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MTG
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Group

Evaluation of Set Class Similarity Measures for Tonal Analysis

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SMC Master Thesis Presentation

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Outline

- Introduction:

Definitions - Problem - Objectives

- Methodology:

Systematic Description - Set Class Theory - Similarity Measures - Segmentation

- Representation:

Three Representation Techniques - Analysis Tool

- Conclusions

- Future Work

Introduction

“Evaluation of **Set Class** **Similarity Measures** for **Tonal Analysis**”

- Tonal Analysis:
 1. Description
 2. Representation
- Set Class Theory: Tool for description stage
- Similarity Measures: Tool for representation stage

Introduction

Problem

1. Existing descriptions of tonality lack depth.
2. Use of “non-musical” similarity measures.

Introduction

Objectives

1. Systematic description
2. Use set class theory
3. Survey set class similarity measures
4. Represent set class data using similarity measures
5. Evaluate model through analysis examples

Methodology

Systematic Description

- What does it mean to be systematic?
 - Mid-Level
 - “Musical Surface”

Methodology

Set Class Theory - What?

Pitch Set: {A4, C#5, E5, A5}

{69, 73, 76, 81}

Pitch Class Set: {9,1,4,9} = {1,4,9}

Set Class: {0,3,7} (Prime Form)

Forte Name: 3-11(B)

Methodology

Set Class Theory - Why?

- An appropriate mid-level descriptive tool
- What are the differences/benefits?

Methodology

Set Class Similarity Measures - What?

- What are they?
- How do they work?
- Why?

