Gujarat University

Department of Computer Science

M.Sc. (Artificial Intelligence & Machine Learning) - Defense Specific

Sessional - II

Semester-II

Numerical Optimization

Date: 12th July 2022

Time: 2:00-3:30 pm **Max. Marks:40**

Answer the following questions (Attempt any **Five**)

(Each carries **Eight** marks)

1. Minimize $f(x_1, x_2) = x_1^3 + 2(x_1 - x_2)^2 - 3x_1$ by taking the starting point as $x_0 = \begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix}$ using Newton's Method.
2. Explain Selection process and Crossover used in the Genetic Algorithm using proper examples.
3. Find the least square line $y = a + b \log x$ for data,

X	1	2	3	4	5
Y	-1	0	1	3	3

4. Brief Annealing process and Explain Simulated Annealing.
5. Using Hooke & Jeeves method minimize $f(x, y) = 3x^2 + y^2 - 12x - 8y$. Take initial point (1,1) and increment vector (0.5 , 0.5). Perform three iterations.
6. Explain Fibonacci search method.

Department of Computer Science
Gujarat University
Sessional-II
Subject: Computer Vision

Marks:30

Q1. Define segmentation. Give difference between : **[10]**

i. Region based and boundary based segmentation
ii. Region based and boundary based approach
iii. Structural and stochastic segmentation
iv. Simple and adaptive thresholding
v. Region growing and region splitting and merging

mask & Structuring element

Q2. How clustering based segmentation can be used to reduce the size of an image(compress it ... say initially image is 8-bit image and you want to make it 3-bit) **[2]**

Q3. Define morphological image processing. Explain using the following: **[3]**
Structuring element
Types with examples of structuring elements
Hits and fits

Explain three all

Q4. Create a camera model for the following: **[10]**
Translation by amount G
Rotation w.r.t. x-axis by angle theta
Translation by amount H
Rotation w.r.t. z-axis by angle phi

OR

Derive the equation of Lucas-Kanade method of object tracking.

Q5. Give difference between dilation and erosion . What effects do they have on image? For the given image and structuring element S, find the erosion and dilation image **[5]**

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

1	1	1
1	1	1
1	1	1

MSc (AI&ML – DS) – Semester II
Sessional – II

Subject: Statistical Foundation
Time: 1 hr 30 min

Date: 11 / 07 / 2022
Max. Marks: 40

Instruction:

1) Calculation should be accurate upto 3 decimal places

Q.1 Wealth(W) can be generated from Employment(E) and Investment(I). Health(H) and Wealth(W) are responsible for bringing Joy(J) to a person. Wealth(W) can be donated to charitable(C) institutions (10)

a) Create a Bayesian network using the information given above
b) Name any one causal trail
c) Name any one common cause trail
d) Name any one common effect trail
e) Is C independent of H? Show the active/inactive trail.

Q.2 A dice is thrown 5 times, and getting an odd number is considered a success. Find the probability using Binomial distribution: (5)

a) Exactly one success
b) At least one success

Q.3 Explain any 5 properties of normal distribution (5)

Q.4 What are Type I and Type II errors? Give examples. (5)

Q.5 Explain any five of the following terms: (5)

a) Marginal probability distribution
b) Expected value of a random variable
c) Standard Error
d) Central Limit Theorem
e) Significance Level
f) Chi-square distribution
g) ANOVA

Q.6 What are the different types of sampling methods? Explain each with appropriate examples.

Department of Computer Science
Gujarat University
M.Sc – II (AI & ML – DS)

Total marks = 20

Date: 13 / 07 / 2022

MCQ (1 marks each)

1. In an ANN architecture, if the number of neurons in an input layer is 3 and the number of neurons in the hidden layer is 7, then what will be the number of learnable parameters from the input to the hidden layer?
   a. 20
   b. 21
   c. 22
   d. 23

2. Which of the following type of model can be built using keras?
   a. Sequential
   b. Non-sequential
   c. Consecutive
   d. Non-consecutive

3. Which of the following can be used as an activation function in the output layer of an ANN if we wish to train the model for predicting objects from 10 different classes?
   a. Softmax
   b. ReLU
   c. Sigmoid
   d. Tanh

4. *data = [15,20,3,23,7,5,35,28,19,33]*
   Given the above data, what would be the output of the following code?
   statistics.median_high(data)
   a. 15
   b. 19
   c. 20
   d. 23

5. Which of the following functionalities of scikit-learn can be used for hyperparameter tuning of ML models?
   a. GridSearchCV
   b. Accuracy_score
   c. Classification_score
   d. Confusion_matrix

Answer in short (2 marks each)

1) Explain in short, what do you understand about dropout in keras?
2) Which data types are considered valid as an input for training ML models using scikit-learn? Explain with proper reasoning.

Answer in brief (3 marks each)

1) Explain why do we need to split the dataset in train and test sets, and how can we do it using scikit-learn.
2) How would you use categorical data with dtype: 'string' as an input feature for training a ML model using scikit-learn?
   Specify any one function or method to handle categorical features.

Answer in detail (5 marks)

1) Explain how to evaluate the performance of a regression model and a classification model. Also state the functionalities of python which you can use to evaluate both the types of ML model stated above.

University
ment of Computer Science
(Artificial Intelligence & Machine Learning) – II
(Artificial Intelligence & Machine Learning) – II (Defense Specific)
MCA-II
Sessional - II
Machine Learning

Date: 14th July 2022
Time: 10:30-12:30

Max. Marks : 30

Q.1

A scientist is investigating whether birds of prey exposed to pollutants lay eggs with thinner shells. A random sample of eggs from six nests is chosen and examined for polluted level p and thinning t of the shell . The results obtained are presented in the following table: [07]

p	3	8	30	25	15	12
t	1	3	9	10	5	6

(a) Draw a scatter diagram. (Use graph paper, it will be provided on request)
(b) Find the regression line of t on p of the form $t = a + b\,p$.
(c) Plot (average p, average t) and regression line on the scatter diagram.
(d) The scientist concludes from similar other researches that pollutant level above 18 is likely to result in the death of a chick soon after hatching. Estimate the minimum thickness of its shell that is likely to result in the death of a chick.

Q.1 Attempt the following

OR

[07]

(a) Explain the concept of linear regression model. Why is it not used for classification problems?

(b) Explain Gradient Descent Method for optimization.

Q 2 Attempt the following:

[07]

(a) Define Odds of an event? What are the odds of occurrence of odd number in throwing a fair dice.

(b) What is logit function? Explain, how logit function maps probability to a number in (-infinity, infinity)

(c) Explain the practical reasons for performing optimization in logistic regression using log likelihood function, rather than likelihood function.

(d) Justify the fact that the decision boundary in logistic regression is linear.

Q.3 Answer the following questions (Attempt any Four)

[16]

(i) Explain SVM (Support Vector Machine) with proper example.

(ii) What do you understand by K-Fold Validation? Explain in detail.

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(iii) What are Attribute Selection Measure in Decision Tree? Explain in detail.

(iv) What is ensemble learning? Explain Stacking technique.

(v) The table below shows six training datapoints with their corresponding labels.

Points	X	Y
1	(1,1)	1
2	(2,2)	1
3	(0,0)	-1
4	(2,0)	1
5	(1,0)	-1
6	(0,1)	-1

I. Find Lagrangian multipliers.

II Find weight vector and bias.

III Classify unseen point (3 , -2).