2006E0165

Candidate's Seat No :_____

M.Sc. (A. I. & M. L.) (Sem.-2) Examination
Numerical Optimization
June 2019

Time : 3-00 Hours]

[Max. Marks : 100

Instructions
1. There are two sections in the paper of 50 marks each. Write both the sections in separate answerbooks.
2. All questions are compulsory.
3. Read each question carefully.

Section I

Q.1. Explain Gradient Descent Algorithm in detail. How does the learning rate affect the convergence of the algorithm?   [10 marks]

Q.2. Find the maximum and minimum values of   [10 marks]

$$x^3 + y^3 - 3axy$$

Q.3. Find a unit vector normal to the surface   [10 marks]
$$x^3 + y^3 + 3xyz = 3$$
At the point (1, 2, -1)

Q.4. Expand the following expression upto powers of third degree   [10 marks]
$$e^x log(1 + x)$$

Q.5. Explain the Genetic Algorithm, list down differences with Gradient Descent Algorithm.   [10 marks]

P. T. O.

Section II E165-2

Q.6. Explain Nelder Mead method in detail. How is it different from calculus based methods? [10 marks]

Q.7. Given a sphere of radius 'R', find the volume of the largest (in terms of volume) right circular cone which can be inscribed inside the sphere. [10 marks]

Q.8. Explain the Genetic Algorithm for optimization and list down differences with calculus based methods. [10 marks]

Q.9.
a) Explain Lagrange's method for optimization. [20 marks]
b) Use lagrange's method to find the volume of the largest rectangular parallelepiped that can be inscribed in the ellipsoid
$$x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$$

2106E0172 Candidate's Seat No :_____

M.Sc. (A. I. & M. L.) (Sem.-2) Examination

Advanced Python

Time : 3-00 Hours]

June 2019

[Max. Marks : 100

Note: (1) Make necessary assumptions wherever necessary.

(2) Write precise and to the point answers.

SECTION – I

Q:1 Answer the following (Any Five) [10]

1. Give any two examples of supervised learning.

2. Out of 200 emails, a classification model correctly predicted 150 spam emails and 30 ham emails. What is the accuracy and error rate of the model?

3. What are the measures for selecting attributes in Decision Tree Learning?

4. Draw a decision tree for $A \vee (B \wedge C)$.

5. Write any two strength of Bayes classifier.

6. Why we specify the seed value in "random_state"?

Q:2 Answer the following (Any Two) [20]

1. What are the different causes of data issues in machine learning? What are the fallouts?

2. While predicting malignancy of tumour of a set of patients using a classification model, following are the data recorded:

   (a) Correct prediction – 15 malignant, 75 benign

   (b) Incorrect prediction – 3 malignant, 7 benign

   Calculate error rate, accuracy, sensitivity, precision, and F-measure of the model.

3. State the difference between Bagging and Boosting.

Q:3 Answer the following (Any Two) [20]

1. Explain the process of ensemble of models. What role does in play in machine learning?

2. Explain in detail underfitting and overfitting in machine learning. How are they overcome?
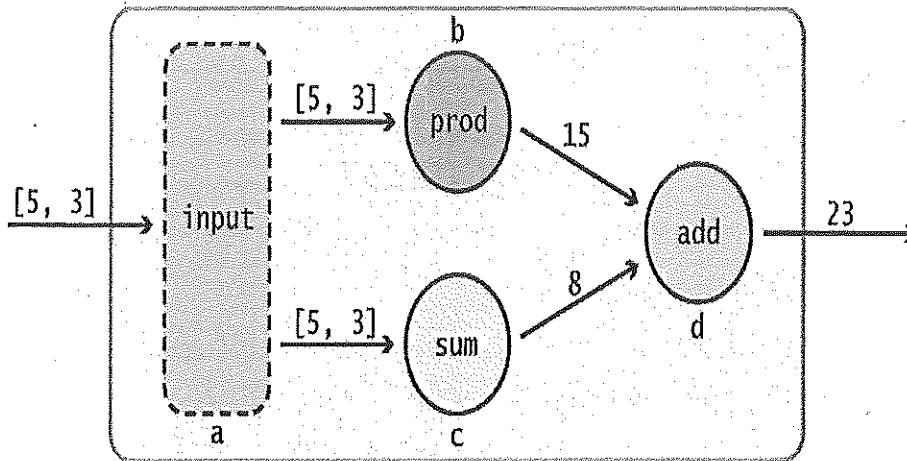
P. T. O.

