Individual Assignment 8

Topic: Logistic Regression, Performance, and Over-Sampling in RapidMiner

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STUDENT ID: ____105078702________________________

Submission instruction:

1. Upload a single PDF to Canvas. It should include all the screenshots and answers to (a)-(g).
2. Hand in the printed copy of your document in class.

Data Details and Goal:

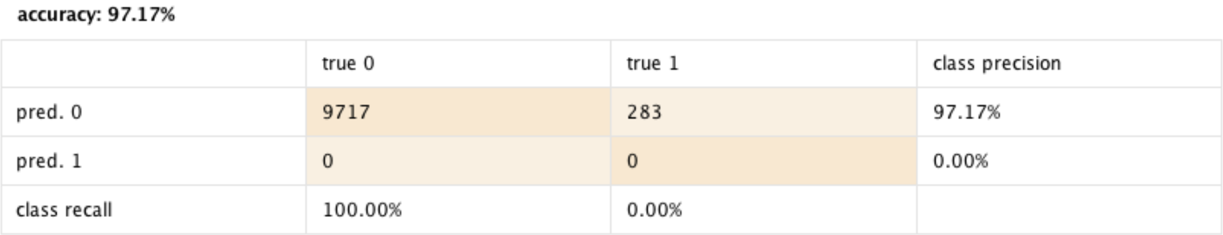
We continue to use the dataset from Assignment 7, in *HubwayTripsByRegistered.xlsx (or csv)*. Reminder: the file has a derived column **trip_type** which says whether the trip started and ended in the same station ("RoundTrip") or not ("OneWay").

Our goal is to classify the trip type of a new ride, right after the bike is taken from the station. Create a CSV file from your Assignment 7 file, that includes all dummies, after sampling 30,000 records.

In RapidMiner:

- Select only the relevant attributes (outcome and predictors) to be used in the logistic regression model.
- Partition the dataset into training, validation, and test sets (equal percentages). Use local random seed 1234.
- Run a logistic regression of *trip_type* with predictors DOW, gender, and hour_bin (all are dummies).

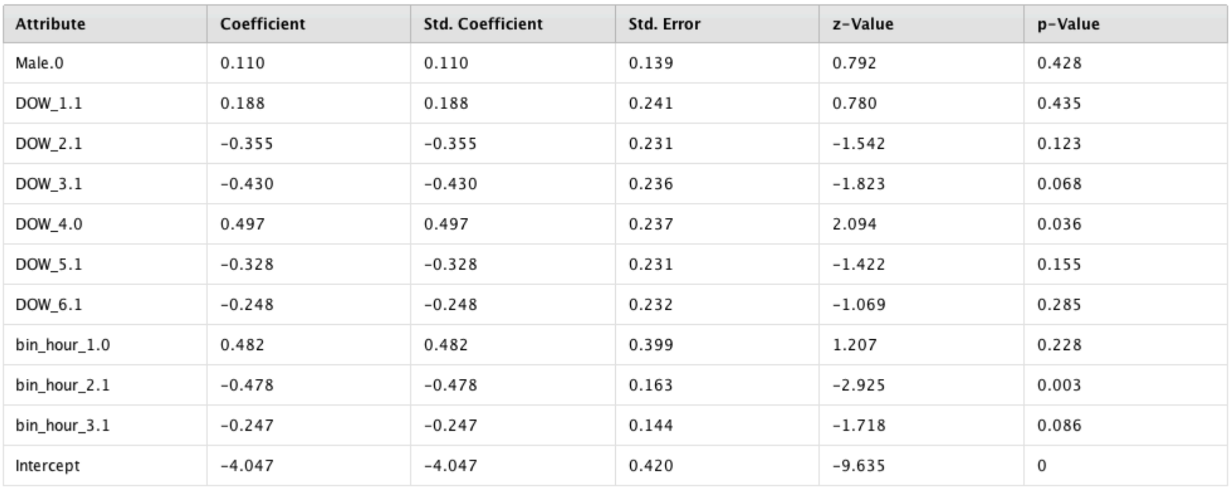
(a) How well does the model with all predictors perform in terms of *classification*? Include a screenshot of the Validation confusion matrix, sensitivity, and specificity.



accuracy: 97.17%

	true 0	true 1	class precision
pred. 0	9717	283	97.17%
pred. 1	0	0	0.00%
class recall	100.00%	0.00%	

(b) Include a screenshot of the model coefficient information.