Methodology

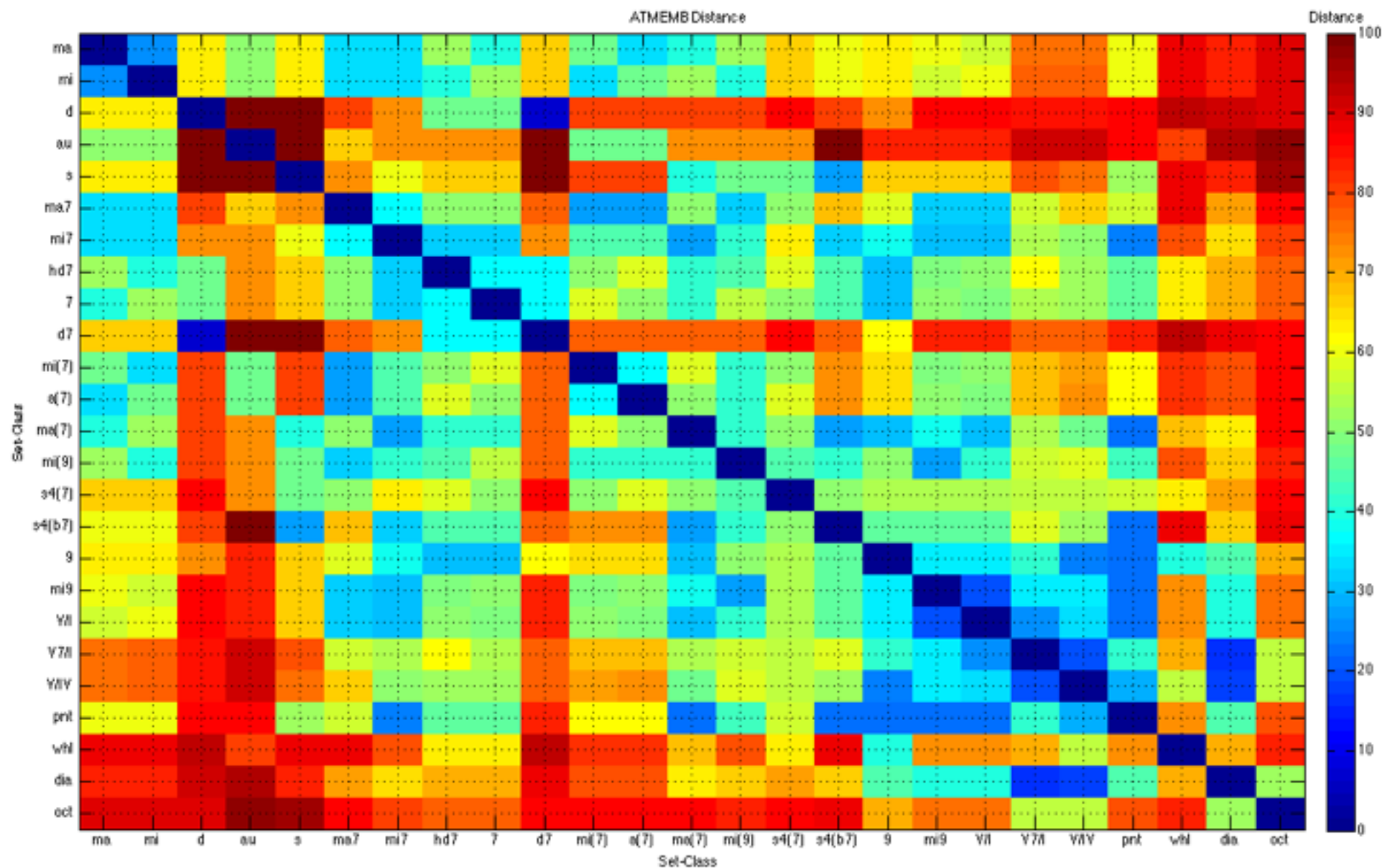
Set Class Similarity Measures - Survey

- Surveyed 25+ measures
- Categorised them
- Selected 6 measures:

ATMEMB REL RECREL TpREL AvgSATSIM TSATSIM

Methodology

Set Class Similarity Measures - Survey



Methodology

Segmentation

- Two segmentation policies:
 1. Fully Systematic (A. Martorell)

For capturing the complete SC contents
 2. Sliding Window

For “tuning in” to a “sets of interest”

Methodology

Segmentation - Fully Systematic

Example:

Prelude in C

