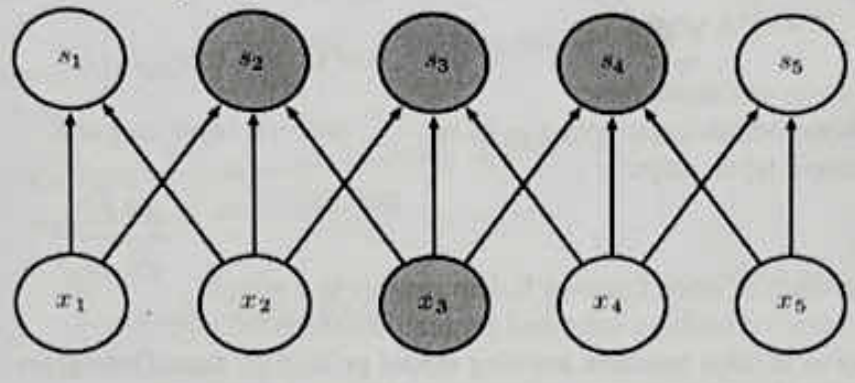
Department of Computer Science, Cochin University of Science & Technology
M Tech Degree in Computer Science & Engineering with Specialization in DS & AI / Software Engineering, II Semester, End Semester Examination, May 2023

21-479-0206: Deep Learning

Max : 50 marks
Time : 3 hours

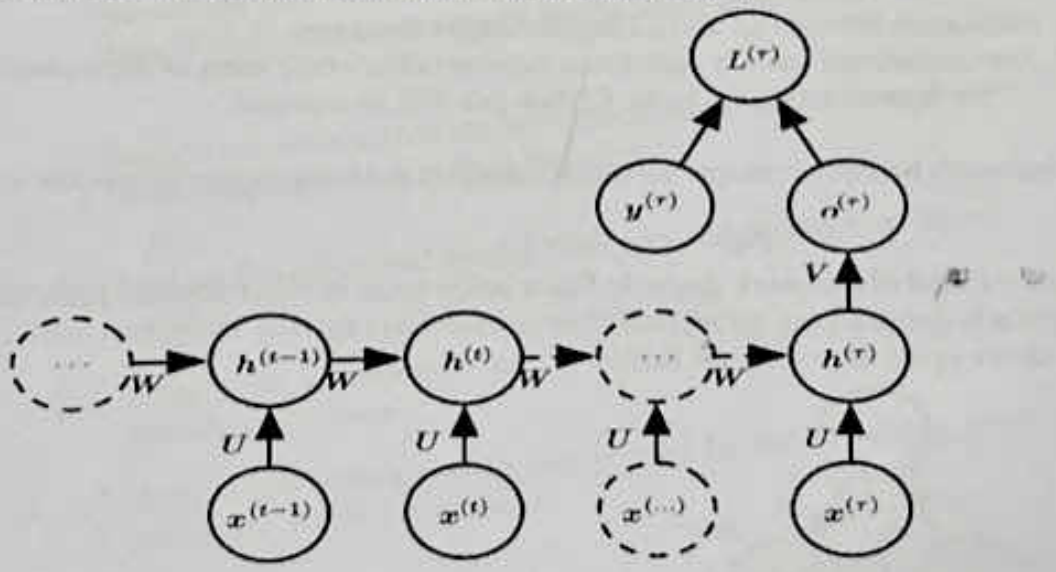
(Answer either Part A or Part B of each question. Each Question carries 10 marks)

I. A. What are the benefits of using Convolution? Interpret the benefit of convolution shown in the figure given below:



OR

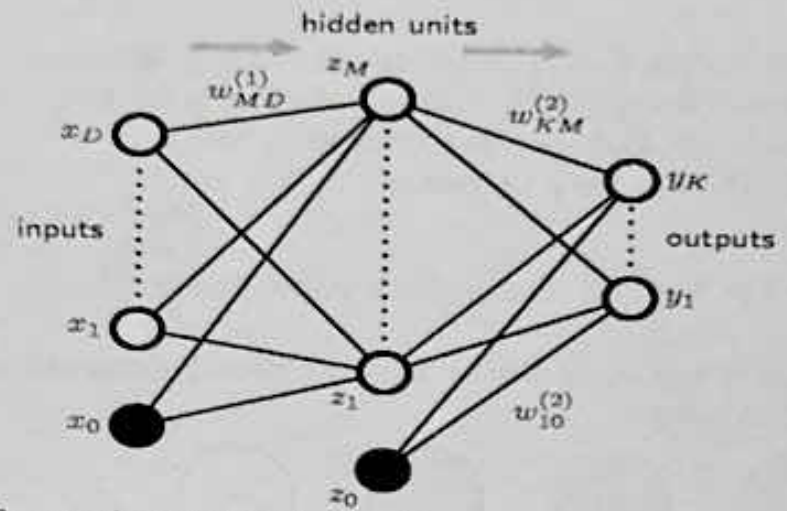
B. Interpret the network shown in the figure given below:



