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Artificial Intelligence

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Lab 5 : Neural Network with backpropagation

Preamble

Backpropagation is a widely used algorithm in training feedforward neural networks for supervised learning. The backpropagation algorithm works by computing the gradient of the loss function with respect to each weight by the chain rule, computing the gradient one layer at a time, iterating backward from the last layer to avoid redundant calculations of intermediate terms in the chain rule. In this tutorial, we will implement the backpropagation algorithm for a neural network from scratch with Scilab/Python.

Dataset : Wheat-Seed Dataset.csv

Dataset Attribute Information:

To construct the data, seven geometric parameters of wheat kernels were measured:

1. area A,
2. perimeter P,
3. compactness $C = 4 \cdot \pi \cdot A / P^2$,
4. length of kernel,
5. width of kernel,
6. asymmetry coefficient
7. length of kernel groove.

All of these parameters were real-valued continuous.

Exercise 1: Write a script to implement the backpropagation algorithm for a neural network and use the trained network to make predictions on a test dataset.

Or

Use MNIST dataset and make a fully connected Neural Network (single hidden layer). Train the network with backpropagation.

The detail of the MNIST dataset can be found: <http://yann.lecun.com/exdb/mnist/>

Following are the script modules:

1. Initialize Network.
2. Forward Propagate.
3. Back Propagate Error.
4. Train Network.
5. Predict the output class and accuracy.

Exercise 2 : Visit <http://ann.miabellai.net/> , which is a web-based visualization tool for exploring the inner workings of artificial neural networks.

References:

1. <http://archive.ics.uci.edu/ml/datasets/seeds>
2. <http://cs231n.github.io/optimization-2/#backprop>
3. <http://cs231n.github.io/optimization-2/#intuitive>