CSE 535 Midterm Spring 2021. Potential points 60

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Q1: There are three ways of monitoring occurrences of Covid19 in a community: [10 points]

A) Rapid test, which can give results within 15 mins of administering the test, but is less accurate and has poor accuracy detect COVID19 in the early stages of infection. This means that rapid test cannot detect COVID19 if you are asymptomatic.

B) PCR test, which takes 2 – 3 days to obtain results, but can detect COVID19 in the asymptomatic phase and early in the disease prognosis.

In a city you have a population of P. You do not have enough tests to test everybody in the city. However, the COVID19 occurrence rate is only 5%. You have two goals: a) detection of COVID19 in the asymptomatic phase, and b) estimate the percentage of COVID19 infections that are asymptomatic.

Describe two strategies for each goal and reason which sensor you will use and when keeping in mind that you have limited supply of tests.

Q2: Volunteer computing is an idea that we discussed in Module 1. Give one example other than the ones discussed in the video that can utilize volunteer computing. [10 points]

Q3: Markov chain is a type of context model that can be used to model many different contexts such as battery states, or location of a person. Stationary property of a Markov chain is an important mathematical property that can be used to determine long term stable relationships between context parameters.

a) Explain what is the stationary property. [5 points]
b) Show an example of how the stationary property can be used in a mobile computing application. [5 points]
c) Does the stationary property of Markov chain always exist? Please explain [5 points]
d) Consider that a Markov chain based mobility model with two states A and B is in stationary condition. Let us assume that given a person is in state A the average number of steps to reach state B is t. Consider the case that the person now takes 3 state transitions and returns back to A. What is the average number of steps taken to reach state B? [5 points]

Q4: You have to develop a diet monitoring application. You want to measure the amount of food consumed by an individual with eat bite. You can install any wearable sensor you would like on the person, but you cannot ask the person to carry a specific utensil with him all the time. You cannot take video. Give a methodology to measure the food weight consumed in each bite. [5 points]

Q5: In adversarial machine learning there is a trade-off between defense strategy and performance of a machine. For example, if we attempt to protect an SVM from poisoning attack, it results in reduction in

the precision and recall of the SVM. What is the core reason behind such an effect? Please provide your reasoning in terms of the confusion matrix of the machine learning system. [5 points]

Q6: Give one real life example each of perturbation and causative attack on a practical deployment of any autonomous system. [10 points].