DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Indian Institute of Technology Jodhpur

Report: Assignment 1, Subject:ML2

Name: Ravi Ranjan, Roll Number: MT19AI032

Answer 1)

1 Dataset Used :

Iris Data Set is collected from below url
https://archive.ics.uci.edu/ml/datasets/iris

2 Preprocessing :

Data is already in the preprocessed state.

3 Model Description(Perceptron model)

The perceptron represents biological neurons that shows how a neural network works. The network takes some inputs, performs required processing on those inputs and produces some output.

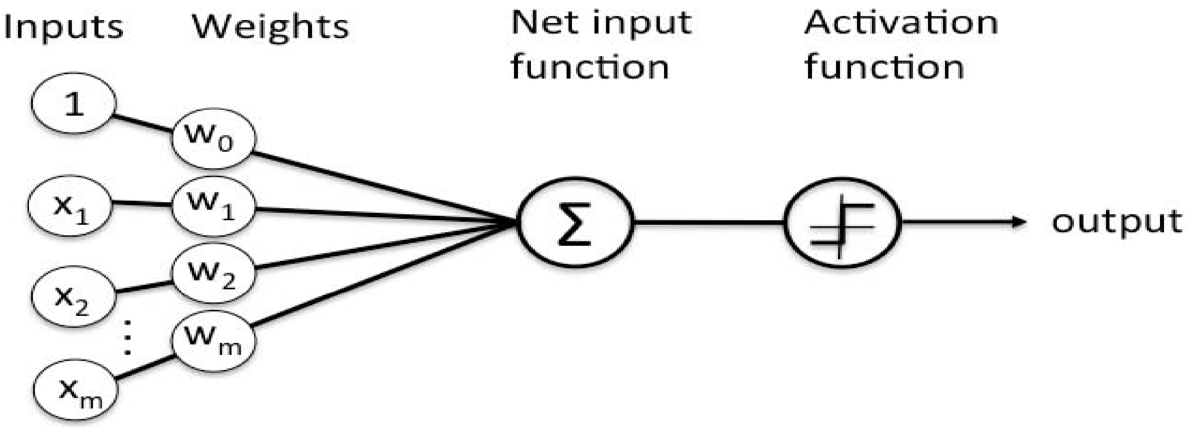

Figure 1 Block Diagram of Perceptron

From the above figure , Here the perceptron model taken has inputs *x1, x2 ,x3 ...xm* and produce one output. The importance of these inputs is determined by the corresponding weights *w1, w2 , w3...wm* assigned to these inputs. The output either 0 or 1 depending on the weighted sum of the inputs. Output is 0 if the sum is below a certain threshold or 1 if the output is above a certain threshold. This threshold could be a real number and a parameter of the neuron.

Output = w1x1 + w2x2 + w3x3+.....wmxm

Since the output of the perceptron could be either 0 or 1, this perceptron is an example of a binary classifier.

4. Approach

For the purpose of distinguishing between three classes one vs all approach is considered. One-vs-all classification is a method which involves training *N* distinct binary classifiers, each designed for recognizing a particular class. Then those *N* classifiers are collectively used for multi-class classification.

