Individual Assignment 8

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

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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:

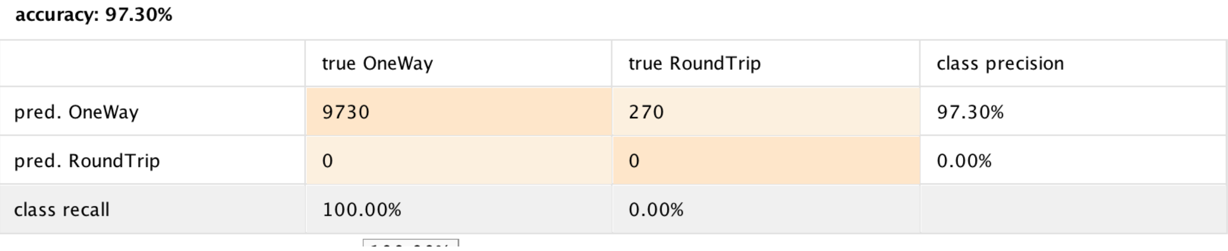
We continue to use the dataset from Assignment 7, in *HubwayTripsByRegistered.xlsx (or csv)*. Reminder: the file has a derived column **trip_type** which says whether the trip started and ended in the same station ("RoundTrip") or not ("OneWay").

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).

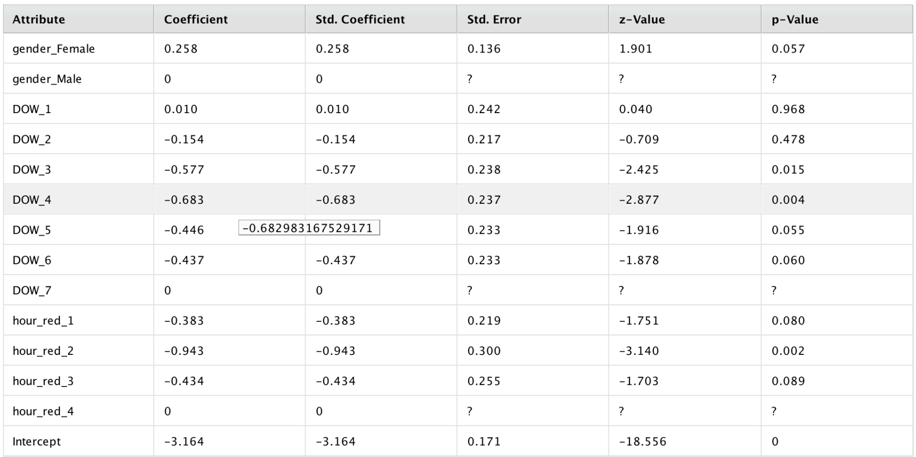
(a) How well does the model with all predictors perform in terms of *classification*? Include a screenshot of the Validation confusion matrix, sensitivity, and specificity.



accuracy: 97.30%

	true OneWay	true RoundTrip	class precision
pred. OneWay	9730	270	97.30%
pred. RoundTrip	0	0	0.00%
class recall	100.00%	0.00%	

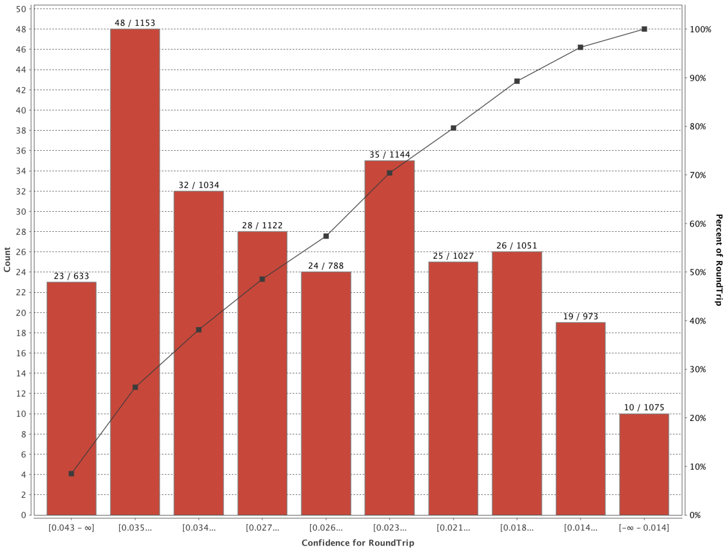
(b) Include a screenshot of the model coefficient information.