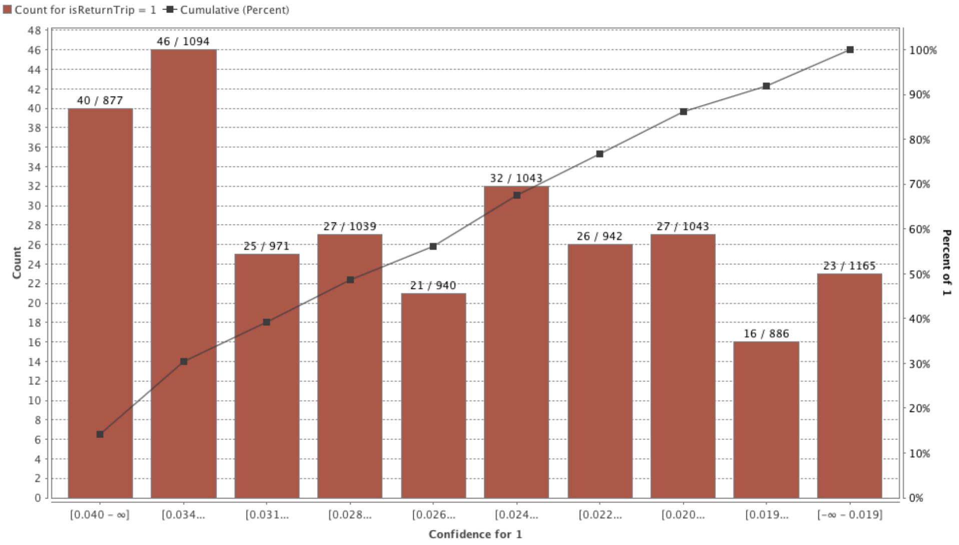
Attribute	Coefficient	Std. Coefficient	Std. Error	z-Value	p-Value
Male.0	0.110	0.110	0.139	0.792	0.428
DOW_1.1	0.188	0.188	0.241	0.780	0.435
DOW_2.1	-0.355	-0.355	0.231	-1.542	0.123
DOW_3.1	-0.430	-0.430	0.236	-1.823	0.068
DOW_4.0	0.497	0.497	0.237	2.094	0.036
DOW_5.1	-0.328	-0.328	0.231	-1.422	0.155
DOW_6.1	-0.248	-0.248	0.232	-1.069	0.285
bin_hour_1.0	0.482	0.482	0.399	1.207	0.228
bin_hour_2.1	-0.478	-0.478	0.163	-2.925	0.003
bin_hour_3.1	-0.247	-0.247	0.144	-1.718	0.086
Intercept	-4.047	-4.047	0.420	-9.635	0

(c) If our goal is *ranking* the top 20% of rides most likely to be RoundTrip, how well does our model perform compared to randomly choosing 20% of rides? Include a chart that supports your answer. See these two videos on ranking in RapidMiner:

