Jose Benitez-Santos

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Lab 2

Lab Report

**Lessons Learned**

Among the many things I learned from this lab I would like to start off by talking about the implementations that I was able to do during this process. It was a great reminder to use the LMS algorithm to update weights. One thing that I can say I certainly learned was that your ‘y’ values are directly correlated with an update by the dot product of the weights and the radial functions values. I say this, even though this concept is basic because if I would have just used this knowledge: I would have struggled a lot less with this lab. For some reason when I looked back at the slides and the lectures I tried to fit in a polynomial equation. Which does not make any sense whatsoever since we are trying to predict our values with Gaussian functions that are created by our centroids. It was until today in office hours that I realized how dumb my mistake was and that I could have avoided all of this if I would have just thought about it conceptually. Aside from that I was just very happy to do a lab that directly had to do with what we have been learning in class. More than anything, I feel like now I fully understand the process. Another mistake that I made was trying to use 2-dimensional data for this problem. That in itself makes no sense since we are trying to predict the y-value that is directly correlated with our x-values. The final thing that I would like to point out is that I was very happy with implementing the k-means algorithm. I could really use a refresher on it to simply re-learn concepts that I had learn from previous classes.

**Detailed Observations**

To start off I will begin by commenting on the increment of clusters specifically for when we computed independent variances. As the number of clusters increased, the predicted graphs got worse and worse. This was a clear example of overfitting, but also a great learning point as to why you might want to do something like this in order to visually see which cluster is better. The same results were on display for both learning rates .01 and .02. Next, the graphs for learning rate .02 with independent variances did a lot better than learning rate .01. Up until cluster number 6 the predicted graphs seemed to better fit the data and have less overfitting. And finally, the advantages of using the same variance for all Gaussian clusters. When using the same variance, the higher one got in cluster number, the better the predicted graphs fit the actual data. The results were the same for both learning rates. The only small difference was that for learning rate .02, the cluster graph with 12 centroids did better than the 16 one. This can be directly correlated to the fact that the max distance between clusters couldn’t be that big since they get closer together with the increase in cluster number.