

Activation Space Visualization of Morse Complex Generation

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Overview

- Our Goal:** To accurately segment Morse complexes from scalar field images, providing insights into the activation space to enhance the understanding of complex scientific data.
- Our Framework:** Utilizes encoder decoder Networks optimized with Dice loss and leverages dimensionality reduction techniques for detailed activation space visualization, ensuring robust preservation of data patterns.

Morse Complex

- A Morse complex analysis begins with a scalar field $f: M \rightarrow R$, where each point in a domain M is assigned a real value by f .
- Morse complex is a mathematical tool that dissects the domain M into regions according to the gradient flow of f .

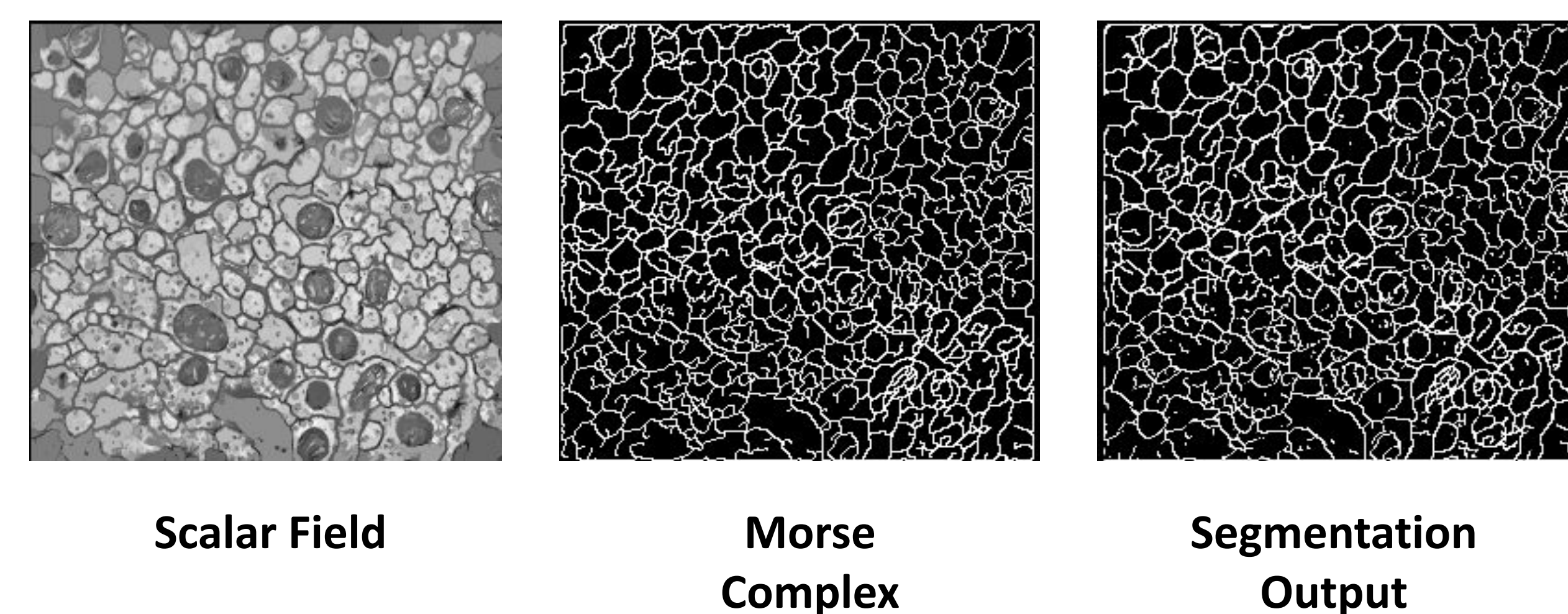
Illustration:

Critical Points (0-cells): maxima (green dots), minima (dark red dots), and saddles (yellow dots).

Arcs (1-cells): black lines connecting the 0-cells.

Regions (2-cells): segmented areas bounded by 1-cells. Within each 2-cell, the gradients move toward a particular local maxima.

