Universitat Pompeu Fabra Barcelona

MTG Music Technology 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

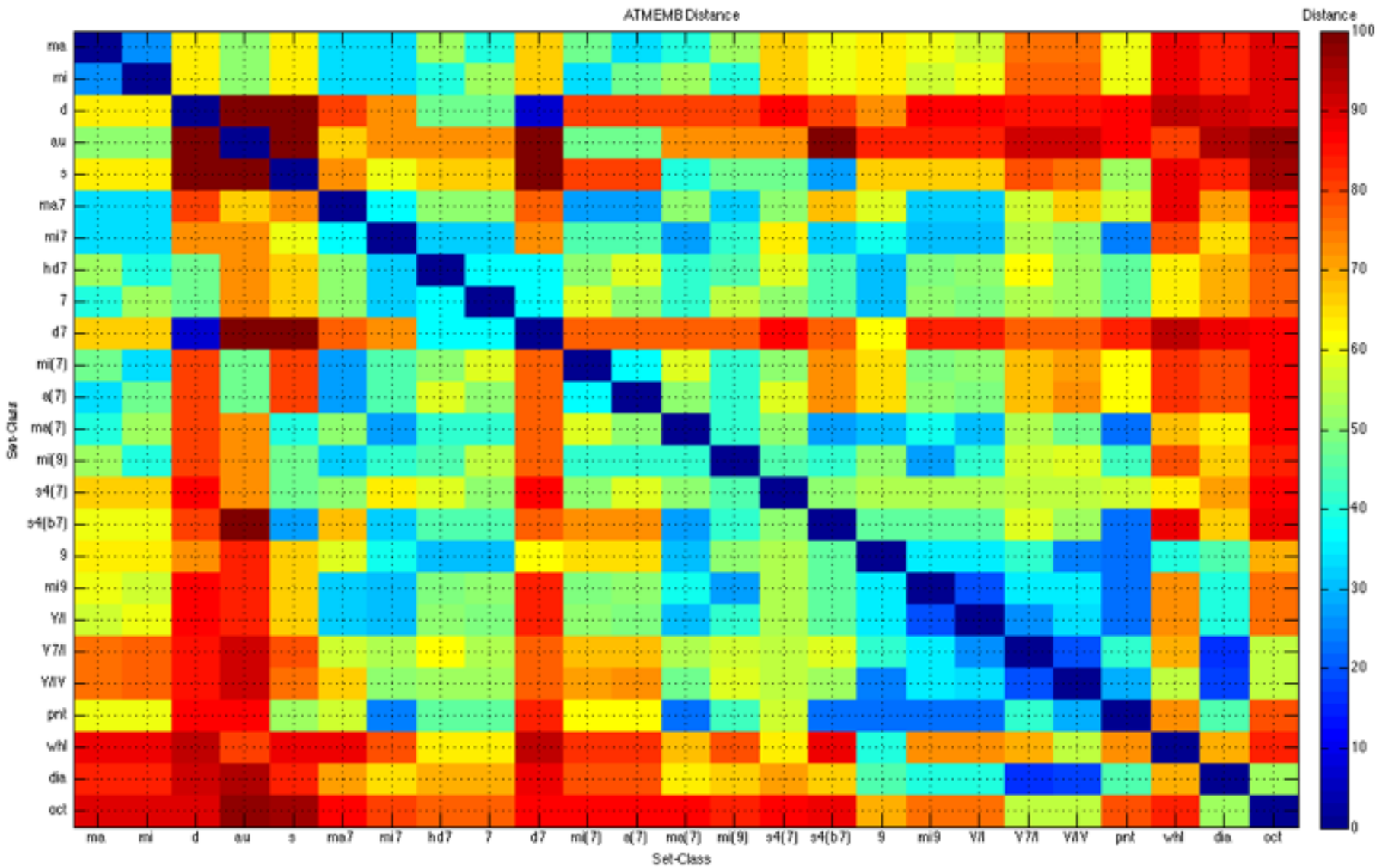
**Set Class Similarity Measures** - Survey

- 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”

