CS 8750

HW #4: machine learning (10 points)

Spring 2017
(Due 3/14, Tuesday, midnight)

Part I (8 points)

1. (4 points) Candy comes in two flavors: cherry and lime. Candy is wrapped and we can't tell which flavor until opened. There are 3 kinds of bags of candy:
   - H_1= 75% cherry, 25% lime
   - H_2= 50% cherry, 50% lime
   - H_3= 25% cherry, 75% lime

   The hypothesis prior over H_1, H_2, and H_3 is $\{0.4, 0.2, 0.4\}$. Given a new bag of candy,
   a) if we draw one candy and it is cherry. Using **Bayesian learning**, what's the probability that the next candy drawn from the bag is also cherry?
   b) if we draw one candy and it is cherry. Using **maximum a posteriori (MAP) learning**, what's the probability that the next candy drawn from the bag is also cherry?
   c) if we draw two candies and they are both cherry. Using **Bayesian learning**, what's the probability that the next candy drawn from the bag is also cherry?
   d) if we draw two candies and they are both cherry. Using **maximum a posteriori (MAP) learning**, what's the probability that the next candy drawn from the bag is also cherry?

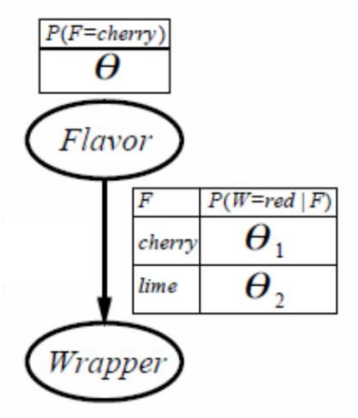
2. (1 point) Given the following data X, using the ML Gaussian estimator, what is $\boldsymbol{\mu}$? What is $\boldsymbol{\sigma^2}$?

   X: 1, 2, 3, 4, 6, 8

3. (3 points) Given the following Bayesian network model for the case of candies with an unknown proportion of cherries and limes, where the wrapper color (red or green) probabilistically depends on the candy flavor. Suppose we unwrap 10 candies and they are as follows.

   (cherry, red), (cherry, green), (lime, red), (lime, red), (cherry, red), (lime, green), (cherry, green), (cherry, red), (lime, red), (cherry, red).

   What are the maximum likelihood estimation (MLE) of parameters θ, θ_1, and θ_2?



Part II (2 points)

Find and read a paper that applies HMM and particle filter algorithm to solve some problems and write a 1-page review. Specifically, the requirements are as follows:

1. Find a technical paper published in the recent 5 years on your topic.
2. In your submission, explain briefly why you select this paper, and then write a 1-page review of it by following the guideline in How to read a paper (slides). Comment on the effectiveness of the method.

Later, everyone will be given 2 minutes in class to share your paper.