5. Results

1. For 50 epochs:

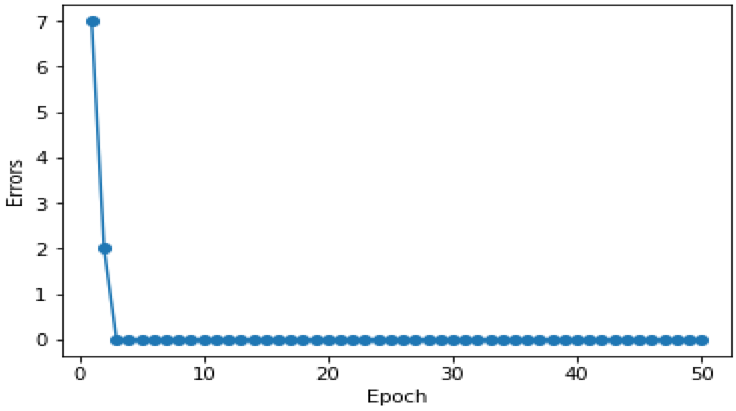

Figure 2 Error Ruduction at 50 epochs

2. For 100 epochs:

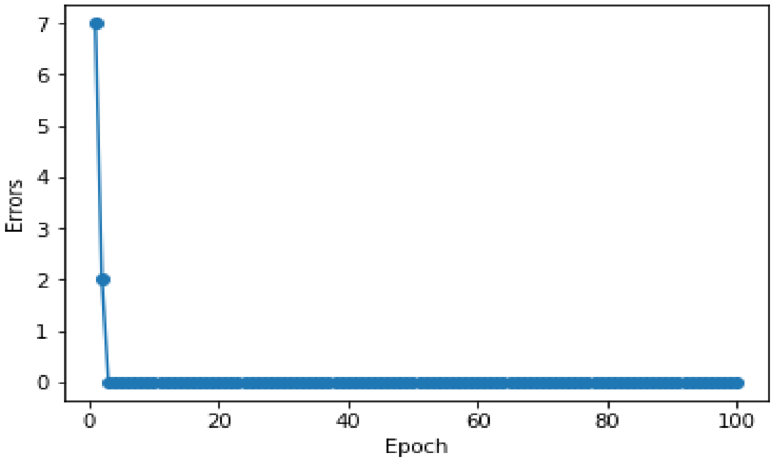

Figure 3 Error Ruduction at 100 epochs

Answer 2)

1) Dataset Used :

Iris Data Set is collected from below url
https://archive.ics.uci.edu/ml/datasets/iris

2) Preprocessing :

Data is already in the preprocessed state

3) Model Description:

Neural Network for 3 class back propogation

Neural nets are a means of doing machine learning, in which a computer learns to perform some task by analyzing training illustration. Usually, the illustration have been hand-labeled in advance. An object recognition system, for instance, might be fed thousands of labeled images of cars, houses, coffee cups, and so on, and it would find visual patterns in the images that consistently correlate with particular labels.

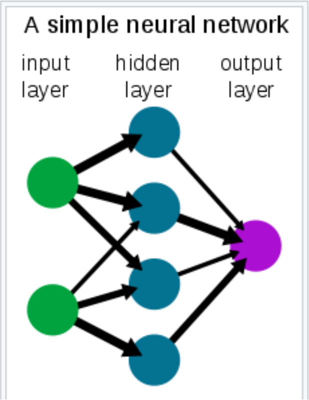

Figure 4 Block Diagram of Neural Network

4. Approach

i) Designing of Architecture

ii) Initilization of Weights

ii) Forward Propogation

iii) Error Calculation

iv) Backward Propogation

v) Optimization(Updation of Weights)

5. Results

a) Training after 50 epoch

Training Accuracy:0.956140350877193

b) Validation after 50 epoch

Validation Accuracy:0.9230769230769231

c) Training after 100 epoch

Training Accuracy:0.9736842105263158

d) Validation after 100 epoch

Validation Accuracy:0.9230769230769231

e) Testing Accuracy: 1.0

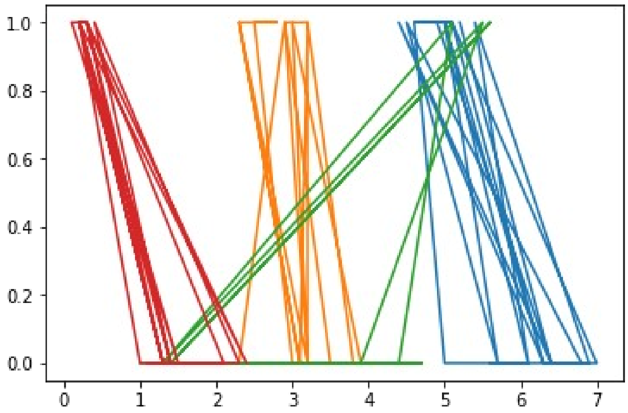

Figure 5. Three Class Classification of Iris Dataset

Answer 3)

1) Dataset Used :

Iris Data Set is collected from below url
https://archive.ics.uci.edu/ml/datasets/iris

2) Preprocessing :

Data is already in the preprocessed state.

3) Model Description(Radial Basis Function NN):

RBNN is composed of input, hidden, and output layer. RBNN is strictly limited to have exactly one hidden layer. We call this hidden layer as feature vector.