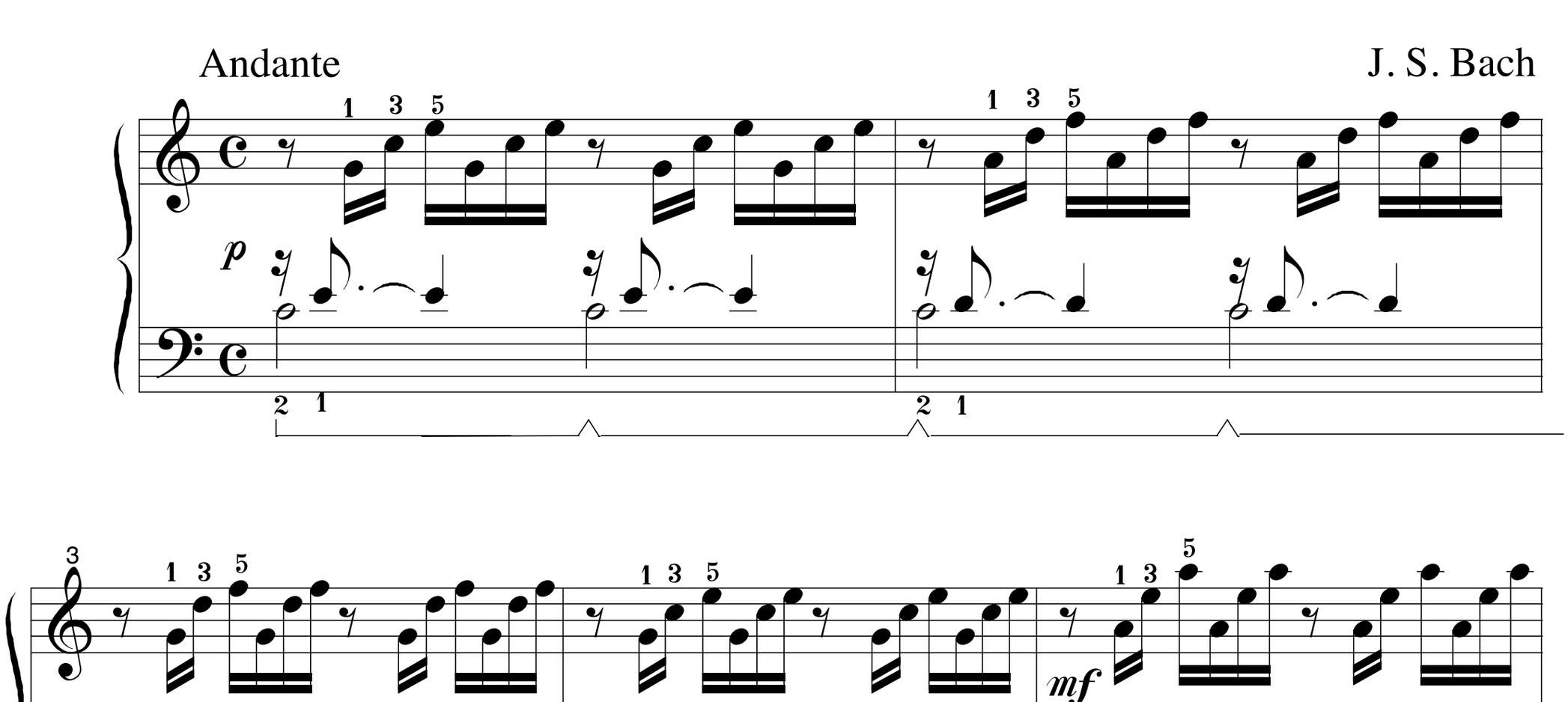
# Methodology

**Segmentation** - Fully Systematic

Example:

**Prelude in C**

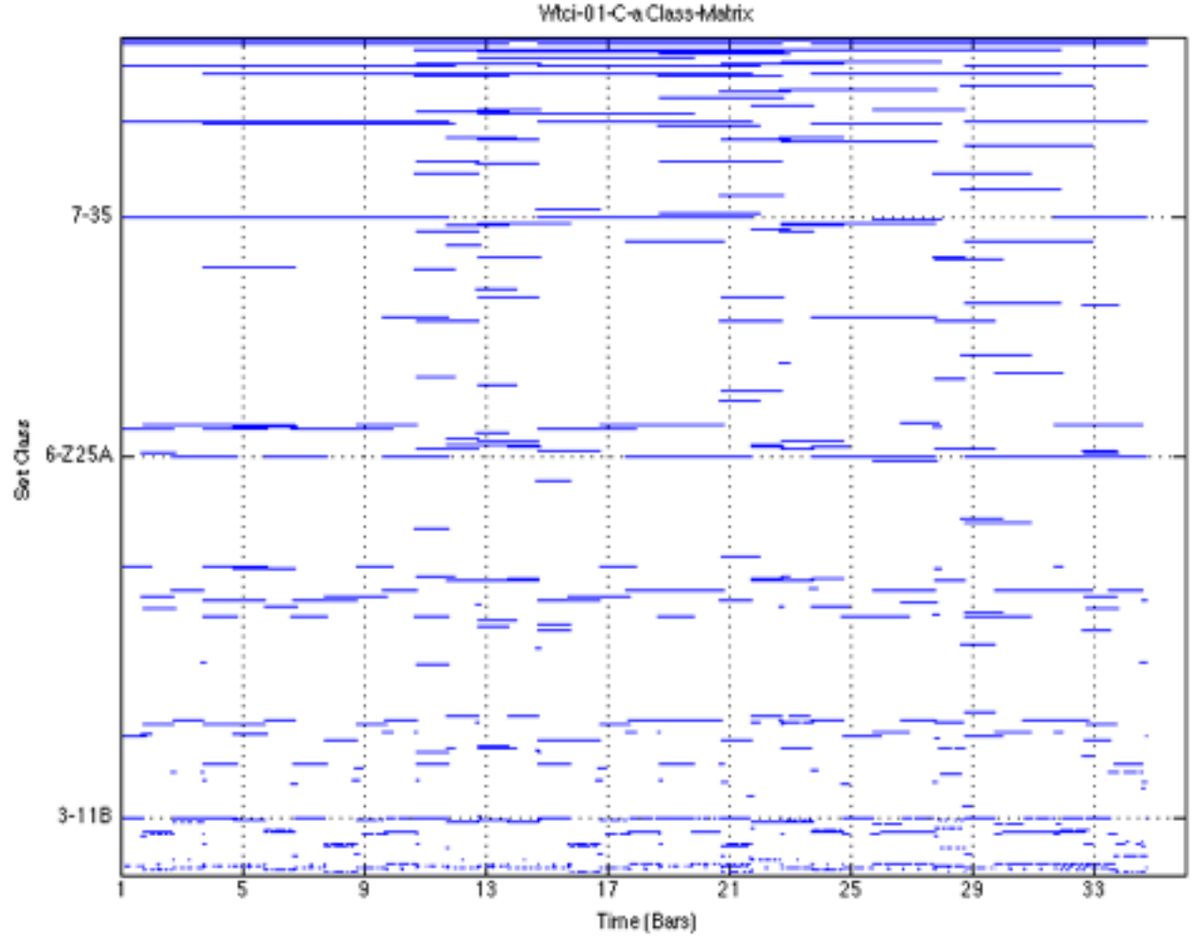
**from *The Well Tempered Clavier*, Book One**