from *The Well Tempered Clavier*, Book One

Andante J. S. Bach

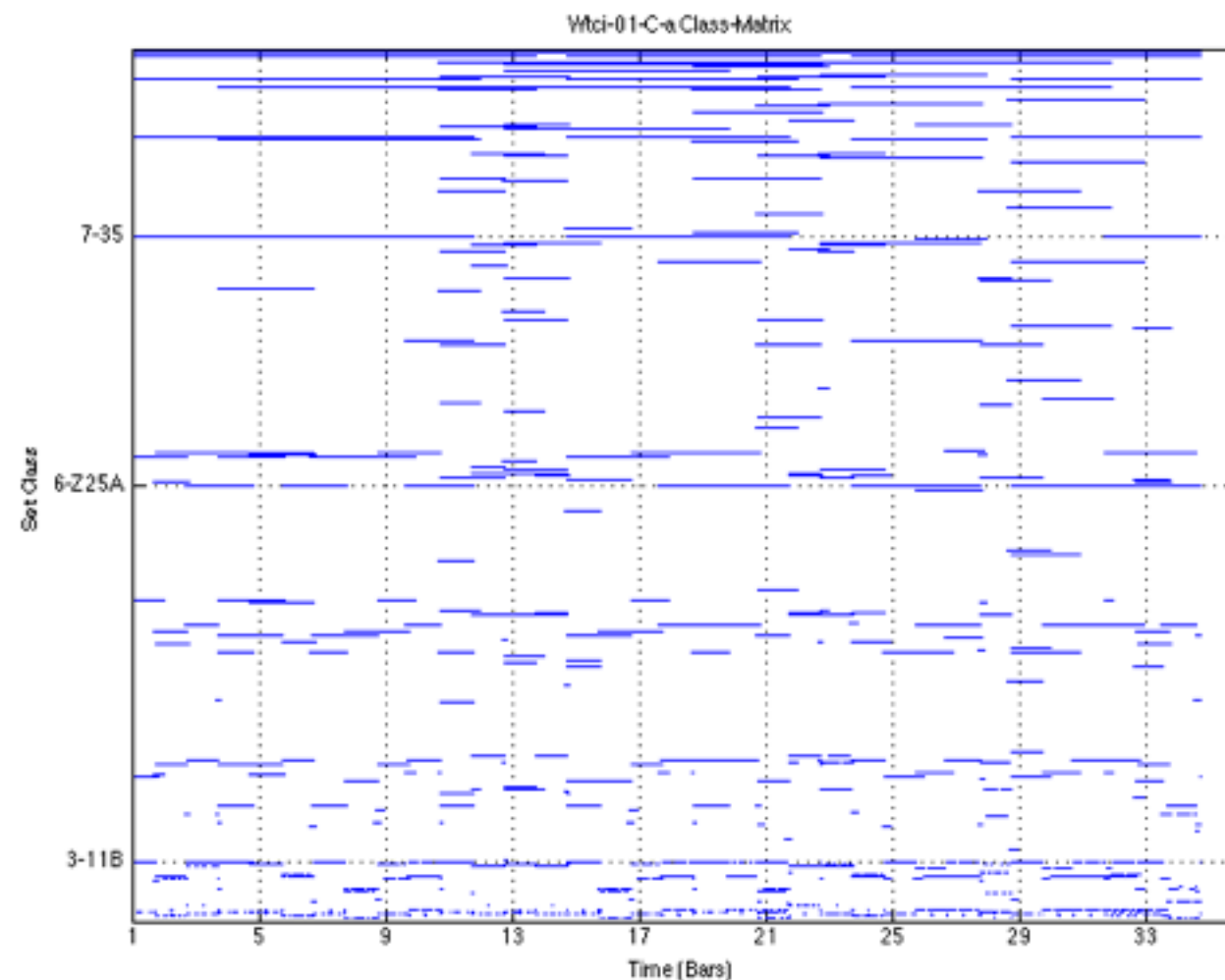
The first system of the Prelude in C, BWV 999, by J.S. Bach. The score is in C major, common time (C), and Andante tempo. It features a treble and bass staff. The treble staff has a melody with eighth and sixteenth notes, and the bass staff has a simple accompaniment of quarter notes. Fingering numbers 1, 3, 5 are shown above the treble staff, and 2, 1 are shown below the bass staff. A dynamic marking 'p' (piano) is present in the bass staff.