Segmentation Results



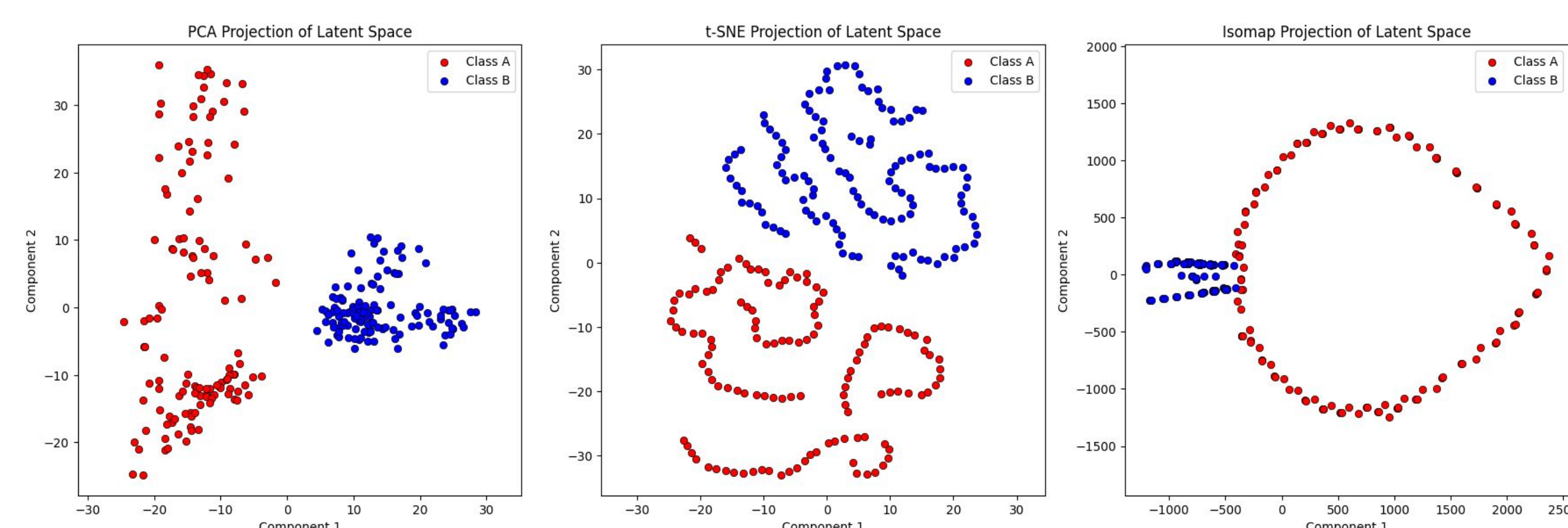
Scalar Field

Morse Complex