# Methodology

**Segmentation** - Fully Systematic

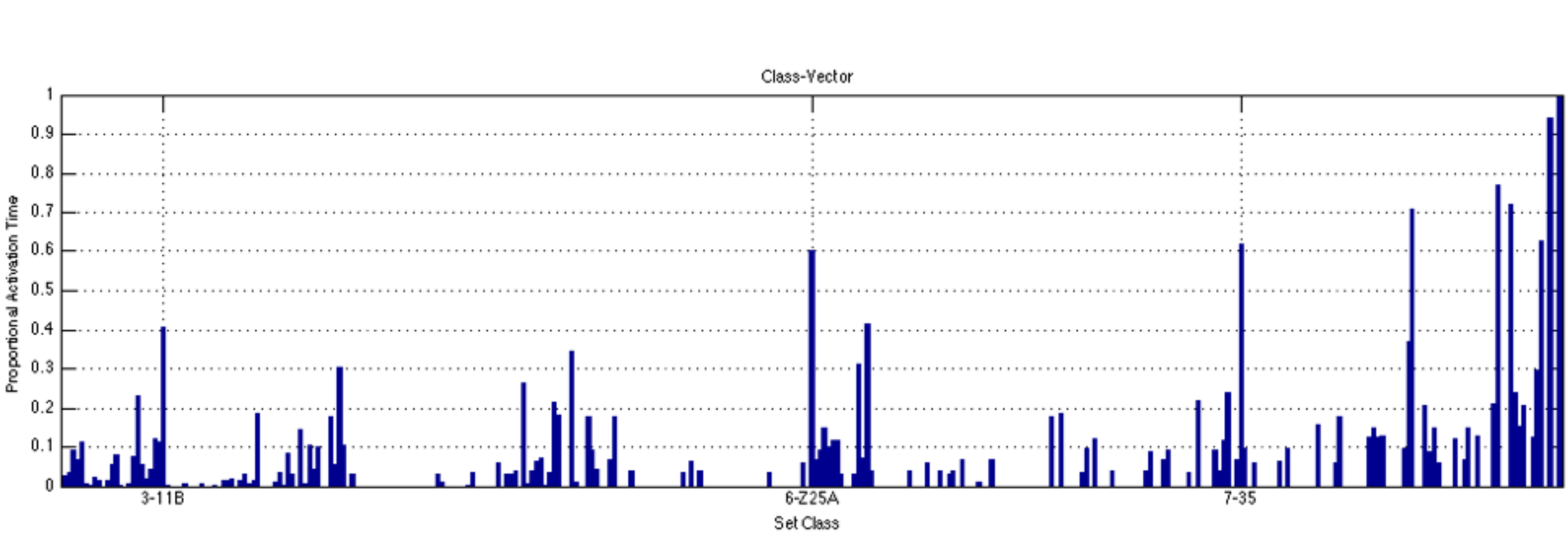
- Class Matrix



# Methodology

**Segmentation** - Fully Systematic

- Class Vector



# Methodology

**Segmentation** - Sliding Window

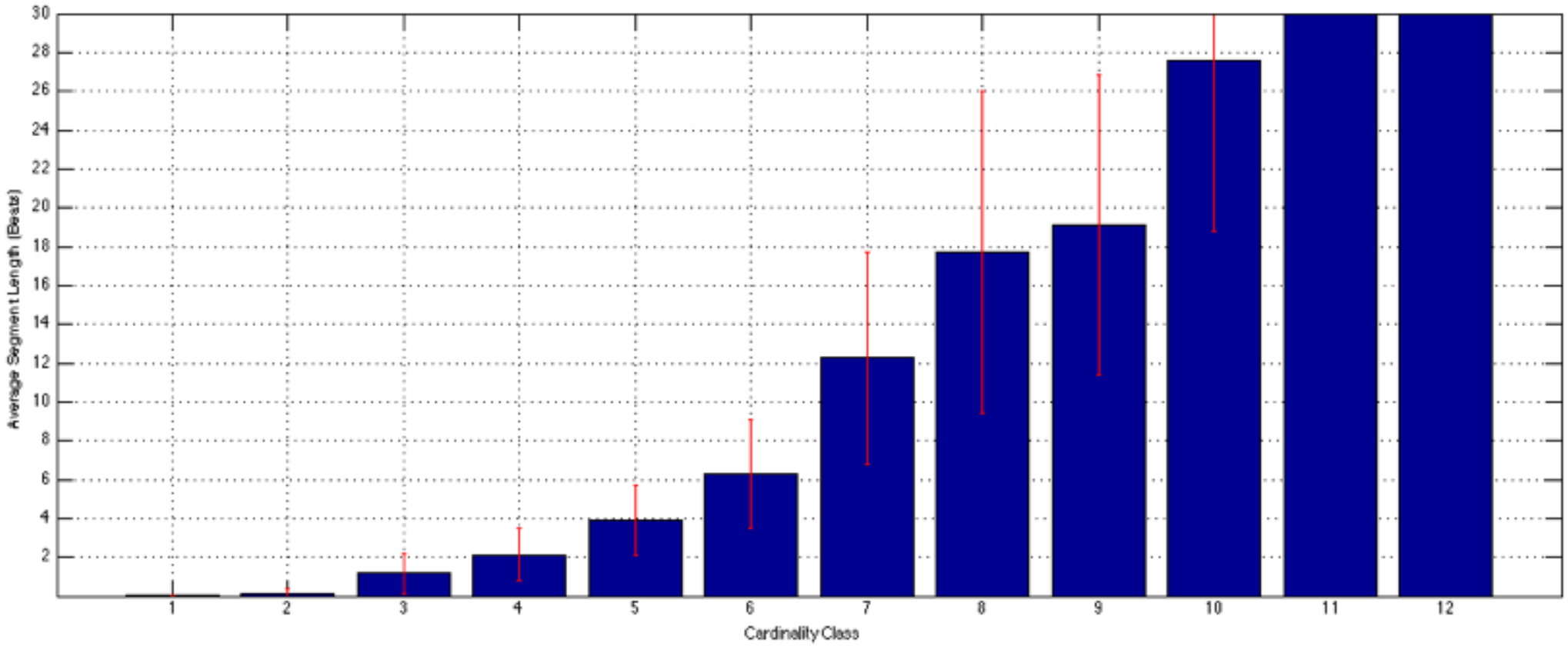
- Window and hop size selection

- What are the “Sets of Interest”?

