Kafrelsheikh University
Faculty of Engineering
Electrical Engineering Department
Final Exam, 2018 - 2019
Subject: Elective course(4)
"Neural network".

Year: 4th Computer Engineering & systems
Academic Number : ECS4230
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Time: 3 Hours.
Full Mark: 70, 2 pages

This exam measures ILOs no: a1, a2, a3, a4, a5, a6, a8, a17, b1, b2, b3, b4, b5, b6, b7, b15, b16, c1, c2, c3, c4, c5, c8, c10, c13, c16, d1, d2, d3.

Q1: Identify which of the following statements are True or False: [5 Marks]

1. **If you increase the number of hidden layers in a Multi-Layer Perceptron, the classification error of test data always decreases.** ( )
2. **Although it takes more time for training, the neural network has advantage of a generalization.** ( )
3. **Increase in size of a convolutional kernel would necessarily increase the performance of a convolutional network.** ( )
4. **The number of classes determines the number of output neurons, while the number of input patterns determines the number of input neurons.** ( )
5. **Boltzmann law is practical for implementation.** ( )

Q2: Choose the correct answer: [5 Marks]

1. What is classification?
a. Deciding which features to use in a pattern recognition problem.
b. Deciding which class an input pattern belongs to.
c. Deciding which type of neural network to use

2-What consist of Boltzmann machine?
a. fully connected network with both hidden and visible units'
b. Asynchronous operation
c. Stochastic update
d. All of the mentioned

3- What are the steps for using a gradient descent algorithm?
1. **Calculate error between the actual value and the predicted value**
2. **Reiterate until you find the best weights of network**
3. **Pass an input through the network and get values from output layer**
4. **Initialize random weight and bias**
5. **Go to each neurons which contributes to the error and change its respective values to reduce the error**

a. 1, 2, 3, 4, 5 b. 5, 4, 3, 2, 1 c. 3, 2, 1, 5, 4 d. 4, 3, 1, 5, 2

4- Which of the following types of learning can used for training artificial neural networks?
a. Supervised learning. b. Unsupervised learning.
c. Reinforcement learning. d. All of the above answers.

5- In which neural net architecture, does weight sharing occur?
a. Convolutional neural Network b. Recurrent Neural Network
c. Fully Connected Neural Network d. Both A and B

Q3- Answer the following questions [15 Marks]

1. **Mention the Restricted Boltzmann machine. With use drawing.**
2. **What are the flexibility in recurrent neural Networks?**
3. **Discuss the exploding and vanishing gradient in Recurrent Neural Network.**

Q4- (a) Derive in steps the Self Organizing Map (SOM) algorithm [5 Marks]
(b)Let the vectors to be clustered be (1,1,0,0); (0,0,0,1); (1,0,0,0); (0,0,1,1) the maximum number of clusters to be formed is m=2. [10 Marks]

Suppose the learning rate (geometric decrease) $\eta(0)=0.6$., $\eta(t+1)=0.5\,\eta(t)$.R=0, and the initial weights matrix: $\begin{bmatrix} 0.2 & 0.8 \\ 0.6 & 0.4 \\ 0.5 & 0.7 \\ 0.9 & 0.3 \end{bmatrix}$

Q5- (a) what is filter, and stride in Convolutional Neural Networks? [2 Marks]

(b) In the image below that represent in 5x5 matrix, what the convolved feature matrix after using a filter 3x3 is shown below, with stride=1 [10 Marks]

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

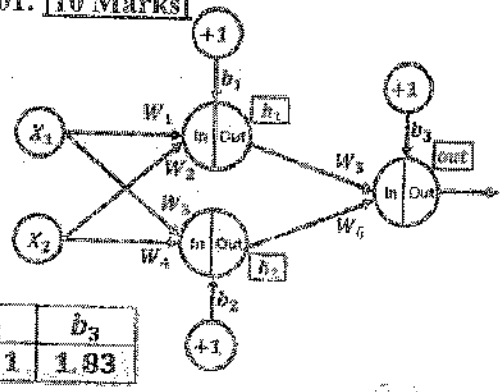
Image

$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

Convolution kernel

Q6- Use back propagation for the below neural network with one hidden layer to find the correct weights that minimize the error between the desired output and the actual output. The inputs are x1, x2, and the desired output is 0.03. Assume the initial weights as in the table, use Sigmoid as an activation function, the learning rate is 0.01. [10 Marks]

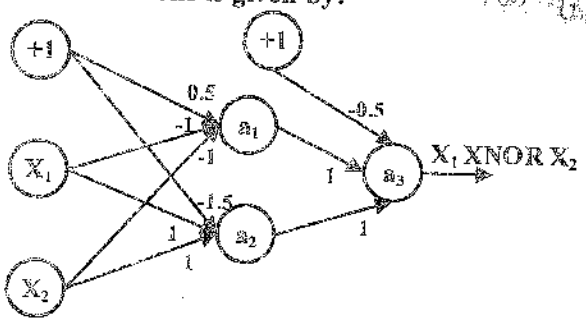
X_1	X_2
0.1	0.3



W_1	W_2	W_3	W_4	W_5	W_6	b_1	b_2	b_3
0.5	0.1	0.62	0.2	−0.2	0.3	0.4	−0.1	1.83

Q7- A network is created when we multiple neurons stack together. Let us take an example of a neural network simulating an XNOR function. [8 Marks]

The activation function for all the neurons is given by: $f(x)=\begin{cases} 0, & for\ x<0 \\ 1, & for\ x\geq 0 \end{cases}$



Suppose X1 is 0 and X2 is 1, what will be the output for the above neural network?

********** With Best Wishes **********

Dr. Wessam Fikry, Committee of Correctors and Testers