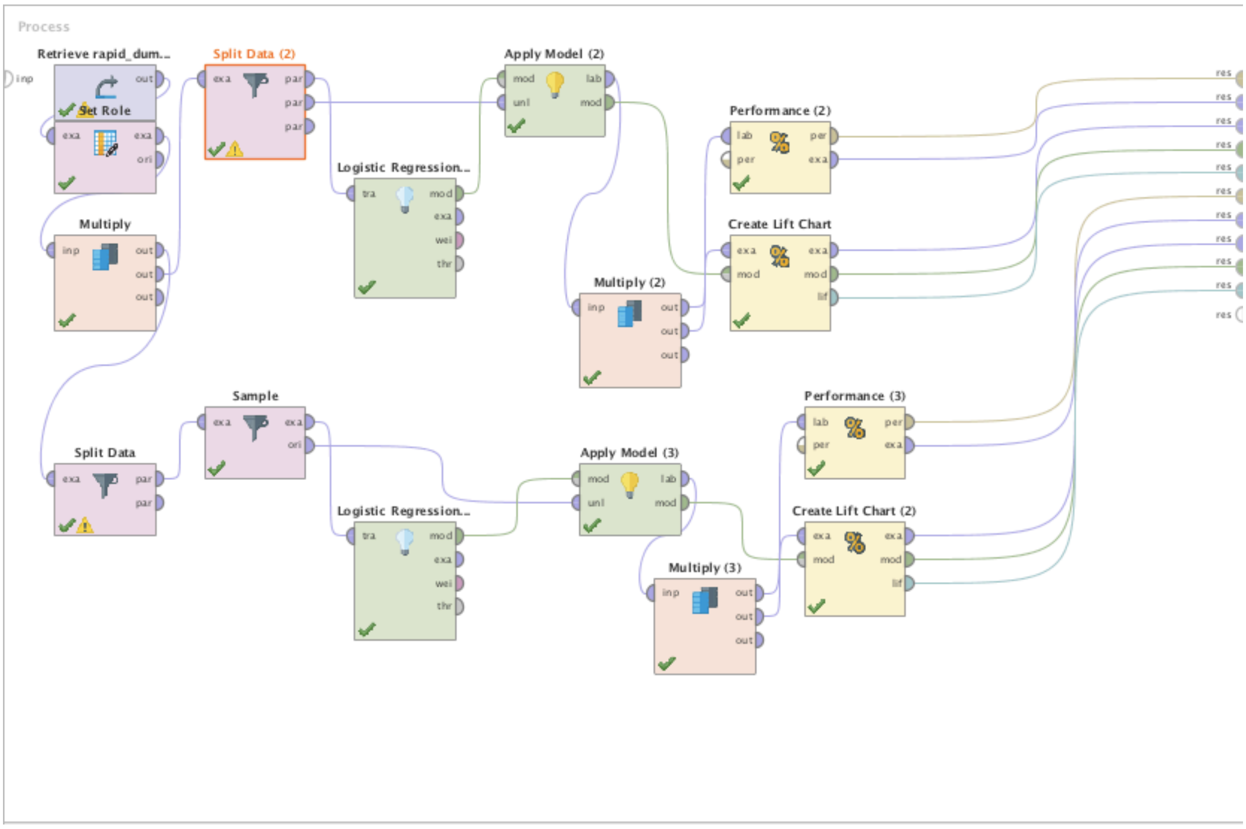
https://www.youtube.com/watch?v=bsiG-xCoKP8

https://www.youtube.com/watch?v=j6Hxf5UtDKU

Ans. The model ranking the top 20% of rides most likely to be RoundTrip has a better performance than the one randomly choosing 20% of rides.



(d) Include a screenshot of your **Main Process**



Over-sampling:

Re-use your data partitioning. Now we want the training data to be over-sampled (50%-50%) , but not the validation and test sets!

In RapidMiner, apply *Sample* for the training data. In the options, click on "balance data" (it might be a hidden parameter – find it!). Create a sample that includes all the RoundTrip records and an equal number of OneWay records.

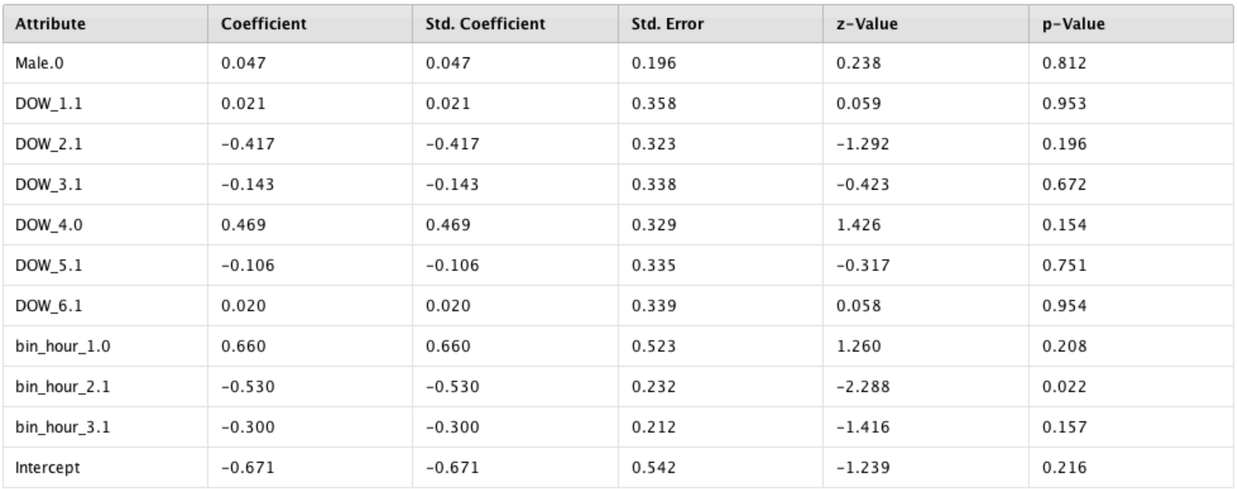
(e) Fill in the table to show your over-sampling procedure:

	# records	**% *ReturnTrip***
Training	10000	50%
Validation	10000	2.83%
Test	10000	2.51%

Re-run logistic regression on the over-sampled training dataset. Apply the model to the validation and test data.