# Methodology

**Segmentation** - Sliding Window

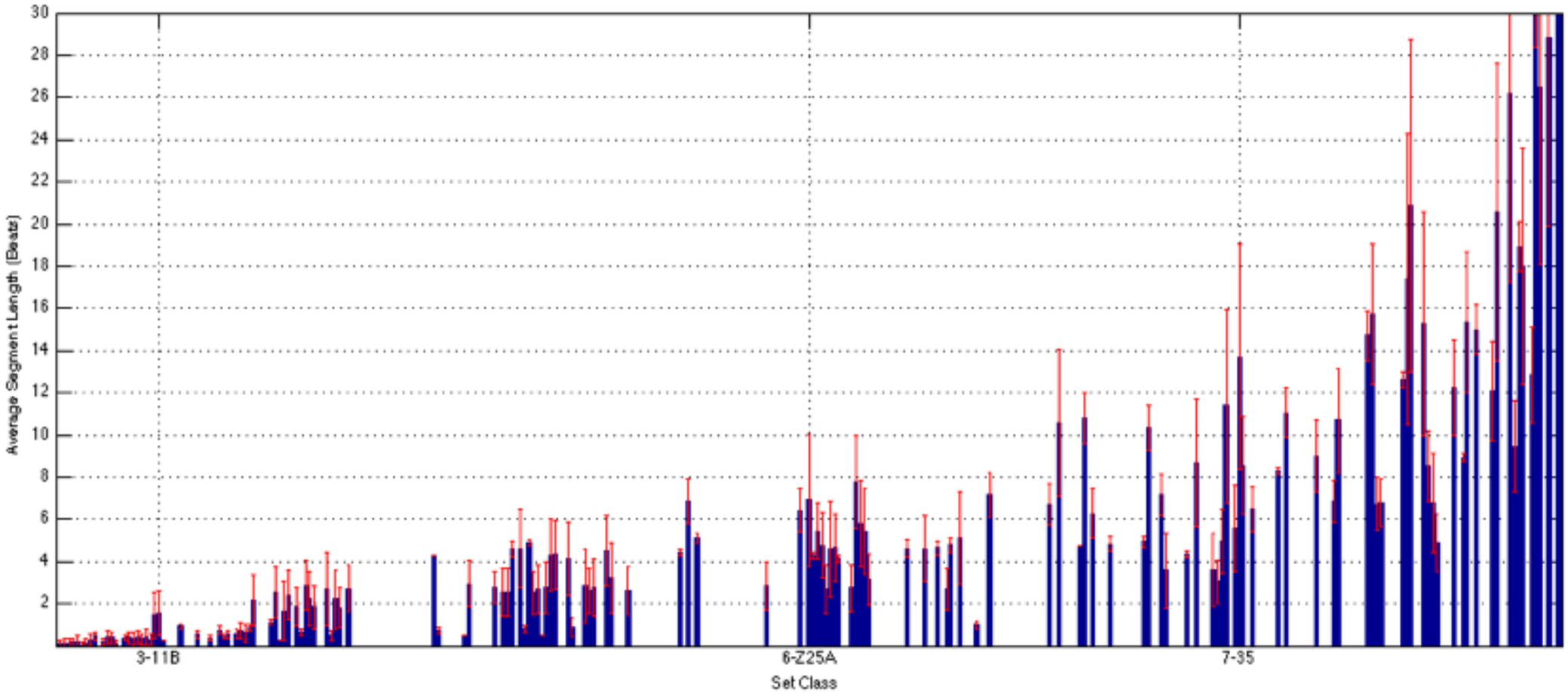
- Average segment length vs cardinality



# Methodology

**Segmentation** - Sliding Window

- Average segment length vs set class

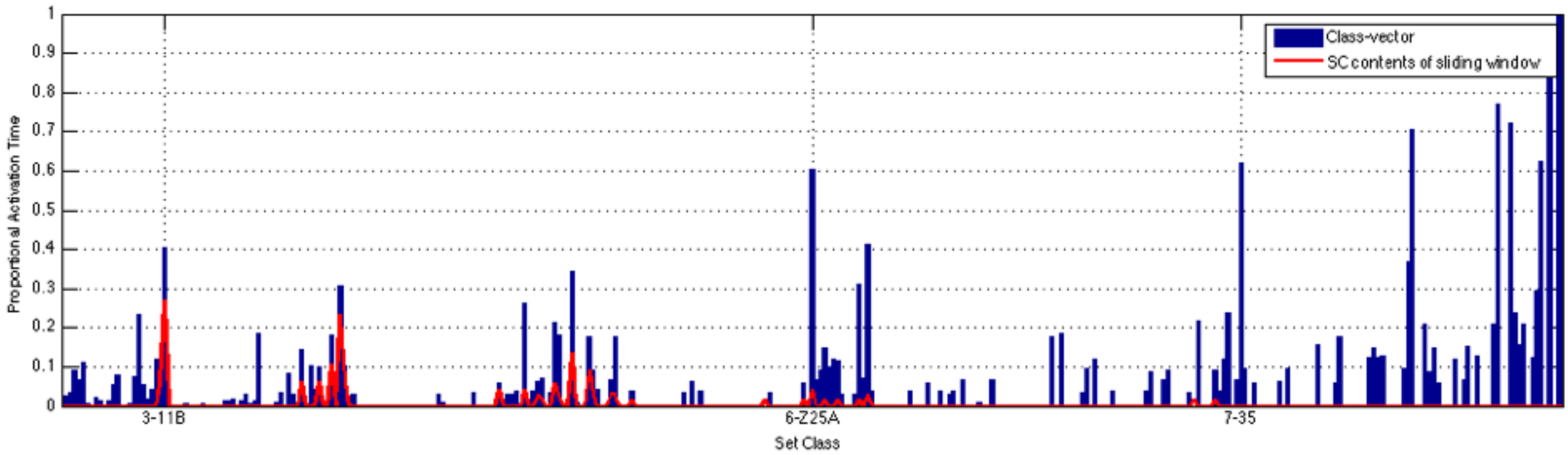


# Methodology

**Segmentation** - Sliding Window

- Class vector + sliding window contents

(Window = 2 beats, hop = 1 beat)



# Representation

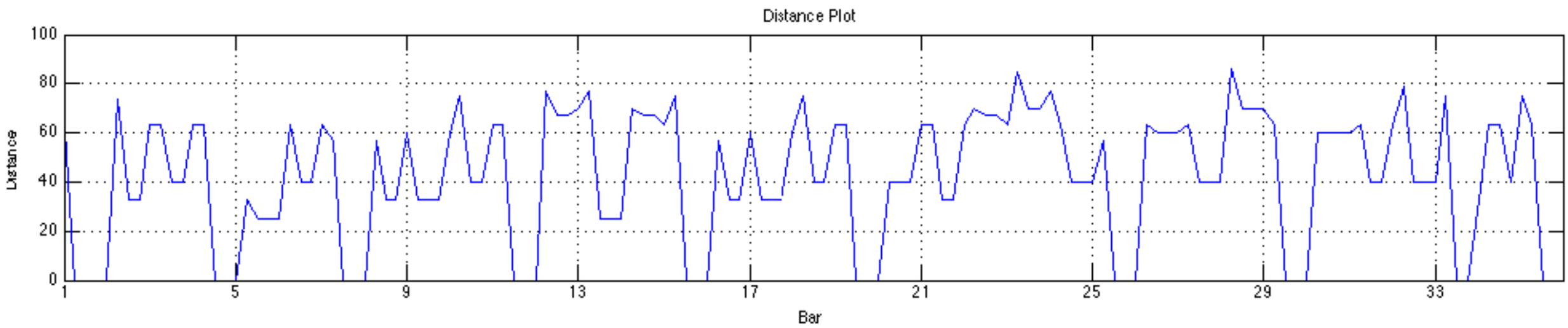
- 3 representation techniques:

1. Distance plot
2. Autocorrelation
3. Self-similarity matrix

# Representation

**Distance Plot**

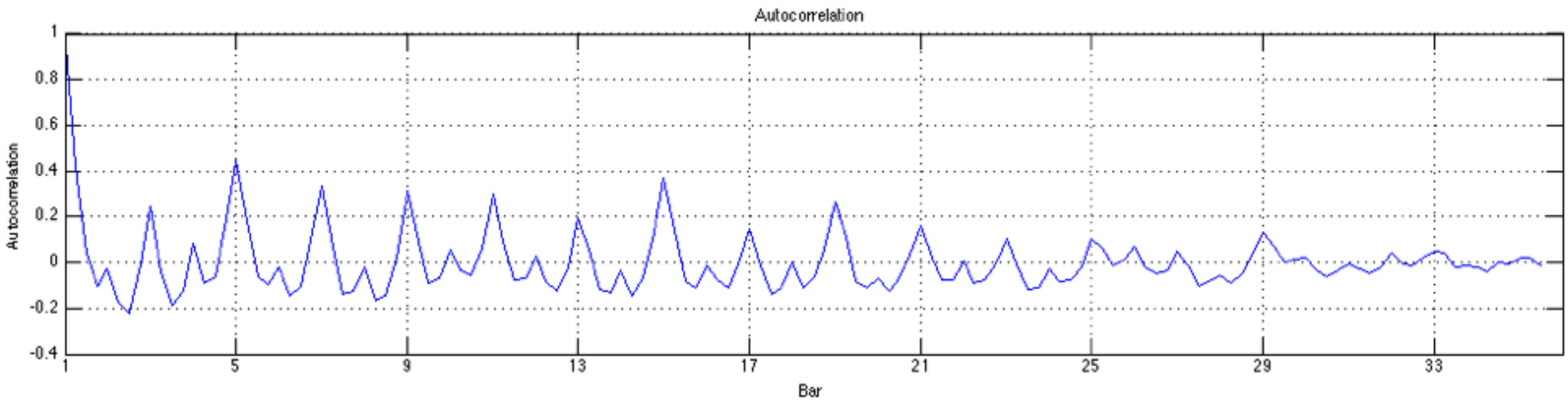
- Represents tonal change in time with respect to comparison set
- Comparison set selection (3-11B)



