Using Normalised Radial Based Functions (NRBF's) to Prodict Energy Consumption in the National Grid

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I. Introduction

Training a Neural Network to prodict the energy Consumptions of the national was not the easiest of tasks for the network to proform. There a number of intrsting occurances in the data, the output of the network and the results of the sigma optimisation and node optimisation.

II. Network

A. NRBF

Normalised Radial Based Functions (NRBF) work by using the activation of all nodes in the hidden layer to work out the output of the network. This is done by using the gaussian activation function of the nodes in the hidden layer, to work out how active the node is when a value is passed to it. if a node is very then its activation value will be one or very close to one, where as an inactive node will be much closer to zero. The activation of all of the nodes is later used to work out what the output of the net work will be.

When the activation has been calculated this can then be used to to get the output of the network as the more active nodes will contribute more to the final value that is output based on these inputs. To do this the the sum of the nodes weights multipied by the activation of the node is calculated. This part of the equaction can be seen in figure 1:

$$\sum_{n=1}^{N} W_n \phi(\|x - x_n\|)$$

figure 1 : sum of all node activations multipied by weights of all nodes

After this the total sum of all node activations is calculated and summed. The equation for this can be seen figure 2.

$$\sum_{n=1}^{N} \phi(\|x - x_n\|)$$

figure 2 : sum of all node activations

When these have been calculated the 2 values are devided. to get the final output from the hidden layer. The whole equation can been seen in figure 3.

$$f(x) = \frac{\sum_{n=1}^{N} W_n \phi(\|x - x_n\|)}{\sum_{n=1}^{N} \phi(\|x - x_n\|)}$$

figure 3 : sum of all node activations multipied by weights of all nodes devided by sum of all node activations

Node Activation Equation

$$y = exp(-\frac{1}{2\sigma^2}\sum_{k=1}^{K}(x_k - w_{jk})^2)$$

Root Mean Squar Equation

$$RMS = \sqrt{\frac{1}{M}\sum_{i=1}^{M}(y_i^p - y_{id}^p)^2}$$

Weight Update Equation

$$W \leftarrow W + \alpha * (target - Networkoutput) * \phi$$

1) Task 1:

Sigma Value	Train Error	Test Error
0.1		
0.2		
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		
1.0		

2) Tast 2:

Number of Nodes	Train Error	Test Error

Sigma Value	Train Error	Test Error
0.1		
0.2		
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		
1.0		

B. MLP

1) Task 2:

III. DATA

A. Data processing methods

B. Problems with the data

IV. RESULTS

V. CONCLUTION