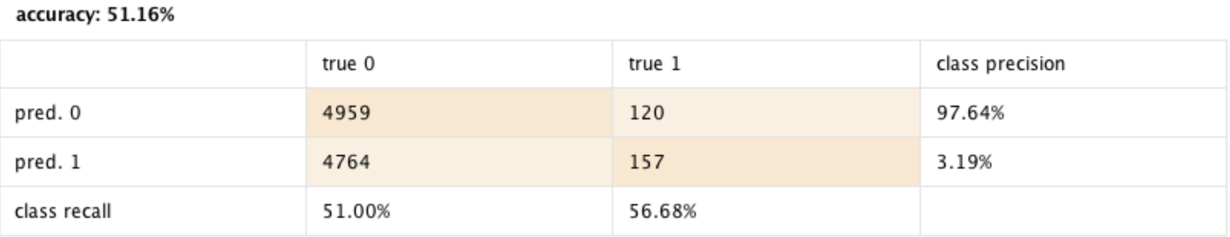
(f) Compare the results to the model which was run on the random partitioning:

- The coefficients in the two models are different – include a screenshot of your model coefficients



Attribute	Coefficient	Std. Coefficient	Std. Error	z-Value	p-Value
Male.0	0.047	0.047	0.196	0.238	0.812
DOW_1.1	0.021	0.021	0.358	0.059	0.953
DOW_2.1	-0.417	-0.417	0.323	-1.292	0.196
DOW_3.1	-0.143	-0.143	0.338	-0.423	0.672
DOW_4.0	0.469	0.469	0.329	1.426	0.154
DOW_5.1	-0.106	-0.106	0.335	-0.317	0.751
DOW_6.1	0.020	0.020	0.339	0.058	0.954
bin_hour_1.0	0.660	0.660	0.523	1.260	0.208
bin_hour_2.1	-0.530	-0.530	0.232	-2.288	0.022
bin_hour_3.1	-0.300	-0.300	0.212	-1.416	0.157
Intercept	-0.671	-0.671	0.542	-1.239	0.216

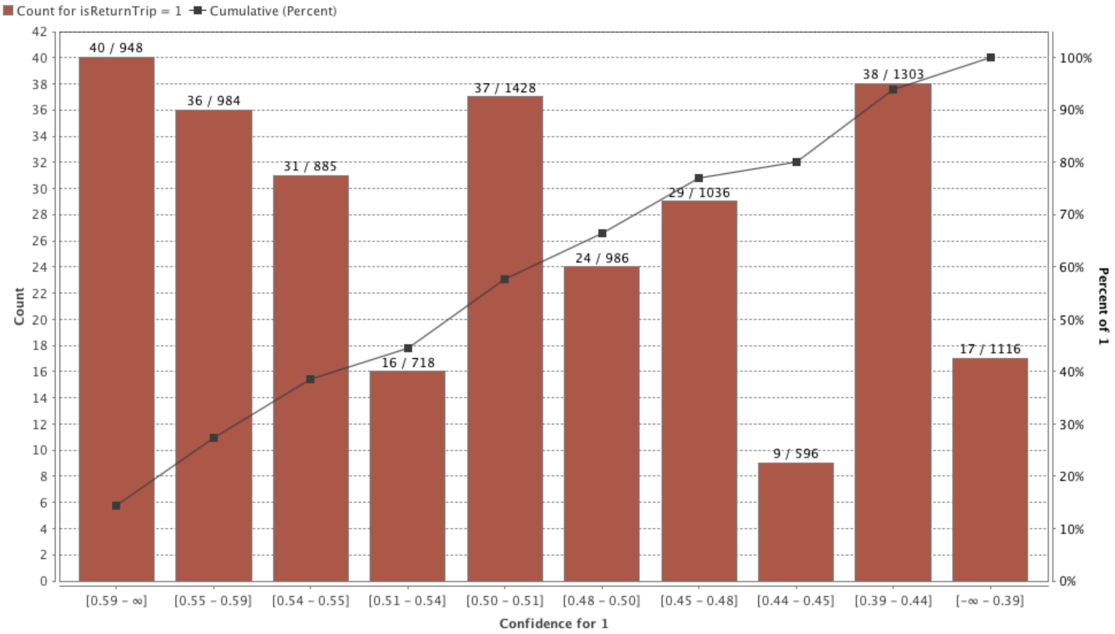
- The validation overall error rate is equal to _48.84%_. It is higher with oversampling.
- The validation sensitivity to *ReturnTrip* is ___3.19%___. It is higher with oversampling.



