CSL603 - Lab 3
Multi Layer Perceptron

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1 2-Dimensional 3-Class Classification problem

1.1 Goal

Study the changes to the

- decision boundary and
- the training error

with respect to parameters such as

- number of training iterations,
- number of hidden layer neurons and
- finally the learning rate

1.2 MLP Training

During forward pass, we made $z_h = \sigma(w_h^T x)$ and $y'_k = \sigma(v_k^T z)$ (The weights and points had different orientation to what discussed in class, therefore an appropriate formula equivalent to these was used.) During backpropagation, for a particular point we used

$$\Delta v_{hk} = \underbrace{\eta(y'_k - y_k)y'_k(1 - y'_k)}_{\text{Common for a particular } k} z_h$$

and

$$\Delta w_{jh} = \underbrace{\eta \left(\sum_k (y'_k - y_k)y'_k(1 - y'_k)v_{hk} \right) z_h(1 - z_h)}_{\text{Common for a particular } h} x_j$$

(Various values were calculated only once which were common for a particular k for Δv_{hk} and these were further used in case of Δw_{jh}, moreover the common values in case of Δw_{jh} for a particular h were also calculated only once.)

1.3 Training Error

The training error for all the points was summed up to get $E = \frac{1}{2}\Sigma||y_i' - y_i||^2$ where the subscript denotes i-th point, rather than the i-th dimension for a particular point.

1.4 MLP Testing

The similar formulas as for MLP training were used but here, instead we had multiple points, so an appropriate form was used (The bias term was introduced differently which in this case would be a column vector, rest was same).

1.5 Observations

1.5.1 Varying the training iterations

1.5.2 Varying the number of hidden layer nodes

1.5.3 Varying the learning rate

1.6 Discussion and Conclusions