# Representation

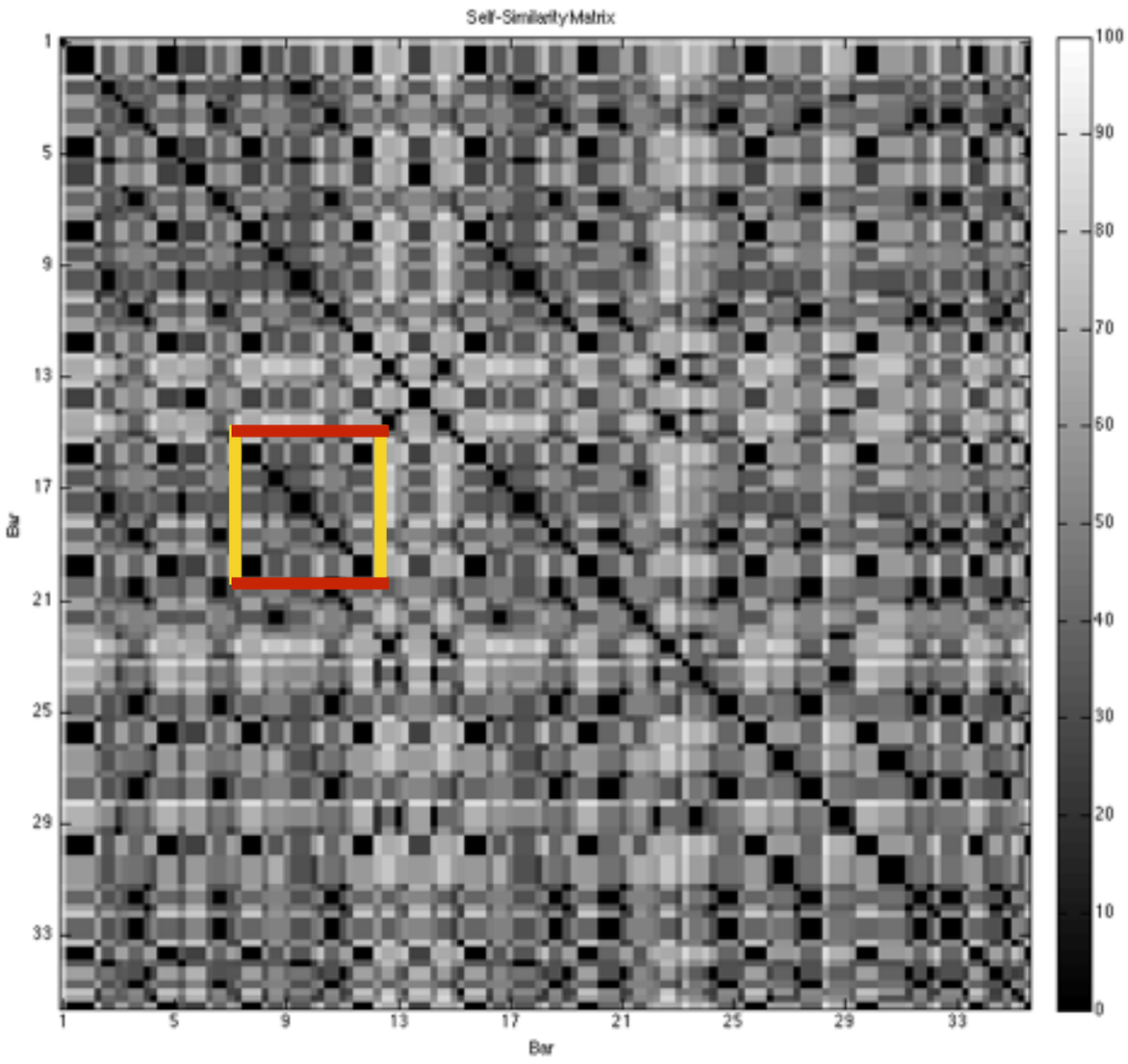
**Autocorrelation**