3. What are the advantages and disadvantages of kNN algorithm?

SECTION – II

Q:4   Answer the following (Any Two)   **[10]**

1. List few advantages of tensorflow.

2. Implement the following graph using tensorflow.

3. Explain hinge loss Vs. logistic loss

Q:5   Answer the following (Any Two)   **[20]**

1. Explain the strengths and weaknesses of Logistic Regression.

2. What do you understand by Tensor in TensorFlow? Explain the structure of Tensor.

3. Explain, in brief, the SVM model.

Q:6   Answer the following (Any Two)   **[20]**

1. Explain (i) Placeholder Vs. Variable (ii) Session() Vs. InteractiveSession()

2. Explain Lasso and Ridge regression.

3. What do you meant by kernel method? What is need of kernel methods?

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2406E0179

Candidate's Seat No :_____

M.Sc. (A. I. & M. L.) (Sem.-2) Examination
Introduction to Machine Learning
June 2019

Time : 3-00 Hours]

[Max. Marks : 100

Note : (1) Write both the sections in the separate answer books
  (2) Figures to the right indicate full marks.
  (3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1   Answer the following:
  An experiment was conducted to study the relationship between concentrations of estrone [18]
  in saliva and in free plasma. The following data were obtained:

Subject	Estrone in saliva(x)	Estrone in free plasma(y)
1	7.4	30.0
2	7.5	25.0
3	8.5	31.5
4	9.0	27.5
5	9.0	39.5
6	11.0	38.0
7	13.0	43.2
8	14.0	49.0
9	14.5	55.0
10	16.0	48.5

  (a) Plot the scatter diagram of the data.
  (b) Estimate the regression line of y on x.
  (c) Plot regression line.
  (d) How good is the fit?
  (e) If the estrone level in saliva is 12.1, predict the level of estrone in free plasma.

Q.2   Answer briefly the following (**Any two**)
  [20]

  (a) A case-control study of 106 participants looked at the association between smoking and
     incidence of lung cancer. Following is the table of observations.

Incidence of Lung Cancer	Smokers	Non Smokers
No	32	11
Yes	60	3

  Fit a logistic regression model to it and interpret the results obtained

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(b) Explain concept of linear regression, cost function. Why is this method called least square straight line fit? Also derive normal equations.

(c) Suppose that a random sample of five families , yielded the following data (measured in thousands of dollars):

Family	Saving S	Income X	Assets W
A	.6	8	12
B	1.2	11	6
C	1.0	9	6
D	.7	6	3
E	.3	6	18

(i) Estimate the multiple regression equation of S on X and W.
(ii) For a family with assets of 5 thousand and income of 8 thousand dollar, what would you predict saving to be?

Q3   Attempt the following (Any Three):   [12]

(a) Give basic differences between linear regression and logistic regression.
(b) Define Odds. What is range of Odds? Assume that the probability of winning a lottery is 0.05. Calculate Odds of winning the lottery as well as odds of not winning the lottery.
(c) What is logit function? Plot the graph of logit function. To what range of real numbers does it map probabilities (range [0,1])
(d) Define Sigmoid function. How is it inverse of logit function?

SECTION-II

Q.4   Answer the following   [16]
(a) What do you understand by soft margin and hard margin ? Explain.
(b) What is the range of values that are possible for the cosine measure? Justify.
(c) For the following vectors, x and y, calculate the cosine similarity and Euclidean distance.
   $x = (0,1,0,1)$, $y = (1,0,1,0)$
(d) Assume, you want to cluster 7 observations into 3 clusters using K-Means clustering algorithm. After first iteration clusters, C1, C2, C3 has following observations:
   C1: {(2,2), (4,4), (6,6)}
   C2: {(0,4), (4,0)}
   C3: {(5,5), (9,9)}

   (i) What will be the cluster centroids if you want to proceed for second iteration?
   (ii) What will be the Manhattan distance for observation (9, 9) from cluster centroid C1 In second iteration?

Q.5   Answer the following   [18]
(a) Explain the basic concept of SVM in your own words.

(b) Design a simple SVM that accurately discriminates the two classes for which following training data is available

Class 1: [1,6], [1,10], [4,11]

Class 2: [5,2], [7,6], [10,4]

OR

Q.5 Answer the following [18]

(a) What is clustering? Differentiate between Hierarchical and Partitional Clustering.

(b) Explain the basic concept of Fuzzy- C mean algorithm in your own words.

