Machine Learning Mid Sem Spring 2021 Set-3

Instructions

1. This is a **closed book online proctored** exam.
   a. You should not refer to books, notes or online resources.
   b. You should not discuss questions or answers with anyone (including outsiders)
   c. You should have your camera and microphone **ON** at all times and no headphones.
2. Write the solutions clearly and legibly in A4 sheets, using pen (NOT pencil) and at the end of the exam you should submit the scanned copy of your solutions as explained by the faculty
3. **Write your name, roll no. and question set (e.g. Set-3) on each page.**
4. Follow all other instructions given by the faculty during the exam.

Descriptive Questions (10 Marks each)

1. State conditional risk of the Bayes theorem for two-category classification. Suppose for example a RT-PCR test for the SARS-COV2 (COVID19) virus is 95% accurate. The test gives a positive result for 95% of those taking the test who are COVID19 positive. Also, the test gives a negative result for 95% of those taking the test who are not COVID19 positive. In country X, forty percent of the residents are COVID19 positive. Suppose a random resident of Country X takes the RT-PCR test and tests positive, what is the probability that the person is infected given that they have tested positive? $(3 + 7)$

2. (a) Define maximum-likelihood estimation for linear regression with an example. (2)
   (b) What is the difference between MLE and MAP? (2)
   (c) What is the tradeoff between bias and variance? Give an example. (2)

(d) Find the Maximum-likelihood for the parameter θ of the binomial distribution given below

$$P(k, \theta) = \binom{n}{k}\theta^k(1 - \theta)^{n-k} \qquad (4)$$