Indian Institute of Engineering Science and Technology, Shibpur
BTech 5th Semester End-Semester Examination, November 2023

Soft Computing (CS3123)

Full Marks: 50 **Time: 3 Hours**

Answer any three questions.

Each question carries equal marks.

Two mark is allotted for precise answer.

1. (a) (i) Write equations of cross entropy loss (L) function for binary classification and multiclass classification problems (say, *m* is the number of classes), considering N number of samples. Define all components of the equations.

(ii) What is the relation between predicted probability and loss L? Plot the relationship.

(b) (i) What is the purpose of using gradient based algorithm in Machine Learning?

(ii) What is the difference between Gradient descent and stochastic gradient descent algorithm? 2.5×2+5+4+2

2. (a) Consider the problem of finding the shortest route through several cities, such that each city is visited only once and in the end return to the starting city (the Travelling Salesman problem).

Use genetic algorithm as optimization algorithm to find the shortest distance among 10 cities.

(i) What is the maximum population size in the search space where in a chromosome each gene is represented as the path between a pair of cities in the tour?
(ii) Design the Fitness Function to estimate the shortest route for each solution.

(b) What is the purpose of applying Mutation and Crossover operators in Differential evaluation algorithm for optimization?

(c) In Particle Swarm optimization algorithm, define functionality of particles using expressions for achieving global optimum solution. 4+3+2×2+5

3. (a)

Decision Table

Patient	Attributes			
	Headache	Vomiting	Temperature	Viral illness
#1	No	Yes	High	Yes
#2	Yes	No	High	Yes
#3	Yes	Yes	Very high	Yes
#4	No	Yes	Normal	No
#5	Yes	No	High	No
#6	No	Yes	Very high	Yes

12 + 10 + 6 = 40

Considering the **Decision Table**

(i) Find out reduced attribute set or REDUCT by using attribute dependency method of rough set theory,

(ii) Find out lower approximation set, upper approximation set and boundary region for the target set X = {Patient#1, Patient#2, Patient#3, Patient#6}

(b) Write the steps of Apriori Algorithm.

6+2×3+4

4. (a) Explain why Neuro Fuzzy models are more intelligent compare to Fuzzy based models and neural Network based models if considered individually?

(b) What is the role of Pareto Optimal front in solving Multiobjective optimization problem?

(c) How do you explain Neural network based classification algorithm as an optimization problem? 5+6+5

5. (a) Describe different layers of Convolution Neural Network, used for Image classification.

(b) Why feedforward neural network is not useful for learning of sequence data?

(c) Describe forward propagation of recurrent neural network.

6+4+6

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