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Artificial Intelligence

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Lab 4: Feed-Forward fully connected Neural Network

Preamble: Artificial Feedforward Neural Network can be used to solve problem or regression or classification. In an supervised form of learning they can be made to learn functional mapping between input and output. Due to their massively parallel structure they can realise highly non-linear relationships between the input and output.

Use ANN tool box in Scilab for following exercises

Exercise I: Study following commands from the ANN tool box

ann_FF:

This provides an algorithms for Feedforward network and it aims to provide engines for feedforward ANN exploration, testing and rapid prototyping. It is important to read through for the proper syntax usage of ANN.

ANN_GEN:

It list functions for user interface, their parameters and functions.

ann_FF_init:

It is used to initialize the weight hypermatrix. This function builds the weight hypermatrix according to network description N. Its format is detailed in ann_FF.

ann_FF_Std_online:

It is online standard back propagation implementation. It returns the updated weight hypermatrix of a feedforward ANN, after online training with a given set of patterns. The algorithm used is online standard backpropagation.

ann_FF_run:

It tests the trained network and runs patterns trough a feedforward net.

Exercise II

Study and execute the following script.

```
clc;
clear;
rand('seed',0);
N = [2,2,1];
x=[0.89, 0.79; 0.85, 0.74; 0.84, 0.72; 1, 1; 0.04, 0.07; 0.03, 0.02; 0.02, 0.01;0.01, 0.01;
0.0086, 0.0053; 0.0061, 0.0026; 0.0044, 0.009; 0.008, 0.0087]';
t=[1 1 1 1 0 0 0 0 0 0 0 0];
lp=[0.1, 0];
W=ann_FF_init(N);
T=400;
W=ann_FF_Std_online(x,t,N,W,lp,T);
a=ann_FF_run(x,N,W)
```

Answer the following questions based on the above script:

1. How many layers are there in the above ANN?
2. How many neurons are present per layer?
3. How do you interpret results in variable “a” ?
4. What is the role of second parameter in variable “lp”?
5. Make the value of lp(1) = 500, execute the script, observe the result and comment it.

Exercise III

Design a Neural network to classify *Iris* flower data set [1].

Iris data set [3 – 4]

It is a multivariate dataset with 50 samples from each of the three species of *Iris; Iris Setosa, Iris virginica and Iris Versicolor*. Four Four features were measured from each sample: the length and the width of the sepals and petals, in centimeters. The data set is available at [2]. The data set is archieved at UCI repository [3].

Attribute Information [3]:

1. sepal length in cm
2. sepal width in cm
3. petal length in cm
4. petal width in cm
5. class:

-- Iris Setosa
-- Iris Versicolour
-- Iris Virginica

The typical sample is given as follows

```
5.1,3.5,1.4,0.2,Iris-setosa
```

Train set: Use 35 samples from each of the three species as to train the network

Test Set: Use 15 samples from each of the three samples to test the network.

Hint: **You may like to look at "One Hot Encoding" [5] for assigning the output class.**

Figure of merit: Accuracy of correct species classification on test data.

Reference

[1] https://en.wikipedia.org/wiki/Iris_flower_data_set

[2] https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data

[3] https://archive.ics.uci.edu/ml/datasets/iris

[4] Fisher, R.A. "The use of multiple measurements in taxonomic problems" Annual Eugenics, 7, Part II, 179-188 (1936); also in "Contributions to Mathematical Statistics" (John Wiley, NY, 1950).

[5] https://www.kaggle.com/dansbecker/using-categorical-data-with-one-hot-encoding