Introduction

You have gotten a dataset with telemarketing data from a Portuguese bank. This dataset is similar to those we have treated in class and has an accompanying paper:

Sérgio Moro, Paulo Cortez, Paulo Rita. "A data-driven approach to predict the success of bank telemarketing", 2014. (uploaded in Brightspace under week 14)

As you might notice, this is from one favourite (co-)authors: Paulo Cortez! You are free to follow the paper and reproduce what they have done. But as we have seen with the papers of the Portuguese research team, they do not follow a DSR-approach. So be careful to follow their reasoning.

In this assignment, we challenge you to apply the skills you have learned in the research skills and the predictive modelling classes. There are three assessments criteria:

1. You are to write an introduction
2. Formulate a DSR-template
3. Perform a model evaluation.

The first two criteria are to assess your research skills and the third is to assess your predictive modelling skills.

You will work on the data yourself and follow the procedures you learned in class. You preprocess the data in a way that is suitable for your problem definition and validate the steps you took in the preprocessing. You identify what model(s) are suitable and why you choose these to solve the problem at hand. Finally, you evaluate the model performance, using the performance metrics you have defined yourself. You describe this in the model evaluation part of the report (assessment criterion 3).

To be clear: you do not have produce a full DSR-cycle in your report. You do not have to explicitly relate the model evaluation to introduction and template. These are more abstract and your model evaluation is very concrete. In that sense your research skills are assessed separately in your report: the introduction and template assess your research skills (criterion 1 and 2) and your predictive modelling skills are assessed by the model evaluation (criterion 3).

First assessment criterion: **Introduction**

You are to write a (short) introduction. Not more than 800 words. In your introduction you describe the broader context in which the stakeholder and its problem is situated. But you are also proposing a solution in your introduction: by creating or redesigning am artifact. So in your introduction you have the opportunity to communicate how the problem space and solution space are connected.

You do this by reducing the problem space to the specific context in which your stakeholders with their more specific problem are situated, and what value is created when solved. Specific in the sense that it should follow logically and intuitively from the broader context who the stakeholders are, what their problem is, what value is produced and how the (improvement of) your artifact contributes to this.

In other words: you are describing the large part of the relevance of your project.

Second assessment criterion: **DSR-template**

You are to construct a Design Science Research template as practiced in class. Perhaps superfluously, but it has to be of this structure[1]:

- *Improve* <a problem context>
- *by* <(re)designing an artifact>
- *that satisfies* <some requirements>
- *in order to* <help stakeholders achieve some goals>.[2]

We ask you to imagine a stakeholder and a value that it might have regarding the dataset. Both the data and the paper point you in a certain direction, but we urge you to be creative and imaginative!

You cannot be wrong or right with your template. What you are aiming for is that the logic from problem context to the perceived stakeholder value, via the techniques that you use to design your artefact (*by*-clause) and the related requirements needed to produce the value (*that satisfies*-clause), is sound.

Also, the logic of your template should be derived from that of the introduction in which you describe the problem space. The balancing trick here try to be as specific as possible in your *Improve-* and *in-order-to*-statement of the template and use the introduction to describe this statement in its broader (problem) context.

To illustrate a short, unrelated example about using ML to diagnose cancer: better diagnoses of cancer is situated in a broader context of a health care system and might therefore have broader health care benefits, but this is part of the broader problem context in which your problem is situated (introduction). Better/cheaper diagnoses for an oncology department in a hospital, oncologists treating a certain type of cancer and/or better survival changes for patients, are stakeholders and values of an *improve-* and *in-order-to*-statement.

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[1] You are also allowed to use the other structure from Wieringa that makes it a question.
[2] Roel J. Wieringa. *Design Science Methodology for Information Systems and Software Engineering*. Springer Heidelberg New York Dordrecht London, 2014.

Not-assessed criterion: Replicability

If you did something different than the paper, describe how it differs. If not you can skip this part.

Not-assessed criterion: Results

If you did the same as the paper, compare results. If you did something different, discuss the results briefly and relate metrics to your DSR-template.

Third assessment criterion: **Model evaluation**

In your report, you explain in moderate detail all steps you took in your Machine Learning Pipeline. You explain what steps you took to clean and preprocess the data. You motivate what models you trained and how you trained them (e.g. how did you split train/test data? Which hyperparameter settings did you choose? Did you do cross-validation?) You discuss the results of your model(s) and evaluate them on overfitting/underfitting. Ideally, you can link the achieved results back to the business case and reflect on the value. In your model evaluation, it should be clear what performance metric you used. This should be motivated from your business case and your DSR template.

If you trained multiple models, compare their results and discuss which model might be best suited in this case.

Make sure to motivate all your choices: why did you choose a specific model? Why did you engineer a certain feature? Why did you choose your performance metric?