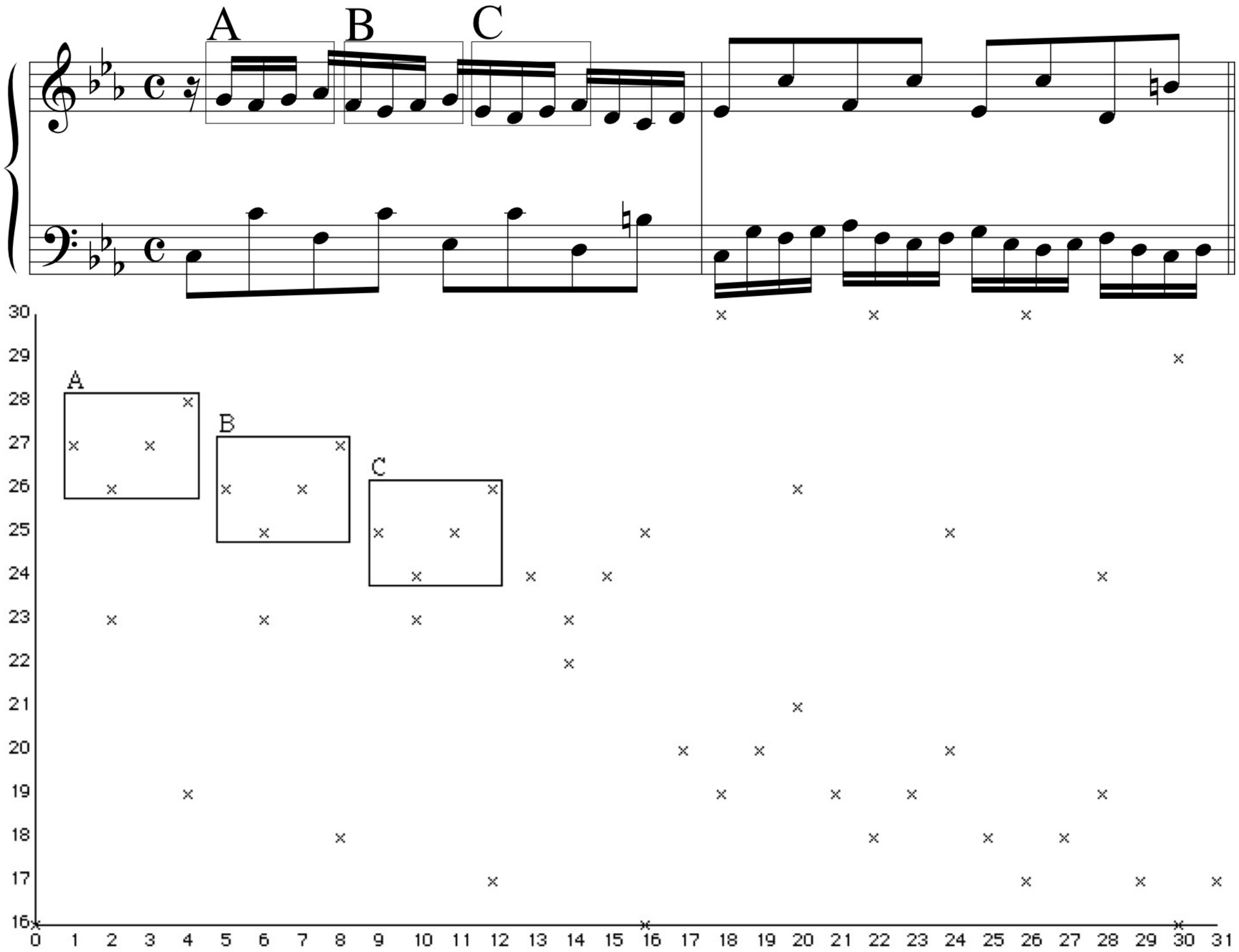


- Polyphonic music can be processed as easily as monophonic music.
- Developed various algorithms for
  1. finding all occurrences of a user-supplied query pattern in a passage of music;
  2. finding the largest repeated patterns in a musical passage;
  3. finding all the occurrences of the largest repeated patterns in a musical passage;
  4. generating a compact representation of a musical passage in terms of occurrences of the largest repeated patterns within it.
- Work was published in various papers (Lemström, Wiggins, and Meredith, 2001; Meredith, Wiggins, and Lemström, 2001; Meredith, Lemström, and Wiggins, 2002, 2003; Wiggins, Lemström, and Meredith, 2002).

6. Representing pitch using MIDI note number ('chromatic pitch')



7. Representing pitch using diatonic pitch



8. Pitch spelling algorithms

Author	*Note accuracy (%)*	*Style dependence*
Meredith	99.43	0.54
Temperley	99.30	1.13
Chew and Chen	99.15	0.35
Cambouropoulos	99.15	0.47
TPR1	99.04	0.65
Longuet-Higgins	98.21	1.79

- Compared algorithms of Longuet-Higgins (1987), Cambouropoulos (1996, 2001, 2003), Temperley (2001), Chew and Chen (2003, 2005) and Meredith (2003, 2005).
- Algorithms run on same, large database of classical and baroque music containing 195972 notes (216 movements) equally divided between eight composers.
- Algorithms compared in terms of note accuracy and style dependence.
- Identified optimal parameter value combinations for the algorithms of Cambouropoulos, Chew and Chen and Temperley.
- Developed new algorithm which achieves a higher note accuracy than the other algorithms over my test dataset.
- Published in various places (Meredith and Wiggins, 2005; Meredith, 2003, 2005).

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