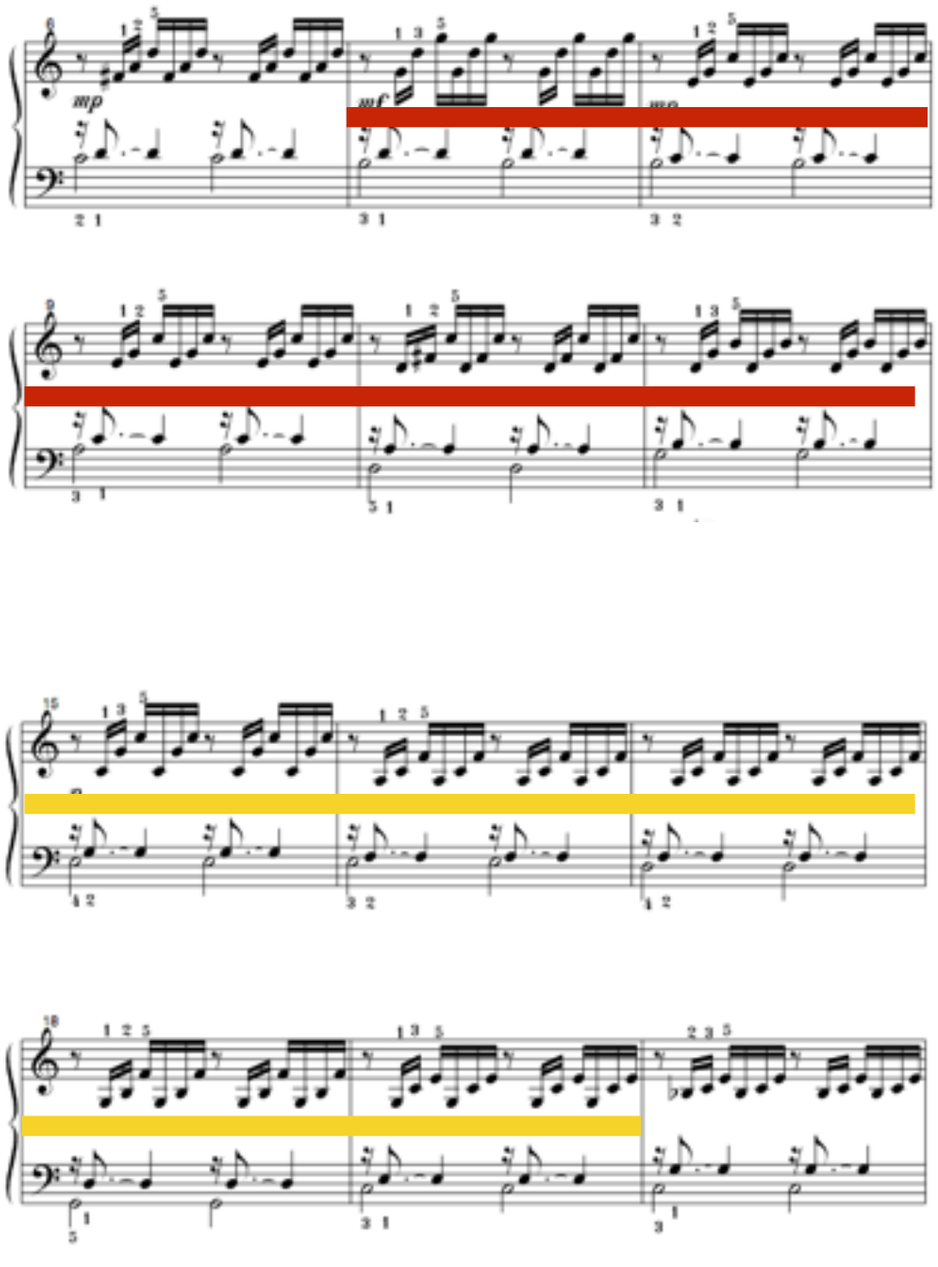
- Autocorrelation of distance plot
- Peaks represent recurring patterns