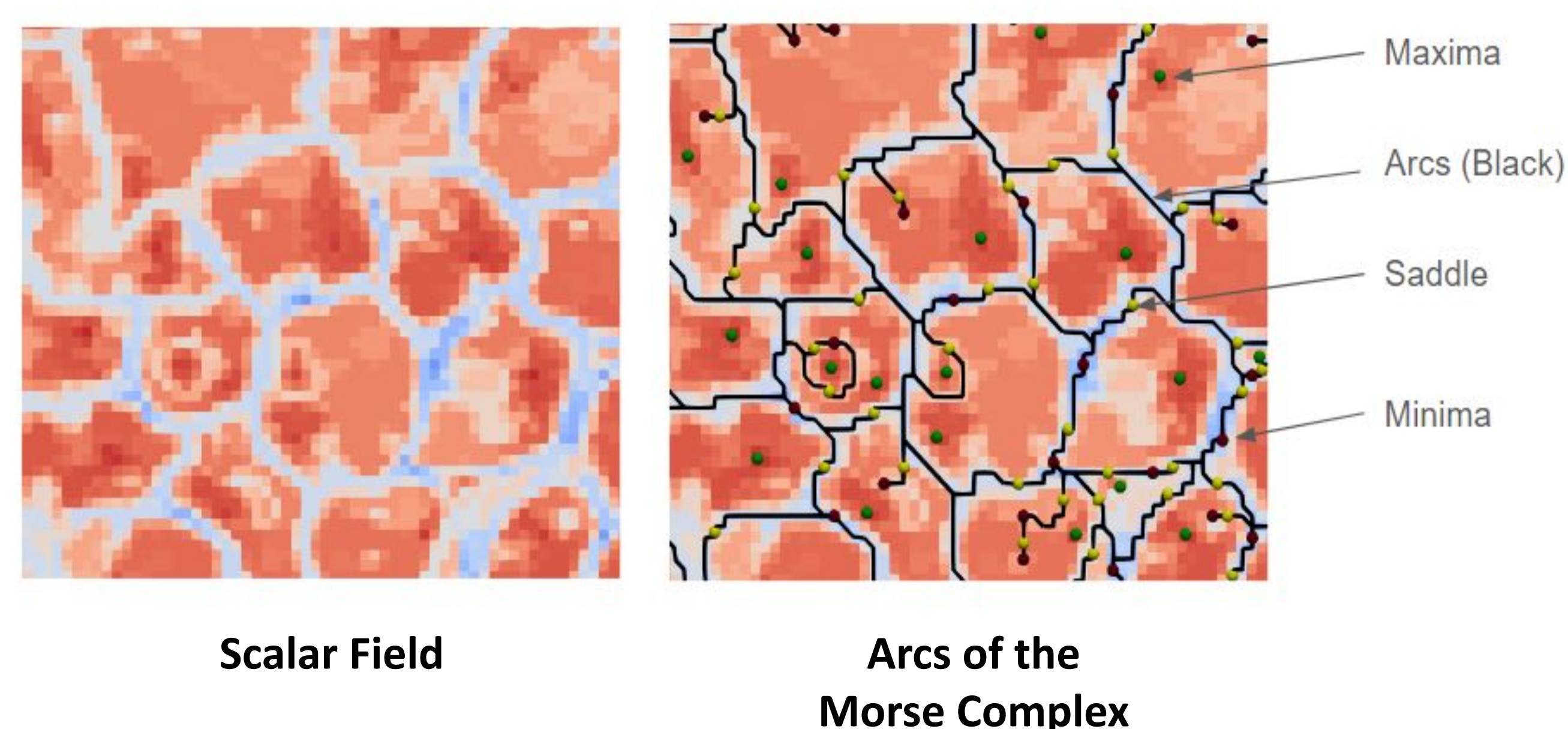
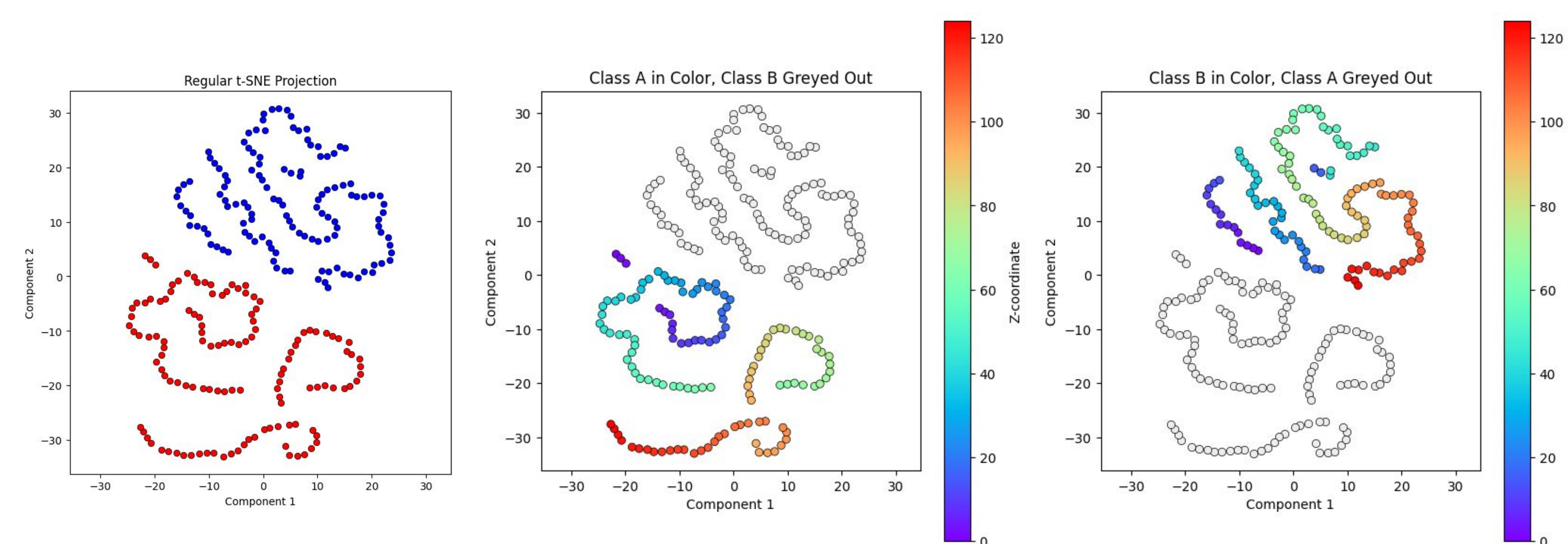
Segmentation Output

