Logo

Description automatically generatedFaculty of Computer & Information Sciences

Ain Shams University

Subject: Neural Networks and Deep Learning

Year: 4th-year undergraduate (CS)

**Task 3-MultiLayer Perceptron using Backpropagation Algorithm**

**Team ID: CS\_H25**

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Content:

* This report contains (with screenshots) the best obtained accuracy using each activation function and what parameters were used for these results.

**Using Sigmoid Function:**

Activation Function: Sigmoid Function

Parameters:

* Number of hidden layers: 2
* Number of neurons for each layer:
  + The first layer consists of 3 neurons.
  + The second one consists of 4 neurons.
* Learning rate: 0.1
* Number of epochs: 1000

Training Accuracy: 100% (reached at epoch number 341).

Testing Accuracy: 100%.

Text

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With the following relation between accuracy and #epochs.

Chart

Description automatically generated

And the following confusion matrix

Chart

Description automatically generated

**Another example using Sigmoid:**

Parameters:

* Number of hidden layers: 3
* Number of neurons for each layer:
  + The first layer consists of 3 neurons.
  + The second one consists of 4 neurons.
  + The third one consists of 5 neurons.
* Learning rate: 0.2
* Number of epochs: 1000

Training Accuracy: 100% (reached at epoch number 725).

Testing Accuracy: 96.67%.

Text

Description automatically generated

With the following relation between accuracy and #epochs.

Chart

Description automatically generated

And the following confusion matrix

Chart

Description automatically generated

**Using Tanh Function:**

Parameters:

* Number of hidden layers: 1
* Number of neurons for each layer:
  + The layer consists of 5 neurons.
* Learning rate: 0.001
* Number of epochs: 5000

Training Accuracy: 100% (reached at epoch number 2102).

Testing Accuracy: 100%.

Text

Description automatically generated

With the following relation between accuracy and #epochs.

Chart, line chart

Description automatically generated

And the following confusion matrix

Chart

Description automatically generated

**Another example using Tanh:**

Parameters:

* Number of hidden layers: 3
* Number of neurons for each layer:
  + The first layer consists of 5 neurons.
  + The second one consists of 4 neurons.
  + The third one consists of 3 neurons.
* Learning rate: 0.1
* Number of epochs: 5000

Training Accuracy: 100% (reached at epoch number 273).

Testing Accuracy: 100%.

Text

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With the following relation between accuracy and #epochs.

Chart

Description automatically generated

And the following confusion matrix

Chart

Description automatically generated

**Bonus Task:**

**Using the MNIST dataset:**

**\*Note: Kindly extract “archive.rar” file before using MNIST**

Activation Function: Sigmoid Function

Parameters:

* Number of hidden layers: 2
* Number of neurons for each layer:
  + The first layer consists of 3 neurons.
  + The second one consists of 4 neurons.
* Learning rate: 0.1
* Number of epochs: 1000

Training Accuracy: 11.367%.

Testing Accuracy: 11.18%.

Better accuracies could be achieved by tuning hyper parameters.

Chart

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Activation Function: Tanh Function

Parameters:

* Number of hidden layers: 1
* Number of neurons for each layer:
  + The layer consists of 5 neurons.
* Learning rate: 0.1
* Number of epochs: 200

Training Accuracy: 9.527%.

Testing Accuracy: 9.82%.

Better accuracies could be achieved by tuning hyper parameters.

Text

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Chart

Description automatically generated