The second system of the Prelude in C, BWV 999, by J.S. Bach. The score continues the treble and bass staves from the first system. Fingering numbers 1, 3, 5 are shown above the treble staff, and 2, 1 are shown below the bass staff. A dynamic marking 'mf' (mezzo-forte) is present in the bass staff.

Methodology

Segmentation - Fully Systematic

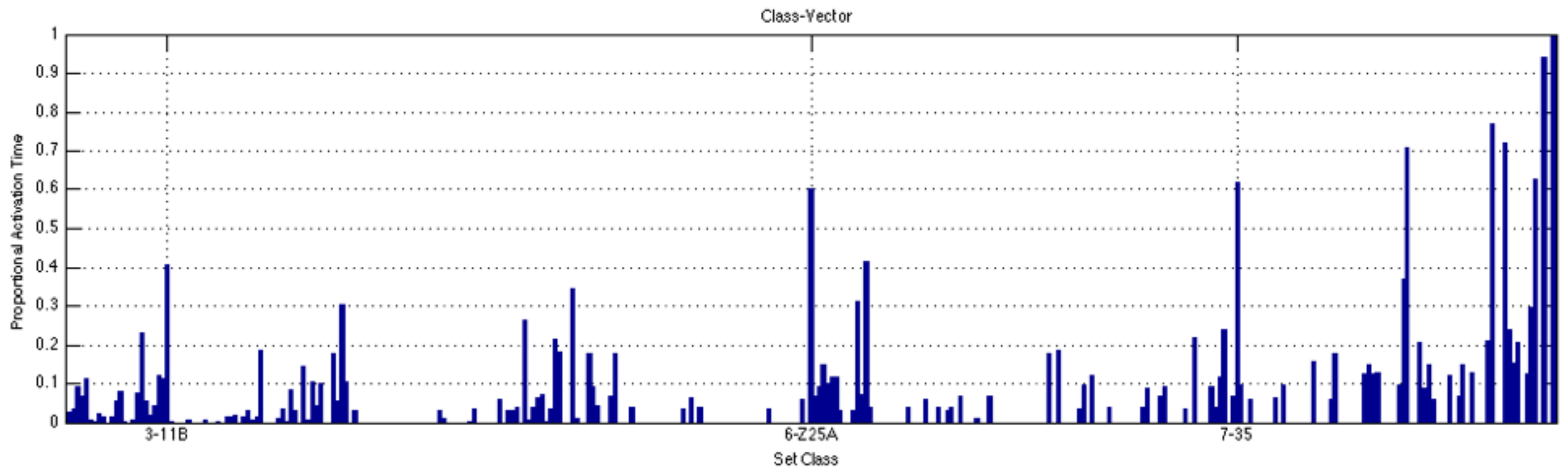
- Class Matrix



Methodology

Segmentation - Fully Systematic

- Class Vector



Methodology

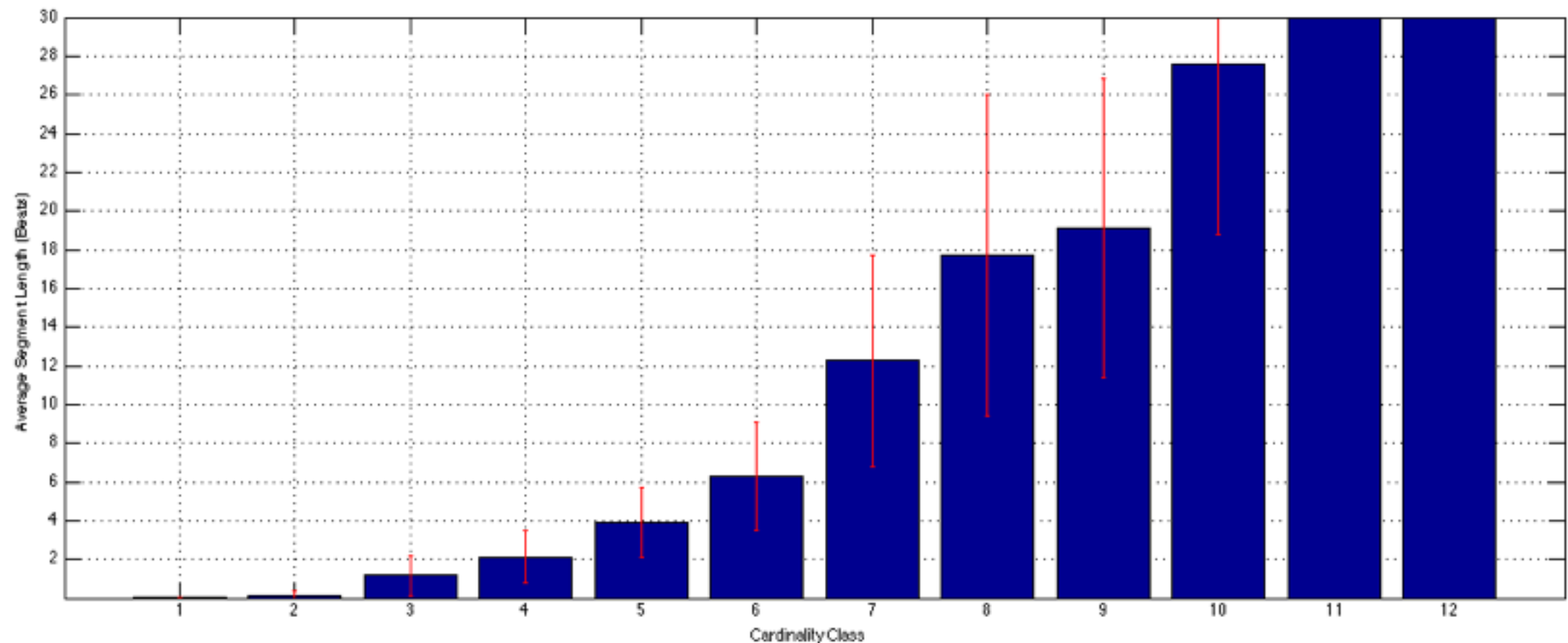
Segmentation - Sliding Window

- Window and hop size selection
- What are the “Sets of Interest”?