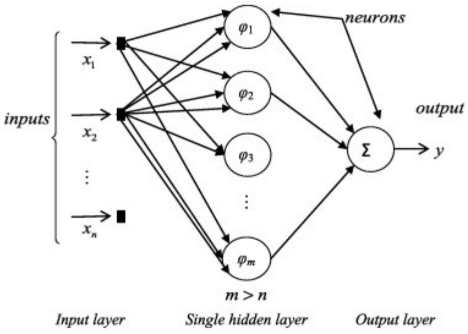

Figure 6 RBF Neural Network

4. Approach

RBF nets are a special type of neural network used for regression. They are similar to 2-layer networks, but we replace the activation function with a radial basis function, specifically a Gaussian radial basis function. We take each input vector and feed it into each basis. Then, we do a simple weighted sum to get our approximated function value at the end. We train these using backpropagation like any neural network.

5. Results

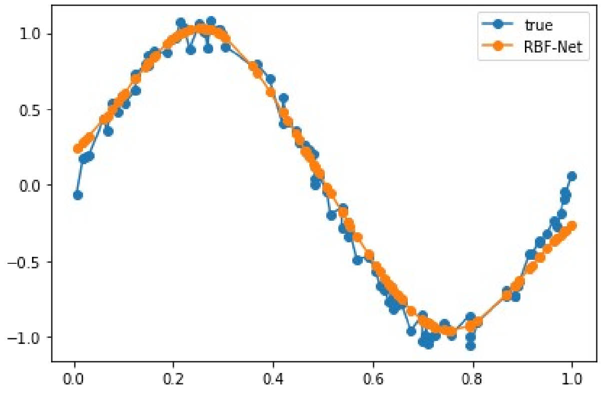

Figure 7. Graph Representing True Distribution vs RBF Net

Answer 4)

1) Dataset Used :

MNIST Data Set is collected from below url
https://www.kaggle.com/oddrationale/mnist-in-csv

2) Preprocessing :

Data is already in the preprocessed state

3) Model Description(Autoencoder):

Autoencoders are an unsupervised learning technique in which we leverage neural networks for the task of representation learning. Specifically, we'll design a neural network architecture such that we impose a bottleneck in the network which forces a *compressed* knowledge representation of the original input. If the input features were each independent of one another, this compression and subsequent reconstruction would be a very difficult task.

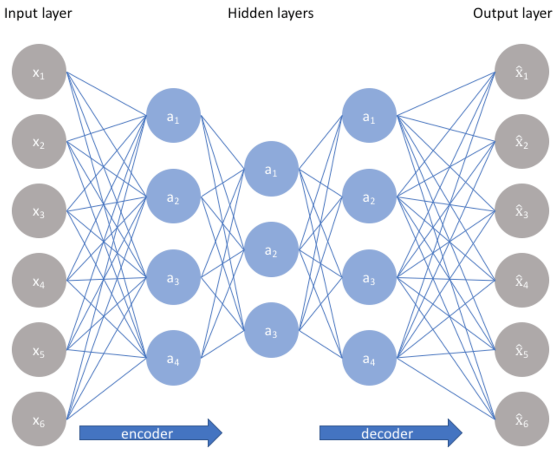

Figure 8. Encoder Decoder Neural Network

4. Approach

Our inputs are images, we make use of convolutional neural networks (convnets) as encoders and decoders. In practical settings, autoencoders applied to images are always convolutional autoencoders --they simply perform much better.

The encoder will consist in a stack of Conv2D and MaxPooling2D layers (max pooling being used for spatial down-sampling), while the decoder will consist in a stack of Conv2D and UpSampling2D layers.

5. Results

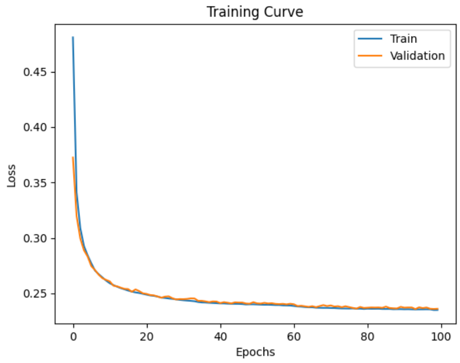

Figure 9. AutoEncoder Loss Function

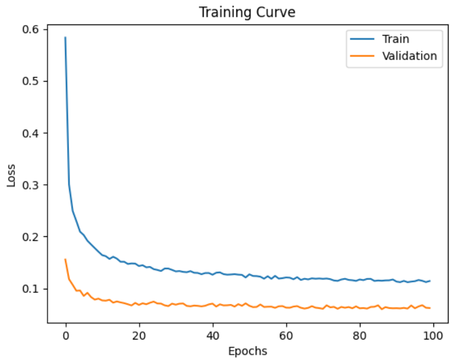

Figure 10. Classifier Loss Function