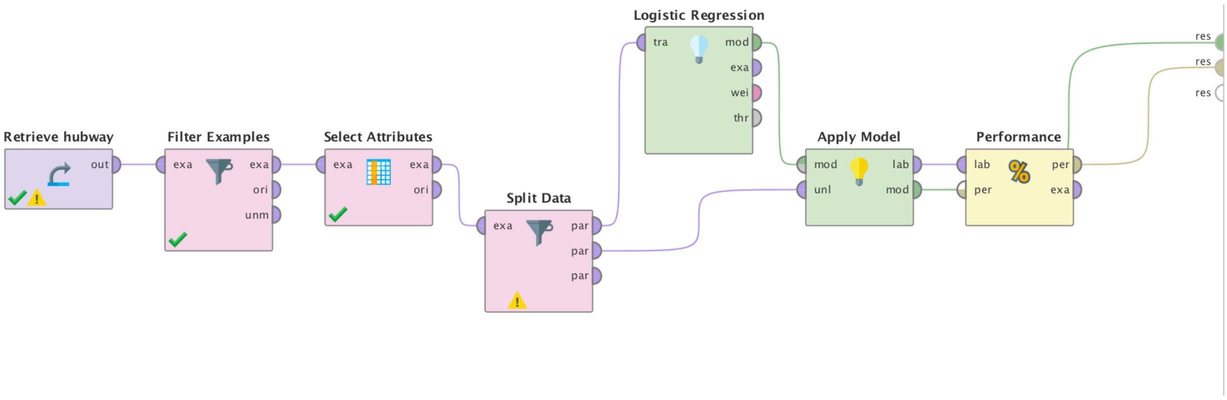
Attribute	Coefficient	Std. Coefficient	Std. Error	z-Value	p-Value
gender_Female	0.258	0.258	0.136	1.901	0.057
gender_Male	0	0	?	?	?
DOW_1	0.010	0.010	0.242	0.040	0.968
DOW_2	-0.154	-0.154	0.217	-0.709	0.478
DOW_3	-0.577	-0.577	0.238	-2.425	0.015
DOW_4	-0.683	-0.683	0.237	-2.877	0.004
DOW_5	-0.446	-0.682983167529171	0.233	-1.916	0.055
DOW_6	-0.437	-0.437	0.233	-1.878	0.060
DOW_7	0	0	?	?	?
hour_red_1	-0.383	-0.383	0.219	-1.751	0.080
hour_red_2	-0.943	-0.943	0.300	-3.140	0.002
hour_red_3	-0.434	-0.434	0.255	-1.703	0.089
hour_red_4	0	0	?	?	?
Intercept	-3.164	-3.164	0.171	-18.556	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:

Better than random



(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.

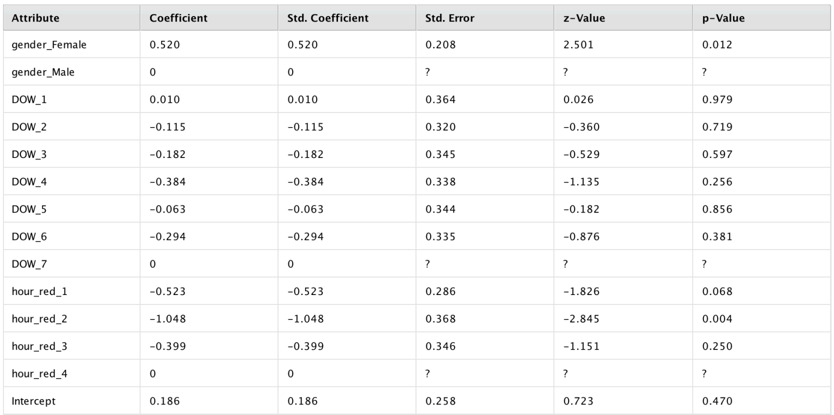
(e) Fill in the table to show your over-sampling procedure:

	# records	**% *ReturnTrip***
Training	540	0.5
Validation	10000	0.027
Test	10000	0.027

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

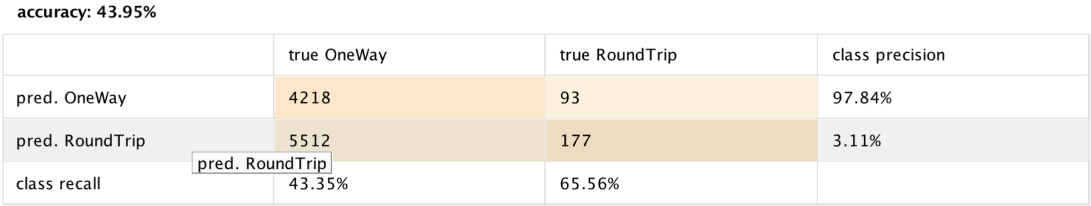
(f) Compare the results to the model which was run on the random partitioning:

- 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
gender_Female	0.520	0.520	0.208	2.501	0.012
gender_Male	0	0	?	?	?
DOW_1	0.010	0.010	0.364	0.026	0.979
DOW_2	-0.115	-0.115	0.320	-0.360	0.719
DOW_3	-0.182	-0.182	0.345	-0.529	0.597
DOW_4	-0.384	-0.384	0.338	-1.135	0.256
DOW_5	-0.063	-0.063	0.344	-0.182	0.856
DOW_6	-0.294	-0.294	0.335	-0.876	0.381
DOW_7	0	0	?	?	?
hour_red_1	-0.523	-0.523	0.286	-1.826	0.068
hour_red_2	-1.048	-1.048	0.368	-2.845	0.004
hour_red_3	-0.399	-0.399	0.346	-1.151	0.250
hour_red_4	0	0	?	?	?
Intercept	0.186	0.186	0.258	0.723	0.470

