REG.NO.: 24BHT0014

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF HEALTHCARE SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

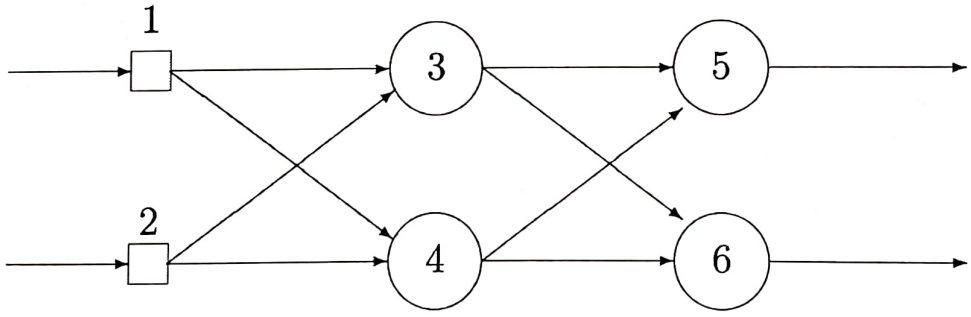
SLOT: B1+TB1

Programme Name & Branch	: B.Tech - Health Sciences and Technology
Course Code and Course Name	: BHST201L - Artificial Intelligence and Machine Learning in Healthcare
Faculty Name(s)	: Kamanasish Bhattacharjee
Class Number(s)	: VL2024250506185
Date of Examination	: 17/03/2025
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)
  3. Demonstrating the use of Supervised, Unsupervised, and Weakly Supervised Learnings in healthcare.
  4. Designing CNN for medical image related tasks.

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>The following diagram represents a feed-forward neural network with one hidden layer:
 

A weight on connection between nodes i and j is denoted by w_{ij}. The weights of the network are $w_{13} = -2$, $w_{14} = 4$, $w_{23} = 3$, $w_{24} = -1$, $w_{35} = 1$, $w_{36} = -1$, $w_{45} = -1$, $w_{46} = 1$. Each of the nodes 3, 4, 5, and 6 uses the following activation function:
$$\varphi(v) = \begin{cases} 1 & v \geq 0 \\ 0 & Otherwise \end{cases}$$
Each of the input nodes (1 and 2) can only receive binary values (0 or 1). Perform forward pass and calculate the output of network (y_5 and y_6) for each of the input patterns:
<table>
<tr><th>Pattern</th><th>P1</th><th>P2</th><th>P3</th><th>P4</th></tr>
<tr><td>Node 1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>Node 2</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
</table></td><td>10</td><td>3</td><td>3</td></tr>
<tr><td>2.</td><td>Consider the dataset given below (Features = Gender, Age, Income; Target = Illness). After one iteration of Adaboost, determine the new sample weights given that the Gender Decision Stump has the lowest Gini Index.</td><td>10</td><td>3</td><td>3</td></tr>
</table>

REG.NO.:

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF HEALTHCARE SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: B1+TB1

Gender	Age	Income	Illness
Male	41	40000	Yes
Male	54	30000	Yes
Female	42	25000	No
Female	40	60000	Yes
Male	46	50000	Yes

3.	a) What are the two objectives/aims of Principal Component Analysis (PCA)? Analyse why these two aims are graphically equivalent.	5	3	4
	b) In k-means clustering, why do we use the Elbow Method to determine the optimum value of ***k***? What is the significance of using Within-Cluster Sum of Squares (WCSS) in Elbow Method?	5		
4.	a) Suppose you are an AI Engineer, and you have a task to train an AI model to identify whether a brain tumour is Malignant or Benign from brain MRI images. You have 5000 brain MRI images of different patients out of which only 1000 are correctly labelled. Right now, you don't have any radiologist at your disposal to ask about the true labels of the unlabelled images. Which Weakly Supervised Learning technique will you implement for training? Defend your choice with appropriate justification.	5	3	5
	b) In Active Learning technique of Incomplete Supervision, for which data points you should query the Oracle for the labels – the points closer to the decision boundary or the points far from the decision boundary? Why?	5		
5.	Construct a Convolutional Neural Network (CNN) where the Feature Extractor has 2 Convolution Layers, 2 Max Pooling Layers, and uses LeakyRelu as the activation function after convolution; the Classifier has only 1 input layer and 1 output layer, and no hidden layers. The CNN takes a 6X6 image input. Both the Convolution Layers use 3X3 filter, (1,1) padding, and (1,1) stride. First Max Pooling Layer uses 2X2 filter, no padding, and (2,2) stride. Second Max Pooling Layer uses 2X2 filter, no padding, and (1,1) stride. Mention the image dimensions after each layer. Determine the image after first convolution for the given image and filter –	10	4	6

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

Image

1	0	-1
1	0	-1
1	0	-1

Filter