Activation Space Visualization

Different Dimension Reduction Techniques



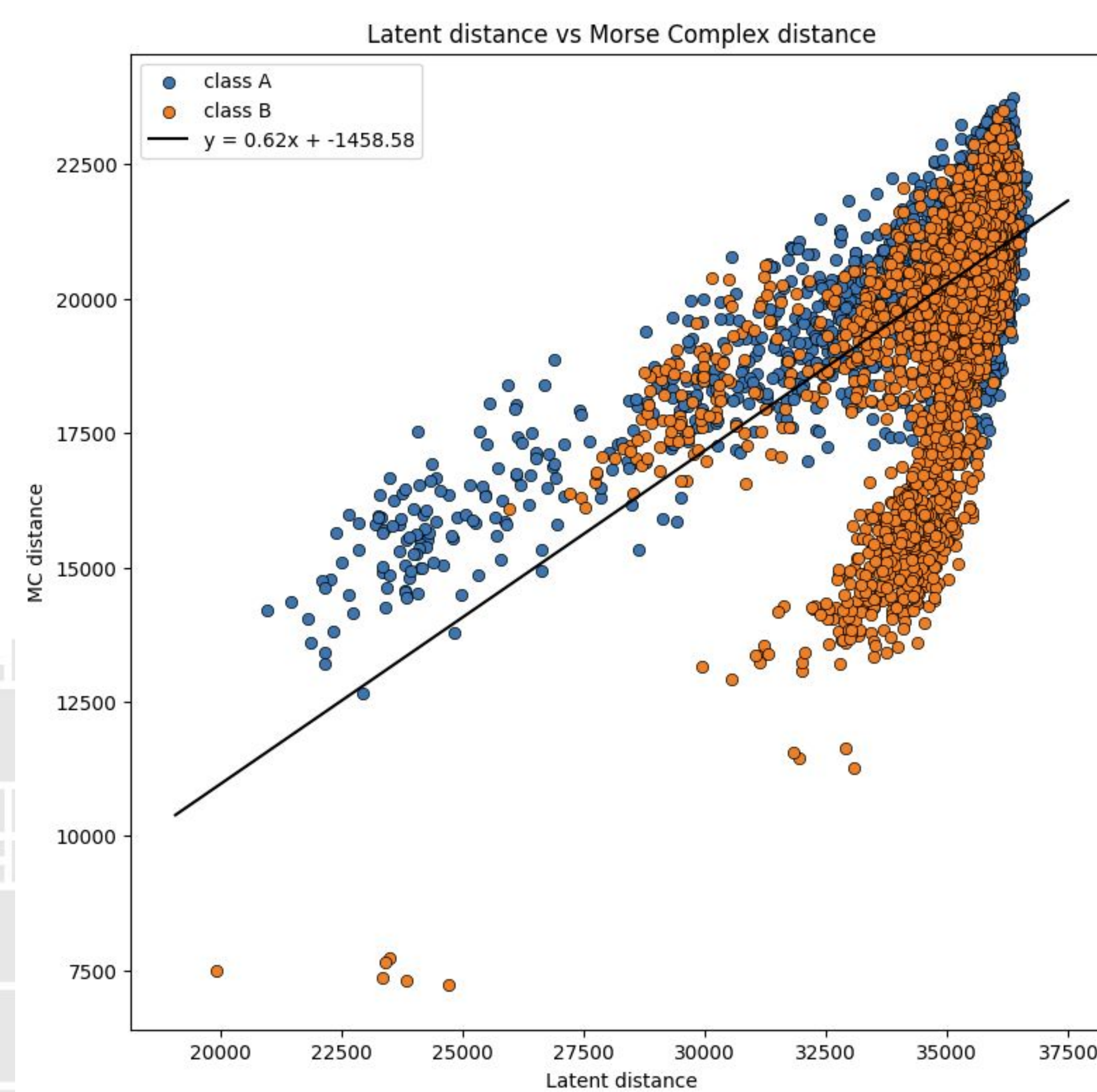
Sequential Patterns



Scalar Field

Arcs of the Morse Complex

Correlation with Morse Complex and Activation Space



Pearson Correlation with Morse Complex and Activation Space is 0.60

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Pipeline

