QM-7063 Data Mining
Professor: Dr. Abdulrashid
Learning Practice 10 – Noah L. Schrick

Problem 5.7

Table 5.7 shows a small set of predictive model validation results for a classification model, with both actual values and propensities.

Table 5.7

Propensity of 1	Actual
0.03	0
0.52	0
0.38	0
0.82	1
0.33	0
0.42	0
0.55	1
0.59	0
0.09	0
0.21	0
0.43	0
0.04	0
0.08	0
0.13	0
0.01	0
0.79	1
0.42	0
0.29	0
0.08	0
0.02	0

a.) Calculate error rates, sensitivity, and specificity using cutoffs of 0.25, 0.5, and 0.75.

The table was first created in Python using a Pandas DataFrame.

Using this DataFrame, rows were iterated through using Pandas' iterrows function. Each value in the "Propensity of 1" column was compared to its corresponding "Actual" value. True negatives, true positives, false negatives, and false positives were counted throughout the row iteration.

After iterating through all rows, error rates, sensitivity, and specificity were computed using the following equations:

$$ErrorRate = 1 - \frac{(True\ Positives) + (True\ Negatives)}{(True\ Positives) + (True\ Negatives) + (False\ Positives) + (False\ Negatives)} \quad (1)$$

$$Sensitivity = \frac{(True\ Positives)}{(True\ Positives) + (False\ Negatives)} \quad (2)$$

$$Specificity = \frac{(True\ Negatives)}{(True\ Negatives) + (False\ Positives)} \quad (3)$$

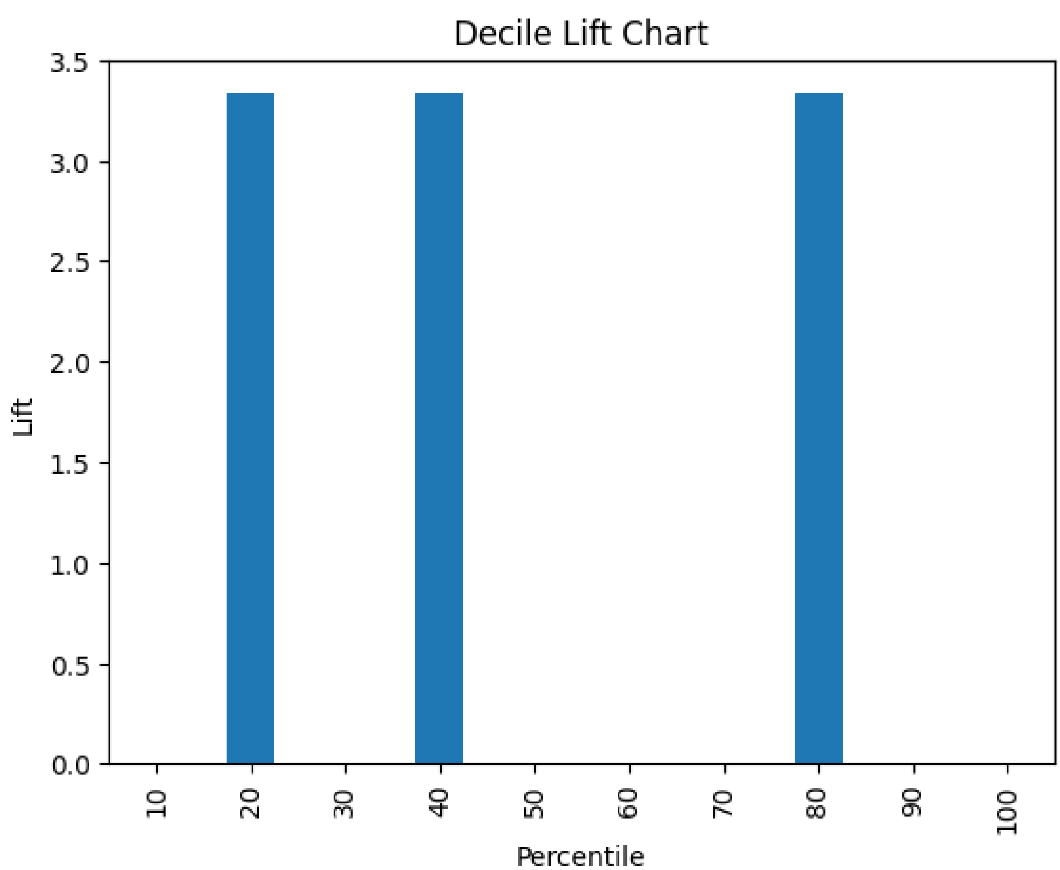
This process was looped through for each cutoff value. The results are as follows:

Cuttoff value of 0.25 has error rate = 0.4, sensitivity = 0.273 and specificity = 1.0
Cuttoff value of 0.5 has error rate = 0.1, sensitivity = 0.6 and specificity = 1.0
Cuttoff value of 0.75 has error rate = 0.05, sensitivity = 0.667 and specificity = 1.0

Cutoff	Error Rate	Sensitivity	Specificity
0.25	0.40	0.273	1.0
0.50	0.10	0.60	1.0
0.75	0.05	0.667	1.0

b.) Create a decile lift chart.
The decile lift chart was created using the DMBA library. Specifically, the liftChart function was used, passing in the first column (Propensity of 1) as the “predicted y values”, and the second column (Actual) as the “actual y values”.

The chart obtained is shown below.



APPENDIX

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# Learning Practice 10 for the University of Tulsa's QM-7063 Data Mining Course
# Evaluating Predictive Performance
# Professor: Dr. Abdulrashid, Spring 2023
# Noah L. Schrick – 1492657

import pandas as pd
from dmba import liftChart

data = [
        [0.03, 0],
        [0.52, 0],
        [0.38, 0],
        [0.82, 1],
        [0.33, 0],
        [0.42, 0],
        [0.55, 1],
        [0.59, 0],
        [0.09, 0],
        [0.21, 0],
        [0.43, 0],
        [0.04, 0],
        [0.08, 0],
        [0.13, 0],
        [0.01, 0],
        [0.79, 1],
        [0.42, 0],
        [0.29, 0],
        [0.08, 0],
        [0.02, 0]
        ]

table = pd.DataFrame(data)
for cutoff in [0.25, 0.5, 0.75]:
        TP = 0; TN = 0; FP = 0; FN = 0
        for row in table.iterrows():
                if (row[1][0] >= cutoff and row[1][1] == 1):
                        TP = TP + 1
                elif (row[1][0] < cutoff and row[1][1] == 0):
                        TN = TN + 1
                elif (row[1][1] >= cutoff and row[1][1] == 0):
                        FP = FP + 1
                else:
                        FN = FN + 1

                ER = round(1 - (TP+TN)/len(table.index), 3)
                if TP+FN == 0:
                        sens = 0
                else:
                        sens = round(TP/(TP+FN), 3)
                if TN+FP == 0:
                        spec = 0
                else:
                        spec = round(TN/(TN+FP),3)

        print("Cuttoff value of " + str(cutoff) +
              " has error rate = " + str(ER) + "," +
              " sensitivity = " + str(sens) +
              " and specificity = " + str(spec))


liftChart(table[1], labelBars=False)
```