## **Computing Assignment 5**

## **Least - Squares Solve and 3 – Factor Wine Quality Predictor**

**Least Squares**

For Matlab’s *fzero,* each iteration requires an interval [am,k, bm,k] in which to search for the root. Similarly, Newton’s method requires an initial guess Xm,k, which is close to the desired root. Using known properties of the Bessel Functions, the initial parameters can be chosen intelligently. The first zero of J0(x) is known to be around 2.5. The initial interval ­­­for *fzero* must bracket this route; therefore, a­0,0 should be slightly smaller than 2.5 and b0,0 should be slightly larger than 2.5. For Netwon’s method the initial guess should be close to the root. Therefore, let

**3 – Factor Wine Quality Predictor**

The goal of this model is to predict the quality of wine based on three given factors. The data used for this modal has ten factors, with each being some numerical attribute for wine. Our model will use three of these factors, specifically the three which yield the smallest relative RMS residual.

Finding these optimal factors is a search problem. search was used to evaluate the RMS for every combination of three factors.

The smallest RMS found from grid search used the following factors:

j = {2, 4, 8},

which corresponds to the numerical attribute’s volatile acidity, residual sugar, and density.

To train our modal, we have the following equating:

,

A has all ones in the first column and the three factor vectors from data red.csv in the next three columns. is the known qualities for each wine in white.csv. Using MATLAB’S backslash to solve for yields the least-squares coefficients. Using this trained vector, for any matrix [A] of wine data, the corresponding quality rating can be predicted. As a test, the model was used to predict the ratings for the wines in the training data. The highest rating predicted by our modal was 7.1, when in actuality it is 8. From this it can be concluded that our model underpredicts the wines quality ratings.

|  |  |  |
| --- | --- | --- |
| Rank | Predicted Quality | Bottle Number |
| 1 | 6.77 | 14 |
| 2 | 6.74 | 25 |
| 3 | 6.69 | 40 |
| 4 | 6.55 | 35 |
| 5 | 6.53 | 42 |

The untrained data whitelist2.csv was used to produce the matrix [A untrained]. This matrix was applied to our model resulting in the following wine predictions seen in table 1.