Program: BS(AI)

Spring 2023 Final Term Exam (Theory)
Machine Learning Fundamentals (AIC-354)

June 26, 2023   Total Marks: (50)   Time: 180 minutes

Name_____   Reg. # _____

Question # 1 [15 Marks] [CLO-1(SO(1))]

For example, you are developing a neural network. The performance graph of your training model is given below. There may be a problem in your dataset or in your proposed neural network model. Look at each graph: how your training model is performing (good, underfitting, overfitting)? Also explain how you will improve the training.
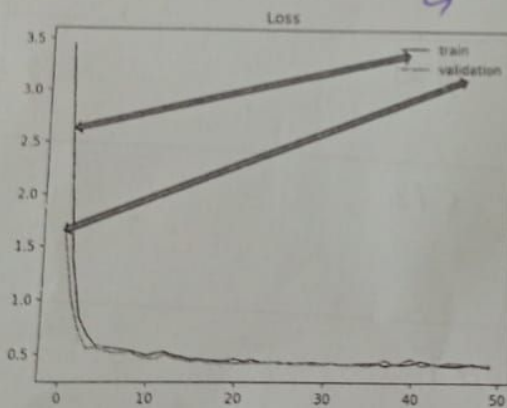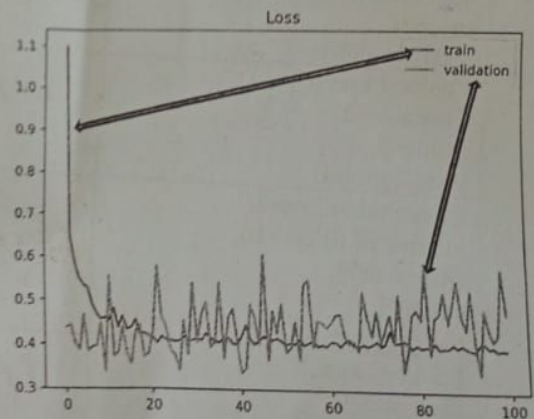
Graph (1.1)
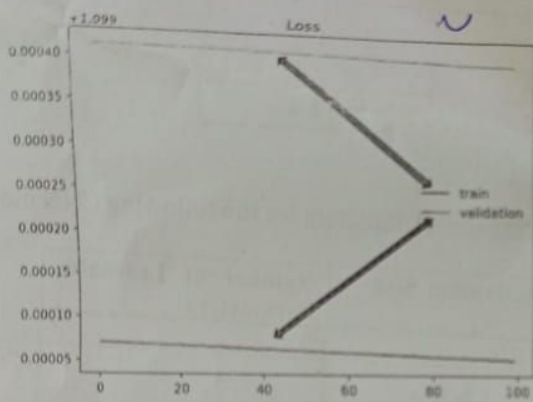
Graph (1.2)
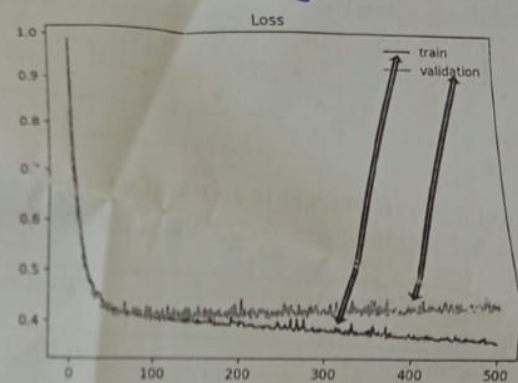
Graph (1.3)

Graph (1.4)

Question # 2 [5 Marks] [CLO-1(SO(1))]

What challenges did you face during developing your semester project and how you overcome them?

Question #3 [10 Marks] [CLO-2(SO(2,4))]

Apply the Feedforward Backpropagation method and update all the weights using Stochastic Gradient Descent optimization technique. Apply the algorithm for a single iteration. Update only the weight w15. Calculate the difference between the cost values (SSE) for before and after weight updating.

Input: [X1=1, X2=0, X3=0; Output=1]

Suppose: Learning rate = 0.5, and Activation function at each hidden and output unit is Sigmoid.

MLP:

Initial Weights:

Hidden layer 1: w04=1, w05=0, w06=1, w14=0, w15=1, w16=3, w24=0, w25=0, w26=0, w34=0, w35=1, w36=0
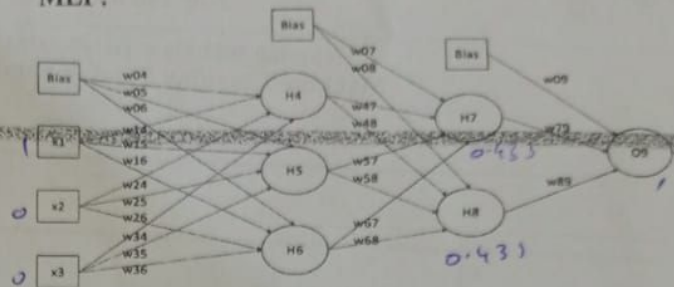
Hidden layer 2: w07=0, w08=1, w47=0, w48=0, w57=0, w58=0, w67=1, w68=1

Output layer 2: w09=1, w79=0, w89=1

Question #4 [10 Marks] [CLO-3(SO(2,4))]

Applying the Hierarchical Agglomerative Single Linkage Clustering technique, make dendrogram of clusters, and how many clusters are there in the dendrogram for threshold (distance) = 2.

The dataset is given by:

Data Points → Features ↓	D1	D2	D3	D4	D5	D6
X	1	2	3	4	5	1
Y	3	4	1	2	1	4

Question #5 [10 Marks] [CLO-4(SO(2,4))]

Find the Activation Shape, Activation Size and the Number of Learnable Parameters for the following CNN model.

Hyper Parameters	Activation Shape	Activation Size	Number of Learnable Parameters
Input(16,16,4)	(16,16,4)	1024	0
ConvolutionLayer1(number of filters=10, filter size=5, stride=1 padding=null)	12,12,10 ?	1440 ?	?
PoolingLayer1(filter size=2, Stride=2, Padding=null)	6×6 ?	36 ?	?
ConvolutionLayer2(number of filters=16, filter size=3, stride=1 padding=yes)	6x6x16 ?	576 ?	?
PoolingLayer2(filter size=2, Stride=2, Padding=null)	3×3 ?	9 ?	?
FullyConnectedLayer3(number of neurons=100)	1×9x18?	900 ?	?
FullyConnectedLayer4(number of neurons=10)	1×9x?10	90 ?	?
OutputLayer(number of neurons=5, activation function=softmax)	?	45 ?	?