CS 760: Machine Learning Spring 2024

Homework 5: Nearest Neighbors & Naive Bayes

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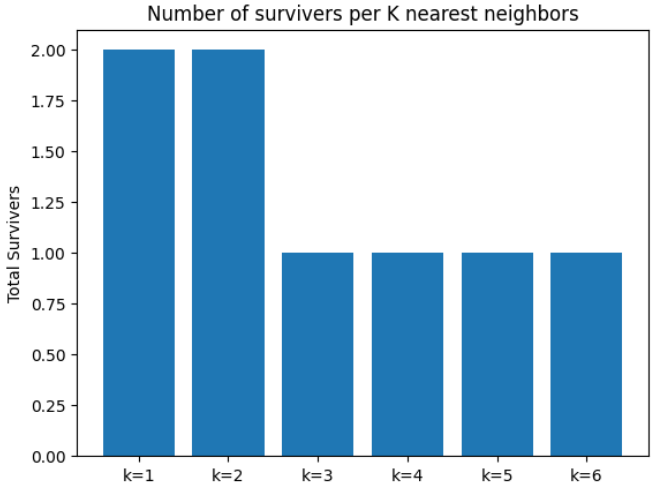
Problem 5.1

(a) See code in *KNN.ipynb* under Problem 5.1. I chose to implement K-Nearest Neighbors where $K = 5$. I went this route since it's as simple as normal Nearest Neighbors to implement, but more robust.

(b) I used *np.linalg.norm* to implement the euclidean distance. I chose the L2 norm because I find it to be more straightforward and intuitive, plus I'm much more used to using it from my previous Linear Algebra classes.

(c) See code in *KNN.ipynb* under Problem 5.1. I tested out multiple features and summed up the counts of survival, based on how many K nearest neighbors I use. Unfortunately, I did not survive based on my demographics. Notably, as I increased K, the number of survivers went down.



(d) While $k = 1$ and $k = 2$ have the most survivors among my samples, I believe that's because there isn't enough wiggle room for correct classification. I believe $k = 6$ is most representative given my 6 different features.

(e) The most apparent solution is to run multiple rounds of cross validation along different values for K to assess the accuracy.

Problem 5.2

(a) See code in *KNN.ipynb* under Problem 5.2.

(b) For simplicity, I modeled all my variables Bernoulli.

(c) Yet again, I do not survive the titanic. But just to quadruple check, I used my $test\_features$ array to try out multiple demographics. Among them, the only sample that survived was a female minor with parents, siblings, and paid a decent fare of 30 dollars.

(d) I calculated the accuracy using $train\_test\_split$ from sklearn which gave me around 80% accuracy. However, another method could be to perform cross validation using different distributions for the different variables.

Problem 5.3

While KNN was by far the easiest to implement among all the other algorithms, I still prefer linear regression. But that's likely due to my familiarity with having used it so often. It also seems to depend on what my data is.

Problem 5.4

See code in *KNN.ipynb* under Problem 5.4. I recreated the data in my code and ran it through my Naive Bayes prediction algorithm, along with a few other features just for kicks and giggles. Based on that, I would classify the new email as ham, NOT spam.

Problem 5.5

See code in *KNN.ipynb* under Problem 5.5. To shake things up, this time I used K-Nearest Neighbors for classification and used three feature vectors, to include the one in the notes. In all three cases, I predict the killer to be male.