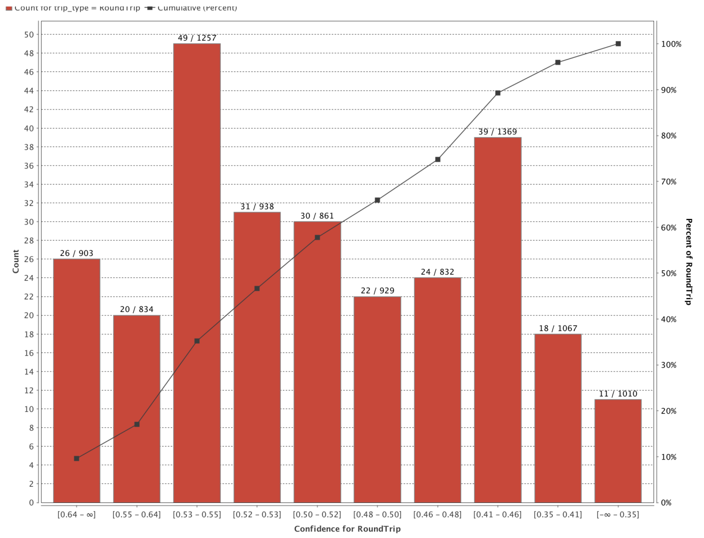
- The validation overall error rate is equal to **56.05%**. It is **higher** with oversampling.



accuracy: 43.95%

	true OneWay	true RoundTrip	class precision
pred. OneWay	4218	93	97.84%
pred. RoundTrip	5512	177	3.11%
class recall	43.35%	65.56%	

- The validation sensitivity to *ReturnTrip* is __**65.56%**__. It is **higher** with oversampling.
- The validation lift, first decile, is **higher** with oversampling – include a screenshot of your lift chart.



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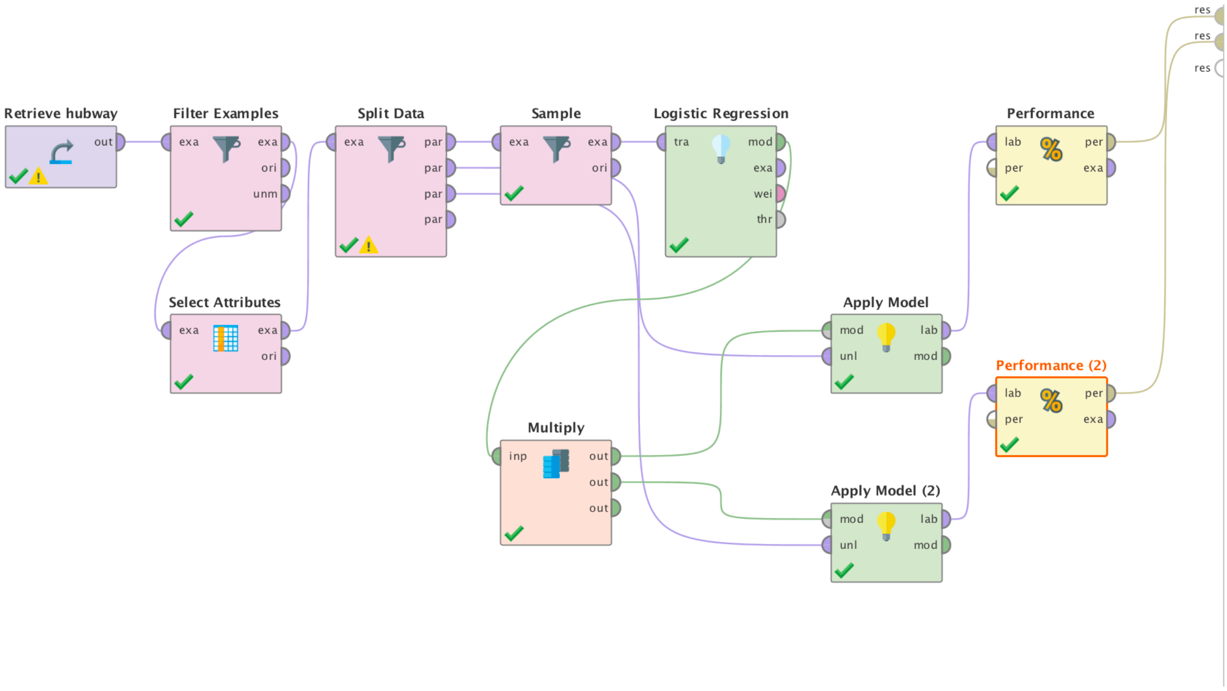
(g) Include a screenshot of your **Main Process (Design)**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