Pattern Recognition Methods

and

Introduction to Machine Learning

Homework 1 - Report

The Curse of Dimensionality

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Part A:

In this part, 1 million points is randomly generated to fill the hypercube and the maximum dimension is 10. The same experiment is repeated for 30 dimension. When number of dimension increases, the points which is inside of hypersphere decreases. Eventually, it converges to zero.

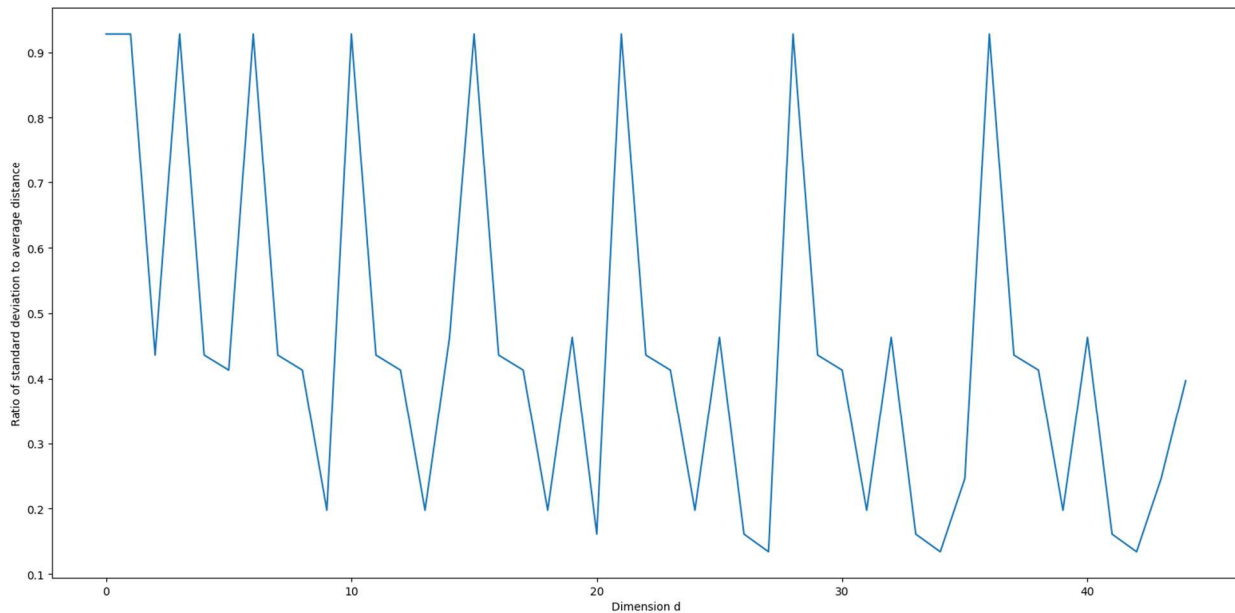This is the graph of the result for 10 dimensions.
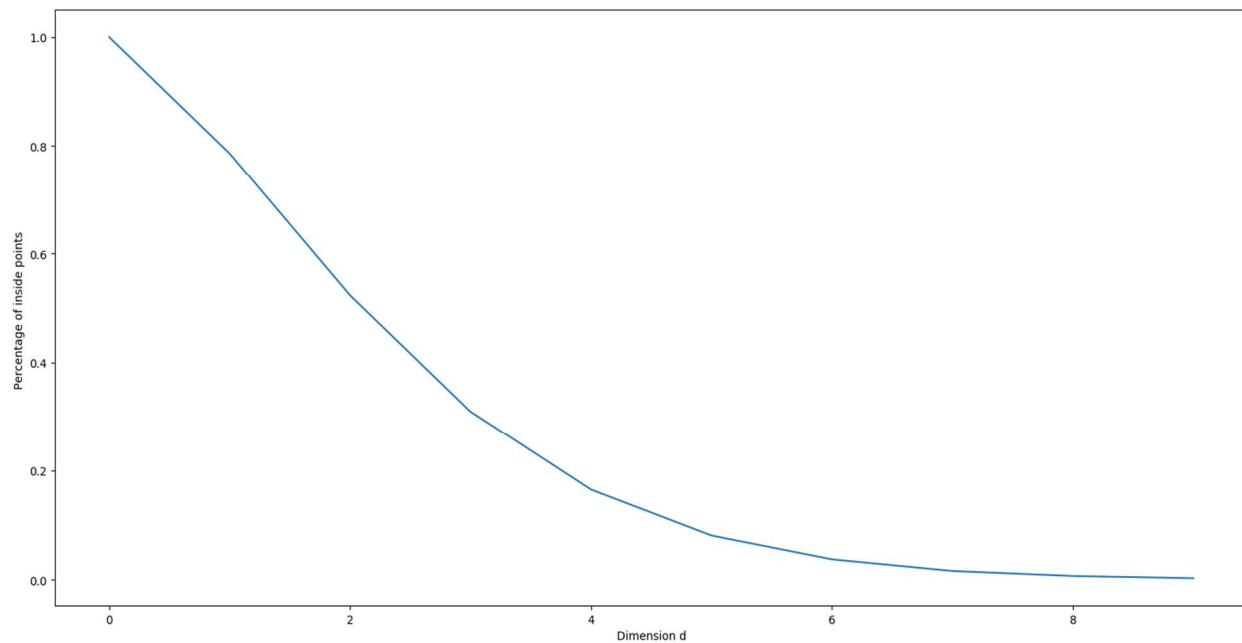
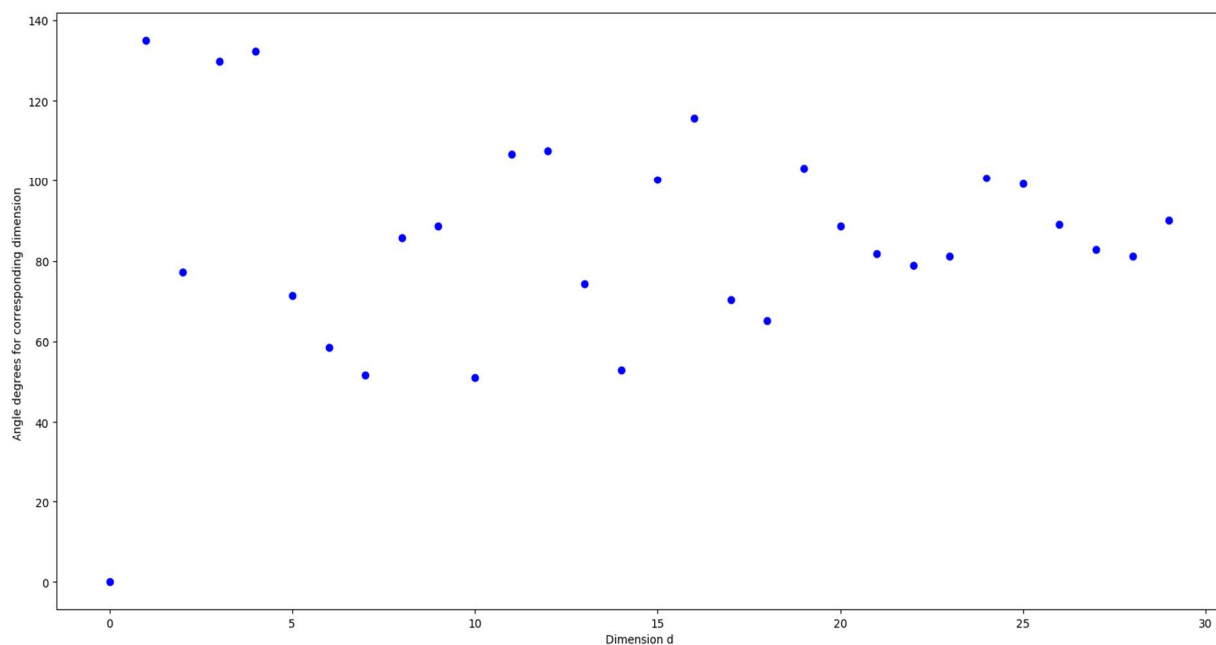This is the graph of the result for 30 dimensions.
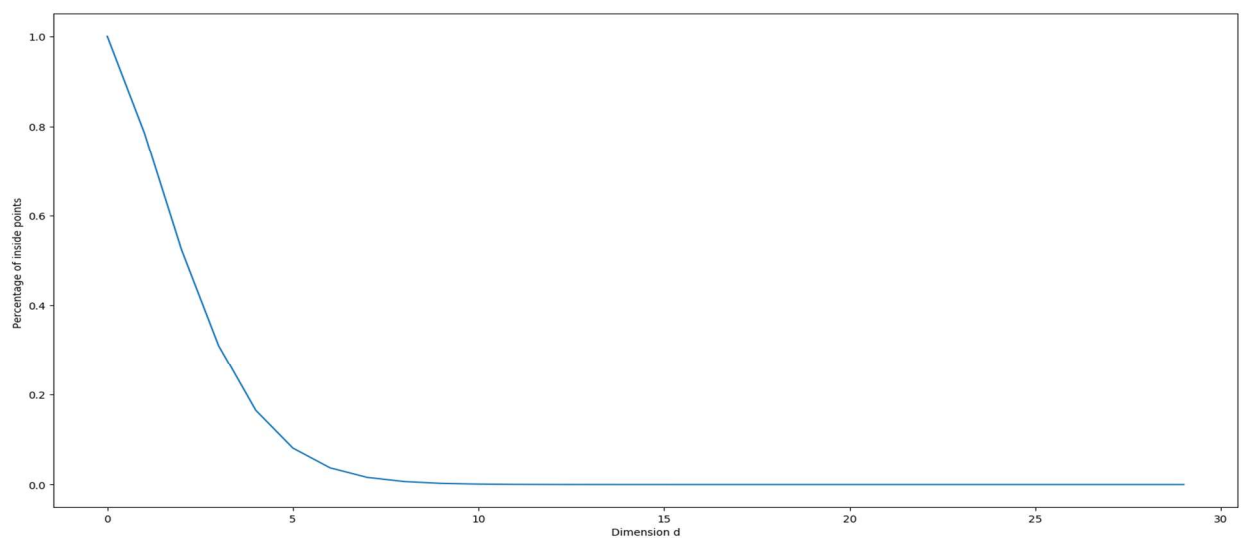
Part B:

In this part, I tried to find the ratio of the standard deviation of the distance between random points to the average distance between these points.

Part C:

In this part, again, 1 million points is randomly generated to fill the hypercube. 4 random points are chosen randomly. 2 vectors are created with these points. The angle between these 2 vectors are found for different dimensions. When this experiment is repeated and done for higher and higher dimensions, the result of angle converges to 90 degrees. Thus; this situation gives a clear result for existence of the curse of dimensionality.

This is the graph of the result for 30 dimensions.

This is the graph of the result for 100 dimensions.