Q.6 Differentiate between the Supervised learning and unsupervised learning. Determine [16] which is the best approach (supervised learning or unsupervised learning) for each problem. (Justify your answer)

    (i) Develop a profile for credit card customers likely to carry an average monthly balance of more than $1000.00.

    (ii) Does meaningful attribute relationships exist in a database containing information about credit card customers?

    (iii) Determine whether a credit card transaction is valid or fraudulent.

2506E0186

Candidate's Seat No :_____

M.Sc. (A. I. & M. L.) (Sem.-2) Examination
Introduction to Computer Vision
June 2019

Time : 3-00 Hours]

[Max. Marks : 100

Instructions:
1. Figures to the right indicate full marks
2. Each section should be written in a separate answer book
3. Be precise and to the point in your answer

SECTION-I

1.   Answer the following questions to the point: (Any 10)   [10]
    i. What is Computer Vision? How is it different from Image Processing?
    ii. List any two applications of Computer Vision.
    iii. What is the importance of Kernel?
    iv. Write the rules for applying Erosion on an image.
    v. Draw figure to show Illumination & Reflectance.
    vi. Write the formula for Hit-and-Miss Transform.
    vii. Define: Gradient operator.
    viii. What is a Convolution Filter?
    ix. Take an example of your choice to show image wrap and rotate operations.
    x. What role Hue & Saturation plays in Image Processing?
    xi. What are Spatial Filters?

2.   A. Discuss all Linear and Non-Linear Filters with the help of examples.   [08]
    B. Explain Hough Transform taking appropriate example.   [07]
    C. What is Image Thresholding? What is its importance in processing images?   [05]

OR

2.   A. Distinguish between Discrete Fourier Transform and Discrete Cosine Transform with the help of examples.   [08]
    B. How Edge Detection is done using first and second order derivative?   [07]
    C. Explain the method of Background Subtraction.   [05]

3.   Do as Directed: (Any 2)   [20]
    A. A 4×4, 4 bits/pixel original image is given by:

$$\begin{bmatrix} 10 & 12 & 8 & 9 \\ 10 & 12 & 12 & 14 \\ 12 & 13 & 10 & 9 \\ 14 & 12 & 10 & 12 \end{bmatrix}$$

Apply Histogram Equalization to the image and sketch the histogram of the original image and histogram equalized image.

    B. Consider the image with written text:
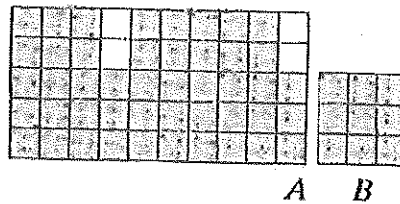
Image Processing

Explain the effect of following operations on the image. Show the results also.
    a) Dilation   b) Closing
    c) Thinning   d) Thickening
    e) Skeletonization

P.T.O.

C.   Extract the boundary of image A by using kernel B:

A   *B*

SECTION-II

4.   **Attempt the following: (Any 1)**   **[10]**
  A.   Considering that the object to be captured is static and a Camera Model is to be set up by performing the following operations in the given order in 3D: Translation t_1, Scaling, Rotation by X-axis in clock-wise direction, Translation t_2 and Rotation by Z-axis in anti-clock-wise direction. Show the complete mathematical derivation for obtaining a Camera Model.
  B.   What is Optical Flow? Explain Horn & Schunk method for optical flow.

5.   A.   What is Convolution Mask? Discuss all necessary properties of a Convolution Mask.   **[08]**
     B.   Discuss the mathematics behind Mean Shift Tracking method.   **[07]**
     C.   Explain the Extrinsic and Intrinsic Camera Parameters.   **[05]**
                                  OR
5.   A.   What are Pyramids? Where are they used? Explain Gaussian and Laplacian Pyramids giving proper example.   **[08]**
     B.   Explain how the Camera Parameters allow you to find camera location and camera orientation?   **[07]**
     C.   What is Distortion? How does it affect the performance of Camera Model?   **[05]**

6.   **Answer the following questions: (Any 4)**   **[20]**
   i.   What is Image Segmentation? Discuss Watershed algorithm for Image Segmentation.
   ii.   Explain the steps of Harris Corner Detection algorithm.
   iii.   What is Mean-shift Segmentation? How it is useful?
   iv.   How Sobel Derivatives are important in image transformation?
   v.   How does Canny Edge Detection method work?

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