COMPUTER SCIENCE AND ENGINEERING
Indian Institute of Technology, Palakkad
CS2180: Artificial Intelligence Lab

01 Feb, 2019

Lab 4

Time: 3 hrs

1. A village contains only kids and adults. The probability of a random citizen being a kid is given by $P(kid)$ and that of an adult is $P(adult)$. Each person is also having a discrete attribute called height denoted by x, which takes values in the set $\{4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8\}$. The probability of height given that the person is a *kid* and *adult* is given by

$$p(x|kid) = [0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1]$$

and

$$p(x|adult) = [0.02, 0.02, 0.02, 0.02, 0.02, 0.18, 0.18, 0.18, 0.18, 0.18]$$

   (a) Implement an environment called *village* that produces a random person in this village, i.e., it gives out the two tuple (kid/adult,height). Query the environment for say $n = 100$, 1000 times and then show the histograms for age, height, height given age. [25]

   (b) Implement an agent which is initialized with $P(kid) = p$ as input. The agent should also contain another method which maps the height attribute to deciding adult or kid, using *Bayes Rule.* [15]

   (c) Computing the expected loss of a given decision: Initialize the agent as well as environment, query the environment some $n = 100$, 1000 or 10000 times. Pass the height attribute to the agent and get the decision. The loss is 1 if the decision is not same as the state, otherwise it is 0. Average the loss over n, and print it. [10]

2. A village contains kids as well as adults. The probability of kids is given by $P(kid)$ and that of adult by $P(adult)$. Each person is also having a *continuous attribute* called height denoted by x

   (a) Repeat Q.1 for the following (see figure below): [10]

   (b) Repeat Q.1 when $p(x|kid) = \frac{1}{\sqrt{2\pi}\sigma_1} e^{-\frac{1}{2}\left(\frac{x-\mu_1}{\sigma_1}\right)^2}$ and $p(x|adult) = \frac{1}{\sqrt{2\pi}\sigma_2} e^{-\frac{1}{2}\left(\frac{x-\mu_2}{\sigma_2}\right)^2}$ are both one-dimensional Gaussian random variables. [10]

3. Repeat Q 2.2, with two attributes namely height and weight, i.e., $x = (x_1, x_2)$, where x_1 denotes height and x_2 denotes weight.

$$p(x|kid) = \frac{1}{\sqrt{2\pi}\sigma_{11}} e^{-\frac{1}{2}\left(\frac{x_1-\mu_{11}}{\sigma_{11}}\right)^2} \frac{1}{\sqrt{2\pi}\sigma_{12}} e^{-\frac{1}{2}\left(\frac{x_2-\mu_{12}}{\sigma_{12}}\right)^2}$$

and

$$p(x|adult) = \frac{1}{\sqrt{2\pi}\sigma_{21}} e^{-\frac{1}{2}\left(\frac{x_1-\mu_{21}}{\sigma_{21}}\right)^2} \frac{1}{\sqrt{2\pi}\sigma_{22}} e^{-\frac{1}{2}\left(\frac{x_2-\mu_{22}}{\sigma_{22}}\right)^2}$$

[20]

End of paper