

Assignment 9

CS 750/850 Machine Learning

- **Due:** May 4th at 11:59PM
- **Submission:** Turn in both a **PDF** and the **source code** on MyCourses
- **Questions:** Piazza
- **Office hours:**
 - Marek: Wed 1:30-2:30pm (email for an appointment)
 - Soheil: Mon 2pm-4pm
 - Xihong: Thu 1:30-3:30pm <https://unh.zoom.us/j/587656408>

Problem 1 [50%]

For this exercise, refer to Chapter 14 of the Russel & Norvig's Artificial Intelligence. It's pdf should be available on mycourses.

We have a bag of three biased coins a, b, c with probabilities of coming up heads of 0.2, 0.6, 0.8, respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each coin), and then the coin is flipped three times to generate outcomes X_1 , X_2 , and X_3 .

1. Draw the Bayesian network corresponding to this setup and define the necessary CPT.
2. Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once. *Hint:* Need to consider only one permutation of flips.

Problem 2 [50%]

Fit a small neural network model to the 'ISLR::Caravan' dataset (You can apparently). The description of the datasets states:

The data contains 5822 real customer records. Each record consists of 86 variables, containing sociodemographic data (variables 1-43) and product ownership (variables 44-86). The sociodemographic data is derived from zip codes. All customers living in areas with the same zip code have the same sociodemographic attributes. Variable 86 (Purchase) indicates whether the customer purchased a caravan insurance policy. Further information on the individual variables can be obtained at <http://www.liacs.nl/~putten/library/cc2000/>

Predict the variable **Purchase** from a subset (at least 5) of the other variables. Experiment with at least two different configurations of layers. Report how well your method works (remember a training/test set split!).

You can use the example in the class repository located at `notebooks/class22/keras_example.Rmd` to get you started. See also <https://keras.rstudio.com/> for a tutorial in R and <https://keras.io/> for one in Python. Even when using R, the Python documentation for Keras maybe useful because the R library is a wrapper around the Python package.