NAME: Renu Tamsekar

ROLL NO: 3253

TITLE : BACK PROPOGATION

LAB NO: 2

PROBLEM STATEMENT :  Write a program to perform classification using back propagation.

METHODOLOGY :

* import required libraries.
* declare input and output arrays (training and testing data) and select weights at random between 2 to 4 and select required hyper parameters like learning rate and number of epochs
* define a sigmoidal activation function.
* Define a function for the feed forward network with input parameters as input and weights, this function will consist of matrix multiplication and sigmoidal activation.
* Define a function for back propagation with input parameters as the hidden layers outputs and inputs and the final output.
* Define a function for weight updation with input parameters as the old weights, learning rate and derivatives of the sigmoidal activation function.
* Define a function for prediction which has input parameters as weights and input, this function performs the forward pass.
* Test the data (prediction)

APPLICATIONS:

* Backpropagation is an important mathematical tool for improving the accuracy of predictions in data mining and machine learning.
* The neural network is trained to enunciate each letter of a word and a sentence
* It is used in the field of speech recognition.
* It is used in the field of character and face recognition

RESULTS :

* For 10000 epochs(iterations) the error rate is 0.08.
* The error rate is high (0.13) when the number or epochs is around 2000 – 5000.
* The error rate gradually starts decreasing at 6000 epochs and goes as low as 0.08 at 10000 epochs.

OBSERVATION :

* The neural network created works well with an error rate of 0.08 on the testing data.
* To get to an error rate of 0.08 it needs to have 10,000 epochs.
* This means that the model finds it global minima and 10000 epochs.
* This convergence also depends on the learning rate hyperparameter since a low learning rate will result in slower convergence and a higher learning rate will result in divergence.
* The number of epochs also has to be carefully chosen since the activation function used is sigmoidal and more epochs could diminish the learning of the model due to the vanishing and exploding gradients problems.

CONCLUSION :

* Backpropagation is an iterative, recursive and efficient method through which it calculates the updated weight to improve the network until it is not able to perform the task for which it is being trained.
* Backpropagation is an essential mechanism by which neural networks get trained.
* advantages of back propagation include its ease of programming and it doesn’t require to have any prior knowledge about the network. It is flexible and works efficiently.
* Disadvantages of back propagation include its high dependency of hyperparameters and needs excessive time for training.

PRINT OF CODE AND OUTPUT