Methodology

Segmentation - Sliding Window

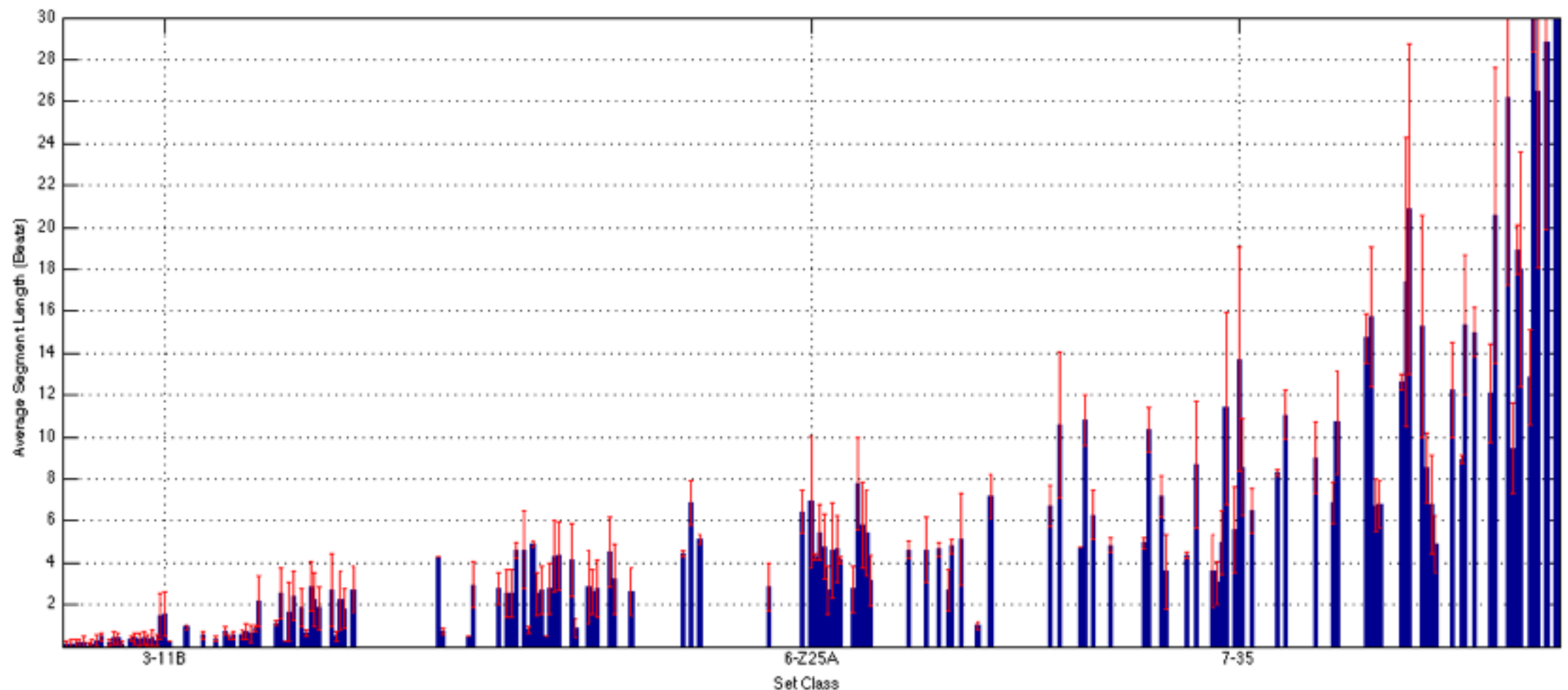
- Average segment length vs cardinality



Methodology

Segmentation - Sliding Window

- Average segment length vs set class

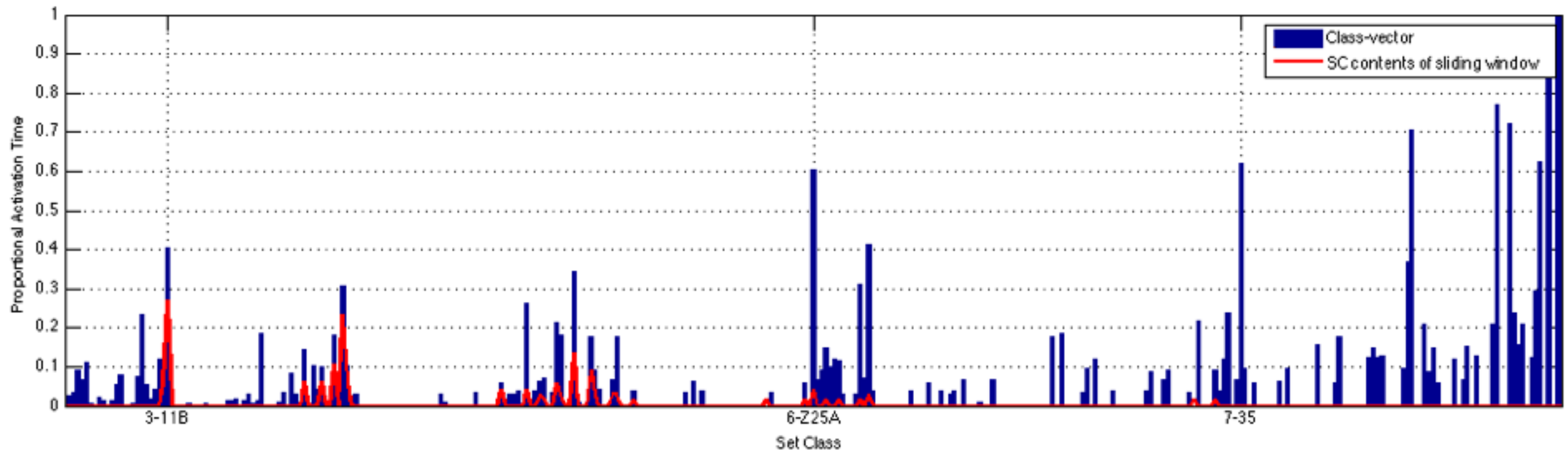


Methodology

Segmentation - Sliding Window

- Class vector + sliding window contents

(Window = 2 beats, hop = 1 beat)



