Indian Institute of Technology Jammu

PATTERN RECOGNITION

Test 1,   Date: Jan 7th 2023

Duration: 2hr 30min, Max Marks: 30

Instructions*:*

- *Answer only in pen and paper then click photo to convert into pdf and upload. Write your name and roll number also.*
- *Please show all computations. No marks for direct answers.*
- *Keep camera on and mic unmute.*

Q1. Which of the following statement is true? Show an example to support your answer. [4]

a) Likelihood is the probability that we observe the data=x once by varying the parameter θ controlling the distribution.
b) Likelihood is the probability that we observe parameter θ once the distribution of data is defined.
c) Likelihood is the probability that we observe the data=x once the parameter θ controlling the distribution is fixed.
d) Likelihood is probability of observing the data=x and has no correlation with the parameter θ controlling the distribution.

Q2. In maximum likelihood estimation why do we take the log of likelihood and not the likelihood directly? Please explain with suitable equations. [3]

Q3. What are the major differences in Bayes Parameter estimation and Maximum Likelihood estimation technique? Explain in your own words and few lines only. [3]

Q4. Consider a case when patient nasal swab is tested to detect the corona virus. Depending upon the outcome of the report either the patient is declared as infected or non -infected. However it is not always possible that nasal swab that is infected is always detected positive by the test. [5]

- Let H be the event that the patient is infected.
- Let nH be the event that the patient is non-infected.
- Let pos be the event that the patient actually corona positive.
- Let neg be the event that the patient actually corona negative.

  Then let $P(H) = 0.15 , P(Pos|H) = 0.95, \ P(Pos|nH) = 0.02$
  What is the probability that the patient is infected with corona given the test outcome is positive? Show your computations.

Q5. Consider a student taking a 4 year BTech course in IIT Jammu. Let there be an efficiency score (EF) falling in the range [0, 50]. The students who are able to complete the course in 4 years have EF scores following a normal distribution with mean 30, and std 5. The students

who are not able to complete the course in 4 years also have EF scores following normal distribution with mean 20 and std 4.

Let G be the event that the student graduates in 4 years and let nG be the event that he does not graduate in 4 years. Suppose that 80% of the students who take admission are able to complete their graduation within 4 years. Let x denote the EF score of the student. [10]

a) Then what is the probability that a student will graduate in 4 years given his EF score is x=25 ?
b) How will you find out the min EF score that maximizes the probability that a student graduates in 5 years.

First frame your problem, outline all major notations and solve step wise to show the results.

Q6. Chain codes: given this 8 directional chain code and following two figures: [5]
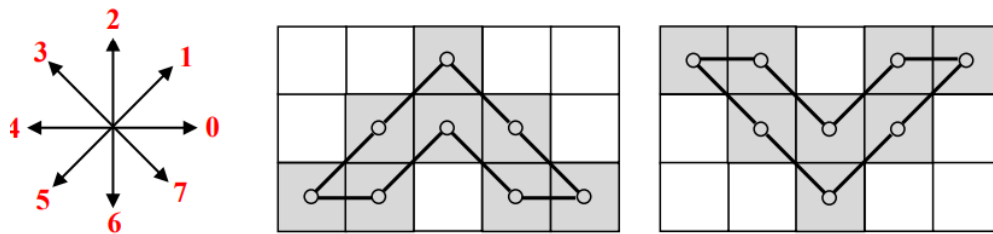
a) What is the chain code for the Λ like figure starting from lower left point?
b) How can you write the description of Λ shape object independent of its starting point? Explain step wise taking the above example.
c) Which technique you will use to prove that both Λ -like and V-like objects get same descriptor, irrespective of their starting point?