II.A. Linear model applied directly to the original input cannot implement the XOR function. We want our network to perform correctly on the four points X = {[0, 0]T, [0, 1] T, [1, 0] T, and [1, 1] T}. Show how a neural network can solve this problem.

OR

B. Neural network with one hidden layer is shown below. With respect to back



Propagation, write equations for

(a) Output activation function y_k (x,w) (b) First layer output z

(c) Second layer output y

(d) Gradient of error function E with respect to a weight $\frac{\partial E_n}{\partial w_{ji}}$

III A. 1. Distinguish between training error and generalization error?

2. The best way to make a machine learning model generalize better is to train it on more data. How dataset augmentation techniques helps here.

OR

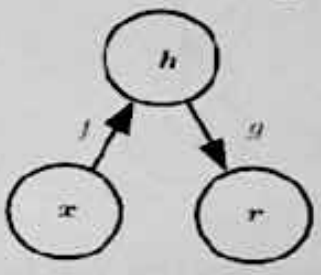
B. 1. Distinguish between L1 and L2 Regularization Strategies.

2. Representational sparsity describes a representation where many of the elements of the representation are zeros. Explain this with an example.

IVA. Distinguish between Principal component analysis and Independent component analysis

OR

B. How the kind of a network shown in figure below helps in dimensionality reduction? An input x is mapped to an output (called reconstruction) r through an internal representation is shown in the network given below.



V. Write short notes on:

A. 1. Boltzmann Machines 2. Restricted Boltzmann Machines

OR

B. 1. Convolutional Boltzmann Machines 2. Deep Belief Networks

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Department of Computer Science, Cochin University of Science & Technology
M Tech Degree in Computer Science & Engineering with Specialization in DS & AI / Software Engineering, II Semester, End Semester Examination, August 2022

21-479-0206: Deep Learning

Max : 50 marks
Time : 3 hours

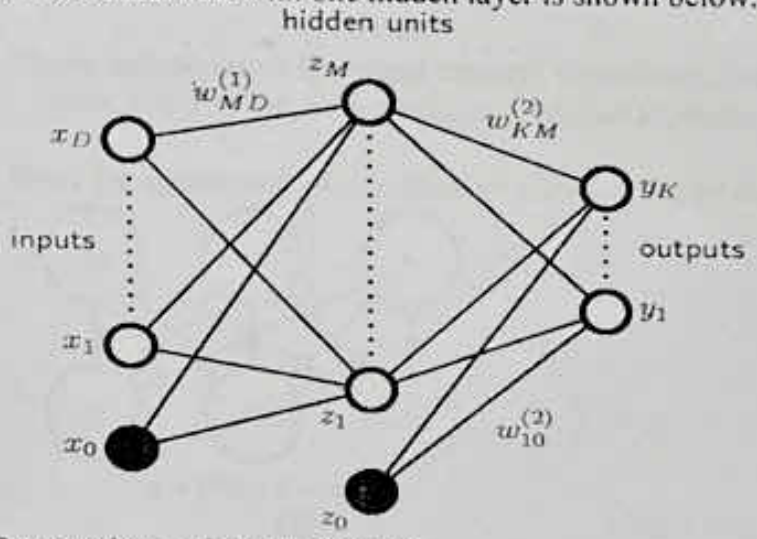
(Answer either Part A or Part B of each question. Each Question carries 10 marks)

I. A. 1.Analyze the significance when the two distributions measured by the Kullback-Leibler (KL) divergence becoming Zero.

2. Define distributions: events = ['red', 'green', 'blue']
   P = [0.10, 0.40, 0.50]
   Q = [0.80, 0.15, 0.05]
   Find KL divergence KL(P || Q) and KL(Q || P) ?