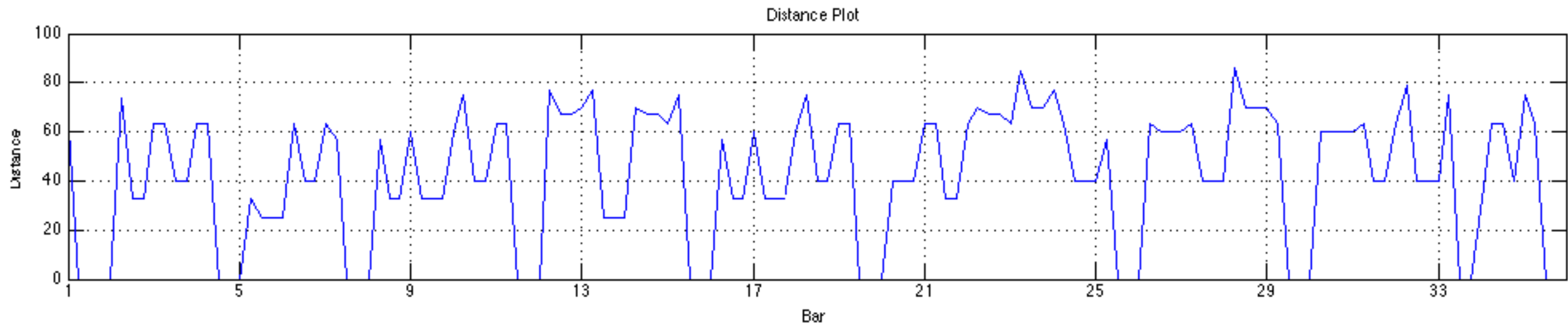
Representation

- 3 representation techniques:
 1. Distance plot
 2. Autocorrelation
 3. Self-similarity matrix

Representation

Distance Plot

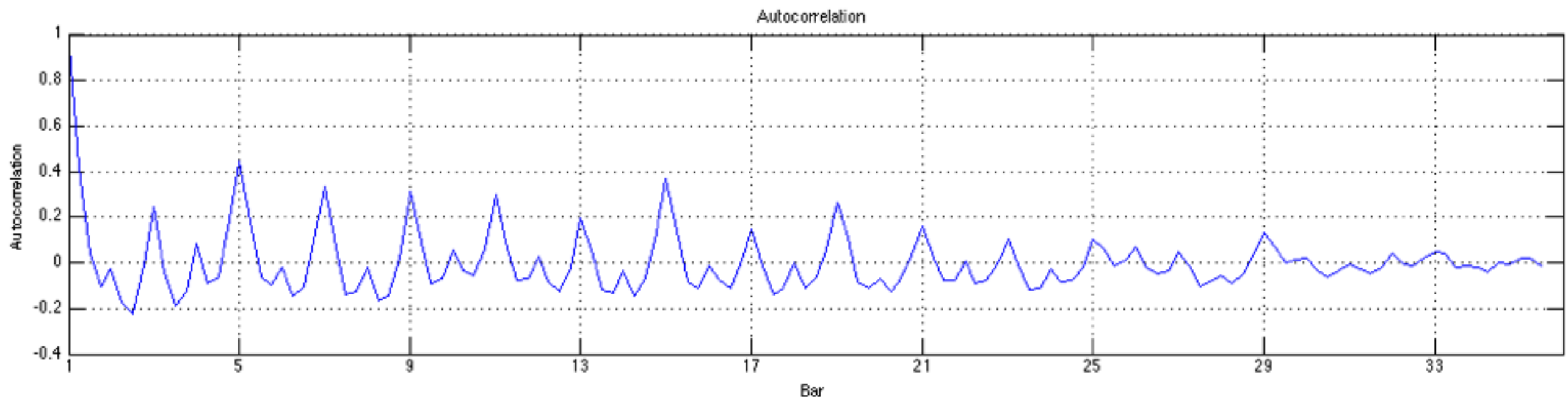
- Represents tonal change in time with respect to comparison set
- Comparison set selection (3-11B)



