Foundations of Machine Learning (DA5400)

Assignment 1

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1 Introduction

This report presents the implementation and analysis of...

2 Part 1: PCA and Kernel PCA

2.1 Principal Component Analysis (PCA)

2.1.1 Theoretical Background

The objective of PCA is to...

2.1.2 Implementation and Results (Q1.a)

The explained variance for each principal component is shown in Table 1...

2.2 Kernel PCA

2.2.1 Theoretical Background

The kernel trick allows us to...

2.2.2 Results and Plots (Q1.b)

The following plots show the data projected onto the top two principal components...

2.2.3 Analysis and Best Kernel Selection (Q1.c)

Based on the visual results, the best kernel for this dataset is...

3 Part 2: Clustering

3.1 K-means Clustering

3.1.1 Theoretical Background

K-means aims to minimize the within-cluster sum of squares (WCSS)...

3.1.2 Random Initializations (Q2.a)

Figure X shows the error function versus iterations for 5 different runs...

3.1.3 Voronoi Regions (Q2.b)

The Voronoi diagrams for K = {2, 3, 4, 5} are presented below...

3.2 Spectral Clustering

3.2.1 Theoretical Background

Spectral clustering treats the data as a graph...

3.2.2 Kernel Selection and Results (Q2.c)

An RBF kernel was chosen because...

3.2.3 Alternative Eigenvector Mapping (Q2.d)

Using the argmax assignment rule resulted in...

4 Conclusion

In summary, this project demonstrated...