OR

B. Neural network with one hidden layer is shown below. With respect to back



Propagation, write equations for

(a) Output activation function y_k (x,w)

(b) First layer output z

(c) Second layer output y

(d) Gradient of error function E with respect to a weight $\frac{\partial E_n}{\partial w_{ji}}$

II. A. 1. How the model capacity is related to training and generalization errors?

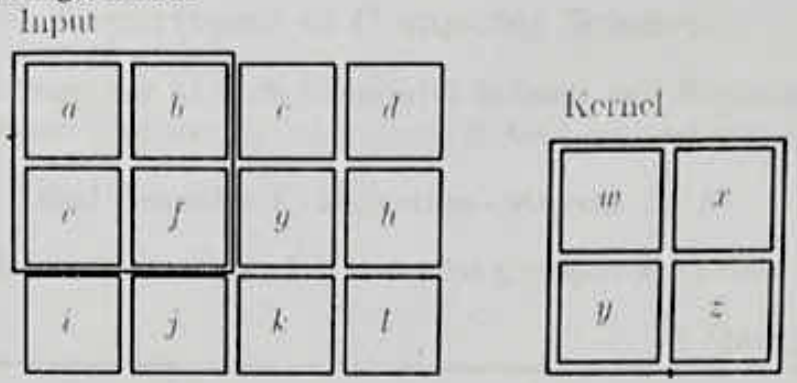
2. Distinguish between L^1 and L^2 Regularization Strategies.

OR

B. 1. Representational sparsity describes a representation where many of the elements of the representation are zeros. Explain this with an example.

2. Discuss on dataset augmentation techniques.

III. A. 1.Find the output of the 2-D convolution operation on the given below input and kernel with single stride.

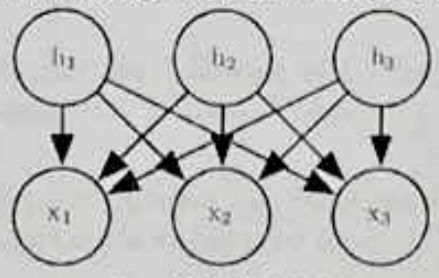


2. Sparse interactions and Parameter sharing are benefits of Convolution. Justify?

OR

B. Show and explain a Recurrent network with recurrent connections between hidden units, that read an entire sequence and then produce a single output.

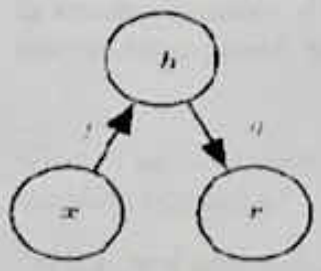
IV. A. Write the significance of the directed graphical factor model given in the figure below:



$\mathbf{x} = W\mathbf{h} + b + \text{noise}$

OR

B. How the kind of a network shown in figure below helps in dimensionality reduction? An input x is mapped to an output (called reconstruction) r through an internal representation is shown in the network given below.



V. Write short notes on:

A. 1. Deep Belief Networks 2. Convolutional Boltzmann Machines

OR

B. 1. Boltzmann Machines 2. Restricted Boltzmann Machines

********* END ********

Department of Computer Science, Cochin University of Science & Technology

M Tech Degree in Computer Science & Engineering with specialization in Data Science & Artificial Intelligence/ Software Engineering, II Semester, I Internal Test, May 2022

21-479-0206: Deep Learning

Max : 20 marks
Time : 2 hours

(Answer All Questions)

I. Analyze the total objective functions given below and comment on the type regularization applied in the models:

(a)

$$\tilde{J}(w; X, y) = \frac{\alpha}{2} w^\top w + J(w; X, y)$$

(b)

$$\tilde{J}(w; X, y) = \alpha ||w||_1 + J(w; X, y)$$

(4 marks)

II. Solve the XOR problem shown

EX-OR gate

Input A	Input B	Output
0	0	0
1	0	1
0	1	1
1	1	0

by using a model that learns a different feature space in which a linear model is able to represent the solution

(4 marks)

III. Show the behaviour of the non linear activation functions given below:

(a)

$$S(x) = \frac{1}{1 + e^{-x}}$$

(b) $F(x) = x, x \geq 0$
$= 0, x < 0$

IV. Describe how Kullback-Leibler divergence helps in learning with maximum likelihood

(4 marks)

V. "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." Elaborate.

(4 marks)

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