Representation

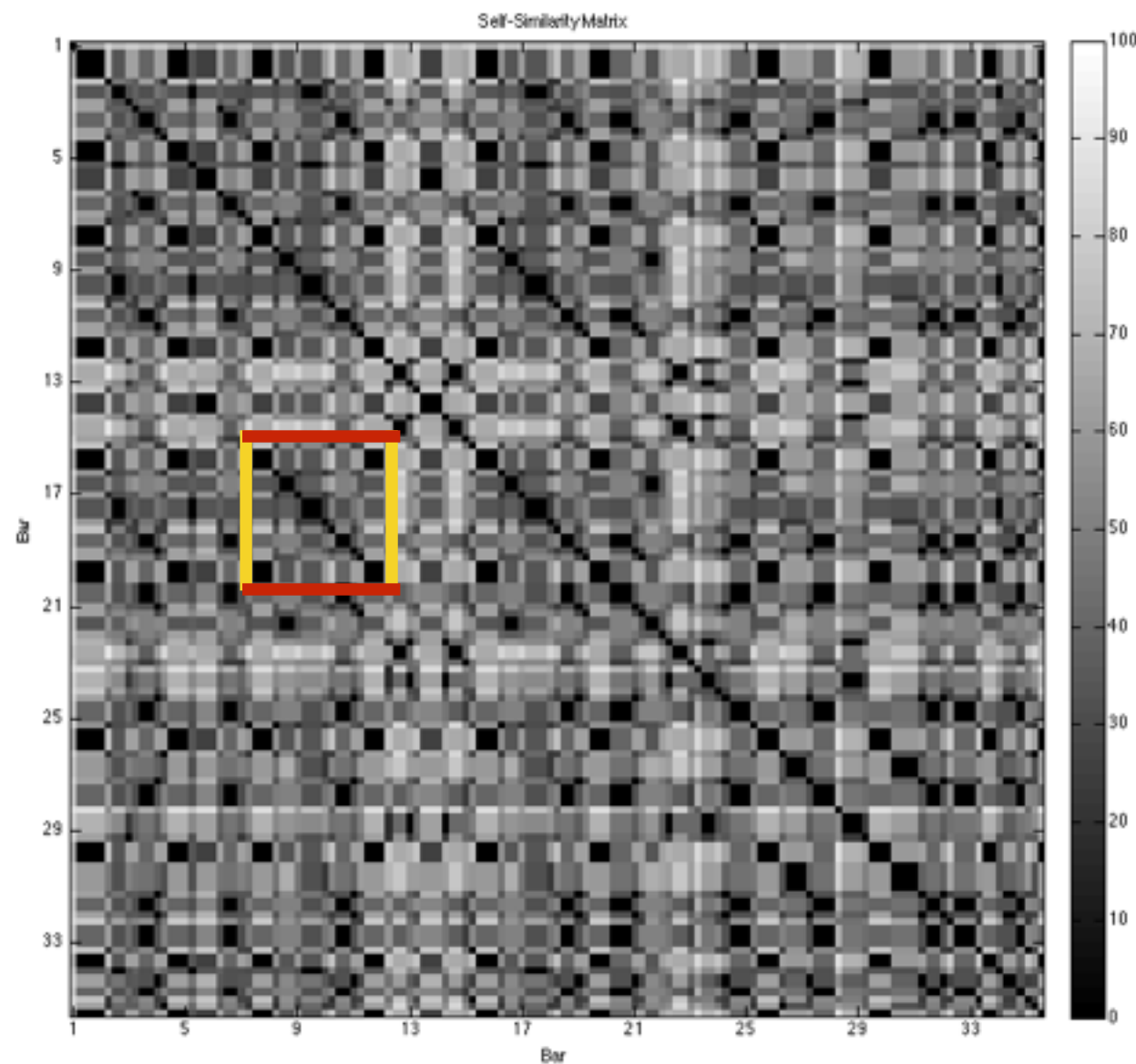
Autocorrelation

- Autocorrelation of distance plot
- Peaks represent recurring patterns



Representation

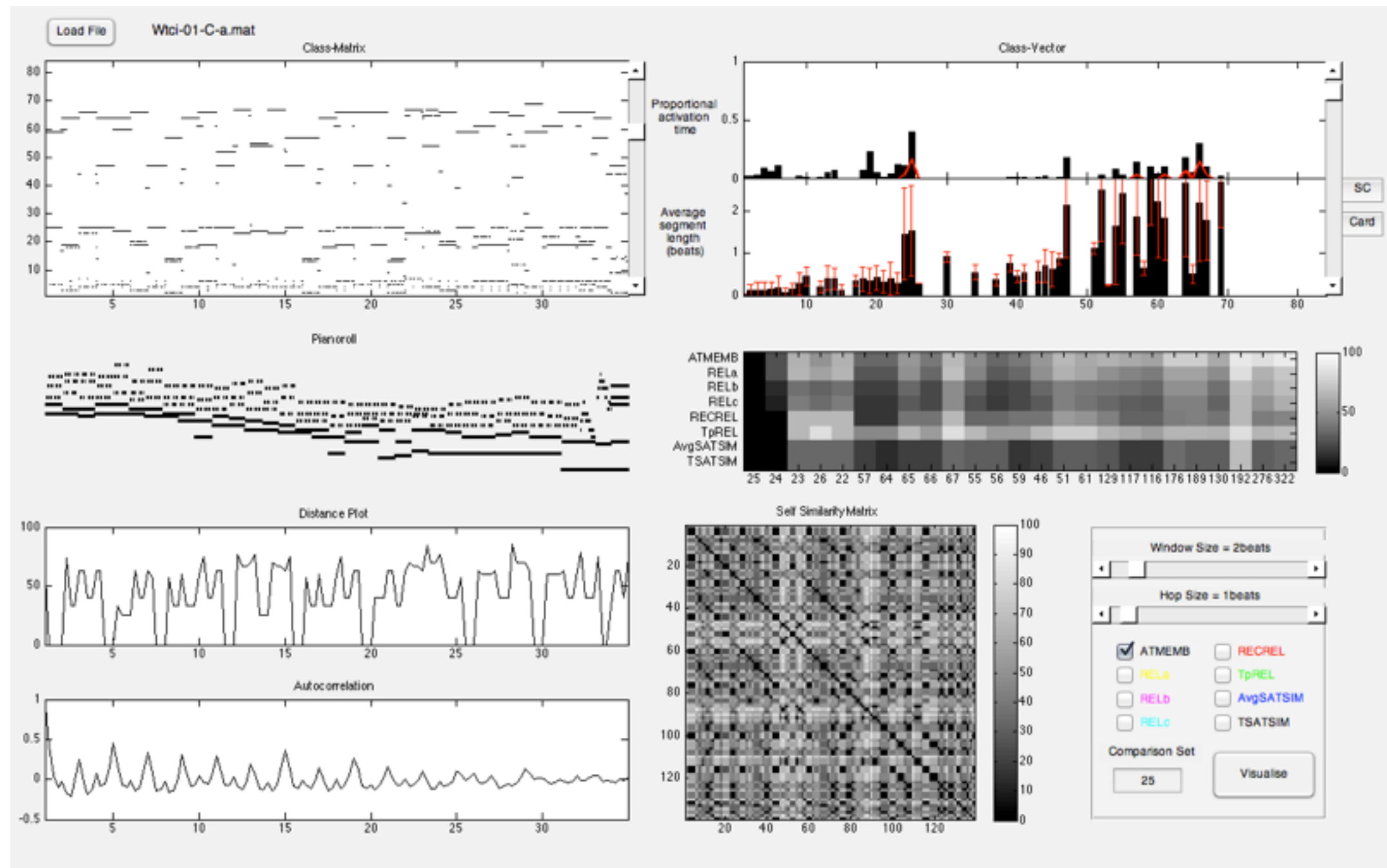
Self-Similarity Matrix



The figure shows four staves of musical notation, likely piano and bass clef parts. The notation includes fingerings (e.g., 1, 2, 3, 4, 5) and dynamics (e.g., *mp*, *mf*). Red horizontal bars highlight specific measures in the first two staves, and yellow horizontal bars highlight specific measures in the last two staves, corresponding to the highlighted regions in the self-similarity matrix.

Representation

Analysis Tool



Conclusions

Conclusions

- Approach - Objectives 1 & 2
- Analysis Outcomes - Objectives 4 & 5

Contribution

- Similarity Measures - Objective 3
- Analysis Tool

Future Work

- “Sets of Interest” vs Comparison Set
- Which similarity measures
- Simpler analysis examples

Questions?