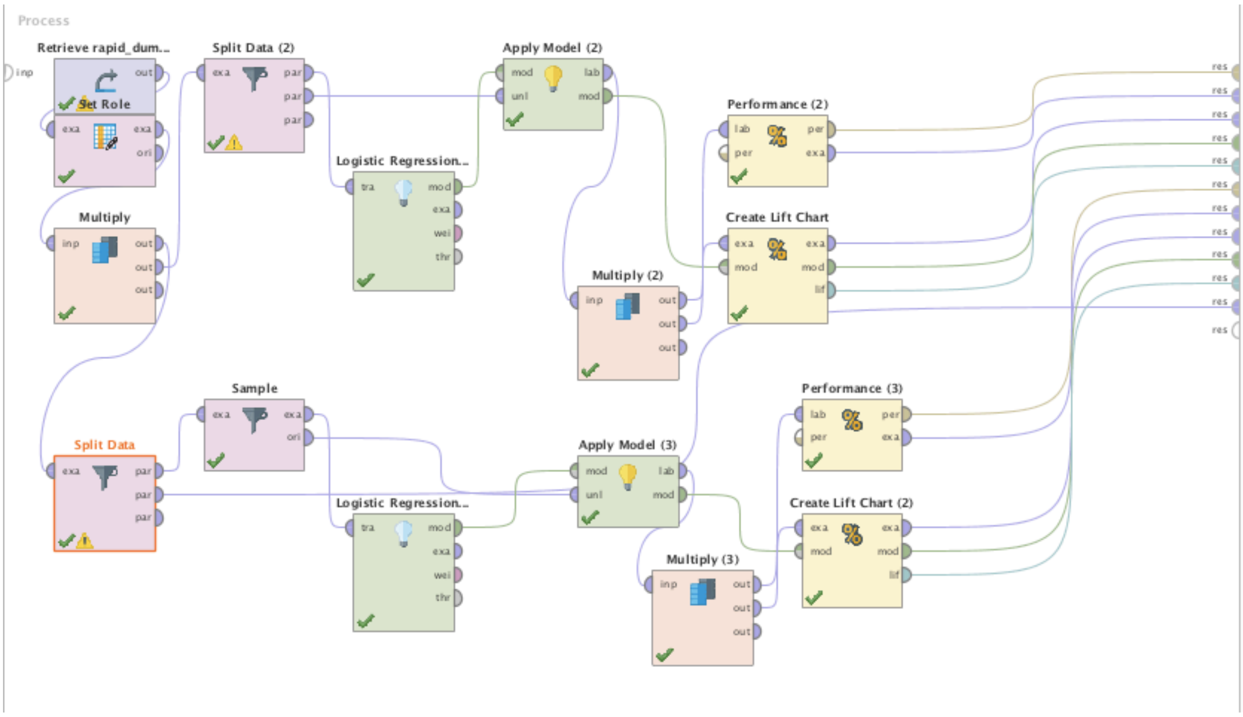
accuracy: 51.16%

	true 0	true 1	class precision
pred. 0	4959	120	97.64%
pred. 1	4764	157	3.19%
class recall	51.00%	56.68%	

- The validation lift, first decile, is higher with oversampling – include a screenshot of your lift chart.



(g) Include a screenshot of your **Main Process (Design)**


Process
Retrieve rapid_dum...
Split Data (2)
Apply Model (2)
Set Role
Logistic Regression...
Performance (2)
Create Lift Chart
Multiply
Multiply (2)
Sample
Split Data
Apply Model (3)
Performance (3)
Logistic Regression...
Create Lift Chart (2)
Multiply (3)