CSE 5526

Lab 2 Summary Report

Kun Peng

In this lab we were required to implement an RBF network for one input variable and one output variable, using Gaussian basis functions to approximate the function **h(x) = 0.5 + 0.4sin(2πx)**. I randomly generated 75 data points from h(x) with added noise in uniform distribution in the interval [-0.1, 0.1], and the x’s were also from a uniform distribution in the interval [0.0, 1.0].

All x’s were categorized into K = (2, 4, 7, 11, 16) clusters using K-means algorithm. The variance for each cluster were calculated with the following formula **(A)**:

And then I used LMS algorithm with η = (0.01, 0.02) to update weights of each base. Epochs of each approximation were fixed to 100.

I repeated the above steps but assumed variances of all clusters were the same, which was **(B)**:

For each approximation F(x), I plotted F(x) together with the data points and the original function where the data points are sampled from, so I got 20 graphs in total. Finally, I also plotted a graph showing MSE for each approximation under different conditions as following:

图表, 折线图

描述已自动生成

According to the MSE graph, it could be concluded that as number of bases increased, with the same learning rate, loss of the functions tended to decrease in general. When number of bases were the same, loss of the functions with η = 0.02 was smaller than when η = 0.01. With the same number of bases and the same learning rate, when variances of each base were assumed to be the same, loss of the functions tended to be smaller in general.

In addition, according to graphs of each F(x), when variances were calculated with formula **(A)**, the approximations seemed to be overfitting as number of bases increased (in my case, when K >= 7). For such cases, with the same number of bases, η = 0.02 seemed to be less overfitting than η = 0.01. If I assumed variances for each cluster were the same as formula **(B)**, the graph of the approximation became smoother and looked like the original function more.