Washington State University
School of Electrical Engineering and Computer Science
Fall 2020

CptS 440/540 Artificial Intelligence
Homework 10
Due: November 19, 2020 (11:59pm pacific time)

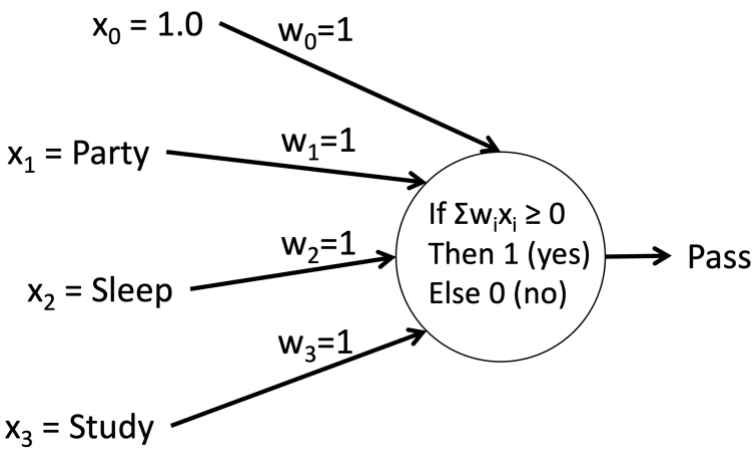
General Instructions: Put your answers to the following problems into a PDF document and submit as an attachment under Content → Homework 10 for the course CptS 440 Pullman (all sections of CptS 440 and 540 are merged under the CptS 440 Pullman section) on the Blackboard Learn system by the above deadline. Note that you may submit multiple times, but we will only grade the most recent entry submitted before the deadline.

1. Consider the table of data below, which contains seven examples of the class value Pass based on the features Party, Sleep and Study. Suppose we want to classify the new instance <Party=yes, Sleep=yes, Study=yes> using the Naïve Bayes learning method. Compute the following. Show your work. Note: use the "add 1 / |values|" method if the original P(feature | class) = 0.

Party	Sleep	Study	Pass
yes	yes	no	no
yes	no	yes	no
yes	no	no	no
no	yes	yes	yes
no	yes	no	yes
no	no	yes	yes
no	no	no	no

   a. Compute the prior probabilities P(Pass=yes) and P(Pass=no).
   b. Compute P(Party | Pass) for all combinations of Party ∈ {yes, no} and Pass ∈ {yes, no}.
   c. Compute P(Sleep | Pass) for all combinations of Sleep ∈ {yes, no} and Pass ∈ {yes, no}.
   d. Compute P(Study | Pass) for all combinations of Study ∈ {yes, no} and Pass ∈ {yes, no}.
   e. Compute P(Pass=yes | Party=yes, Sleep=yes, Study=yes) and P(Pass=no | Party=yes, Sleep=yes, Study=yes).
   f. Which class would Naïve Bayes choose for the new instance?

2. Train a perceptron on the 7 examples from the table in Problem 1 and then use the trained perceptron to classify the new instance. Specifically,
    a. First, translate the examples (including the Pass class value) according to the mapping: no→ 0, yes → 1. Show a new table of examples using this mapping.
    b. Train the perceptron below by updating the weights according to the perceptron learning rule (slide 34 of Learning lecture). Assume the initial weights are all equal to 1.0, and the learning rate $\eta = 0.25$. Consider each example in the order presented in the table in Problem 1 and show the weight updates for each incorrectly-classified example. Continue until the perceptron correctly classifies all the training examples. Show the final perceptron weights. *Hint*: The perceptron should correctly classify all 7 examples on the 3rd pass through the examples.
    c. How would the trained perceptron classify the new instance <Party=yes, Sleep=yes, Study=yes>? Show your work.



3. *CptS 540 Students Only*: Put the 7 training examples from the table in Problem 1 into an ARFF file suitable for input to WEKA. Follow the procedure below to run the Naive Bayes classifier.
    a. Download and install WEKA from www.cs.waikato.ac.nz/ml/weka/downloading.html.
    b. Start WEKA and choose the Explorer mode.
    c. Under the Preprocess tab, choose "Open file..." and load your ARFF file.
    d. Under the Classify tab, choose the "bayes→NaiveBayes" classifier.
    e. Under Test options, choose "Use training set".
    f. Click Start to run the classifier on your data.
    g. Include your ARFF file and WEKA's output in your submission.