

Assignment 3 Report - KNN and Decision Trees

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1 Introduction

2 Model Selection for KNN

2.1 Implementing the K-Nearest Neighbors Algorithm

The K-Nearest Neighbors Algorithm is implemented in Python in the file knn.py

In implementing the KNN algorithm, we first read in the data from the provided csv. The data is in the form of an Nx31 dimensional matrix. The dataset constitutes 30 features with the first value being the true class label. For example:

1, 19.59, 25, 127.7, 1191, 0.1032, 0.09871, 0.1655, 0.09063, ..., 0.2293, 0.06091

In this case, the true class value is 1, meaning that it is malignant. If it were benign, the true class value would be -1.

The implementation reads in each line of the csv, removes the first value as the true class value then uses the following 30 features to determine the distance between data points. Before the distance between two points can be calculated, the scale for each feature must be determined and the feature scaled to be all in the same range (for example $[0, 1]$).

We can use the Euclidian or straight line distance to determine the distance between two points x and x_i with m features.

$$x = \begin{bmatrix} x_1 \\ \vdots \\ x_m \end{bmatrix}, x_i = \begin{bmatrix} x_{i1} \\ \vdots \\ x_{im} \end{bmatrix}$$
$$D(x, x_i) = ||x - x_i||$$
$$D(x, x_i) = \sqrt{(x - x_i)^T (x - x_i)}$$
$$D(x, x_i) = \sqrt{\sum_{j=1, \dots, m} (x_j - x_{ij})^2}$$

For each line in the csv, its k nearest neighbors will be used to determine its value.

2.2 Evaluation of Error with Respect to K

2.2.1 Computed Training Error

2.2.2 Computed Leave-One-Out Cross-Validation Error

2.2.3 Number of Errors on Provided Test Data

2.2.4 Plot of Errors as a Function of K