Data Analytics – Exercises

(Week 09)

In these exercises, you will learn:

- to perform classification analyses using classification trees (CTs).
- to perform classification analyses using random forest (RF) classifiers.

In the data analytics process model, these exercises cover part of the steps "Statistical data analysis and/or Modeling" and "Evaluation & Interpretation" (see figure 1). Results of the exercises must be uploaded as separate files (**no .zip files!**) by each student on Moodle. Details on how to submit the results can be found in the tasks below.

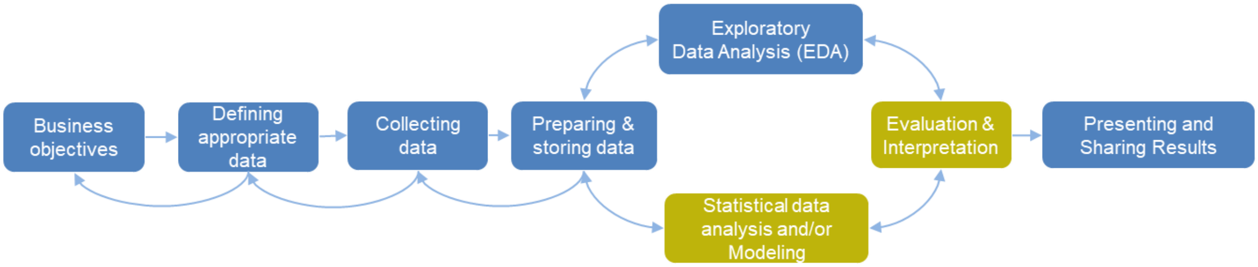

Business objectives
Defining appropriate data
Collecting data
Preparing & storing data
Exploratory Data Analysis (EDA)
Statistical data analysis and/or Modeling
Evaluation & Interpretation
Presenting and Sharing Results

Figure 1: Data analytics process model (see slides of week 01)

Task 1

In this exercise, you will learn to perform classification analyses using a classification tree and a random forest classifier based on the titanic data. The tasks are:

a) Run the Jupyter notebook 'classification_analysis_titanic.ipynb' step by step and try to find out, what the Python code does.

b) Go to the section 'Classification Tree' -> 'Create train and test samples …'. Change the parameter `test_size` from 0.20 to 0.50. This will change the proportion of observations (passengers in this case) used for training and testing from 80/20 to 50/50. Compare the accuracy & recall from the classification report of the model based on the 80/20 samples with the one based on the 50/50 samples. In the Jupyter notebook, try to explain the differences (if there are any).

c) In the section 'Fit the classification tree model and make predictions' change the `max_depth` parameter and run the Jupyter notebook again. Look at the text representation and graphical output of the tree (you can change the fontsize of the graphic to a smaller value). In the Jupyter notebook, state what you can see.

d) In the section 'Random Forest Classifier' -> 'Show feature importance', look at the feature importances in the bar chart. Then go to the section 'Random Forest Classifier' -> 'Create train and test samples …'. Remove the variables 'Age' and

‘Sex_male’ from the train and test samples and run the Jupyter notebook again. In the Jupyter notebook, state, which feature is now the most important one.

e) Fit models with/without the variables ‘Age’ and ‘Sex_male’ and state how the ROC curve and AUC value change.

To be submitted on Moodle:

- The Jupyter notebook as html-file ‘classification_analysis_titanic.html’ with the changes and short explanations according to b), c), d) and e)

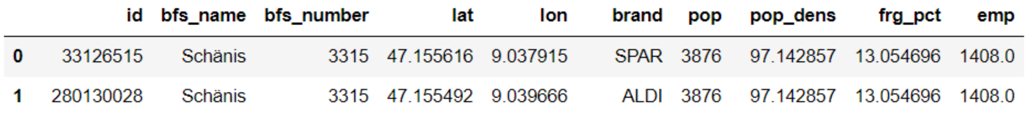
Task 2

In this exercise, you will perform your own classification analyses using a classification tree and a random forest classifier based on the supermarkets data. In detail, you will create classification models which are able to predict the brand of a supermarket based on municipality-level and other characteristics. Use the Jupyter notebook from task 1 as a template to solve the tasks.

a) Create a new Jupyter notebook ‘classification_analysis_supermarkets.ipynb’.

b) Use the following steps to create a classification tree:

- Load the required Python libraries.
- Import the supermarkets data from the file ‘supermarkets_data_enriched.csv’ into a data frame named ‘`df_supermarkets`’. We need the following variables:



	id	bfs_name	bfs_number	lat	lon	brand	pop	pop_dens	frg_pct	emp
0	33126515	Schänis	3315	47.155616	9.037915	SPAR	3876	97.142857	13.054696	1408.0
1	280130028	Schänis	3315	47.155492	9.039666	ALDI	3876	97.142857	13.054696	1408.0

- Remove all missing values from the data frame.
- Create a subset named ‘`df_sub`’ with only ‘Migros’ and ‘Volg’ as brands.

```
df_sub = df_supermarkets.loc[df_supermarkets['brand'].isin(['Migros', 'Volg'])]
```

- Create train/test samples (X_train, y_train, X_test, y_test) based on `df_sub`.
- The X_train and X_test must contain: lat, lon, pop, pop_dens, frg_pct, emp.
- The y_train and y_test must contain the target variable, which is: brand.
- Fit the classification tree model and make predictions.
- Print a text representation of the classification tree.
- Visualize the classification tree.
- Print the confusion matrix and classification report of the model.
- Print the ROC curve and AUC of the model.

c) Use `df_sub` from b) and the following steps to create a random forest classifier:

- Create train/test samples (X2_train, y2_train, X2_test, y2_test).
- Fit the random forest classifier and make model predictions.
- Show the confusion matrix and classification report.

- Show the feature importance in a bar chart.
- Print the ROC curve and AUC of the model.

To be submitted on Moodle:

- The Jupyter notebook as html-file ‘classification_analysis_supermarkets.html’.