# Representation

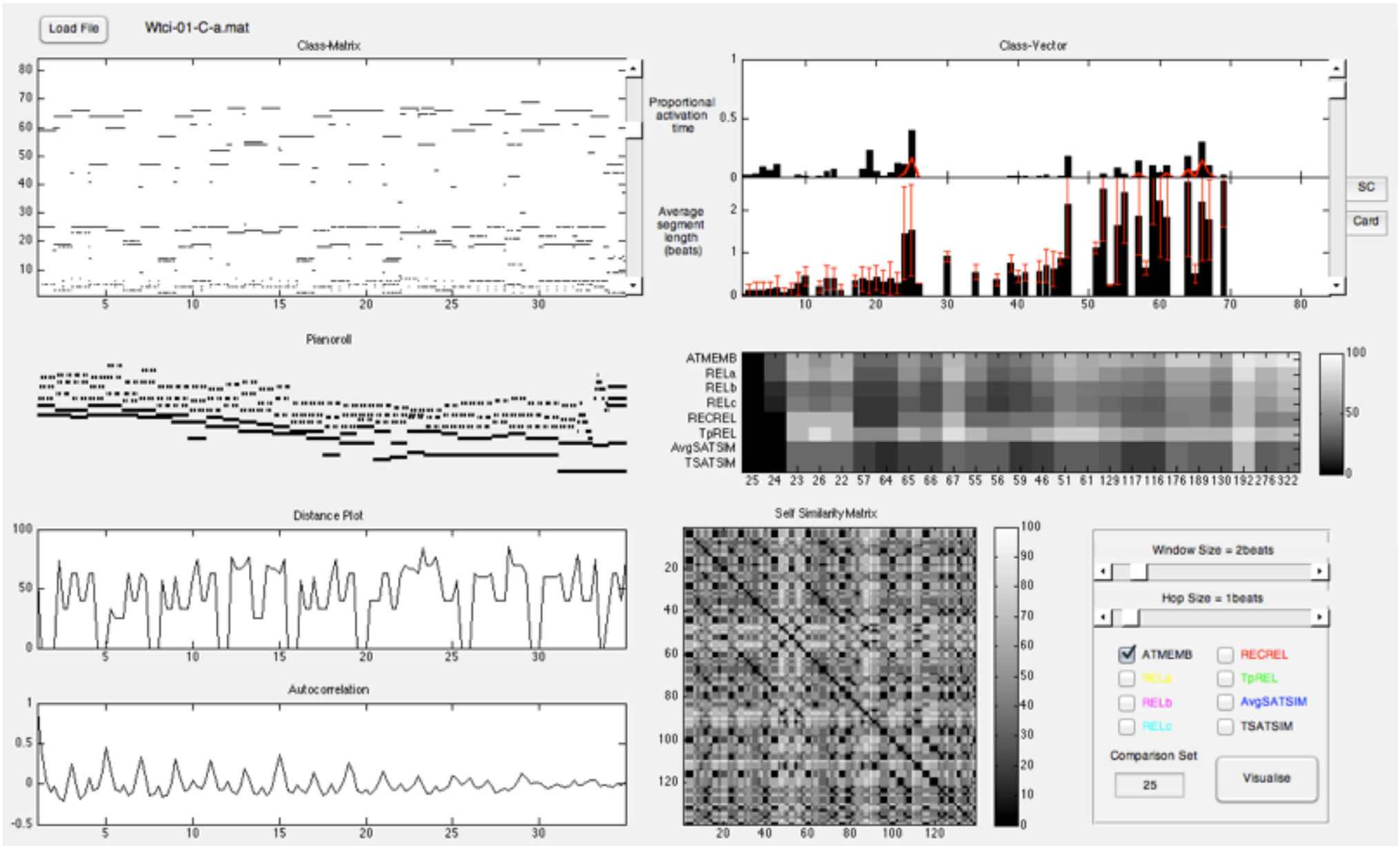
## Self-Similarity Matrix



# 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?