

Project Guidelines

Machine Learning, Master in Data Science, UPC

This document contains the guidelines for the practical work (the *project*). Please read with care!

General Information

This project is meant to give you the opportunity to apply the techniques seen during the course to a real-world dataset. The project should cover all aspects of the modelling methodology seen in class from preprocessing to generating a final predictive model together with an assessment of its prediction quality.

The project is to be done in teams of **two** persons; singles are not allowed. Once you have chosen your partner, the next thing will be to select a dataset to work on. You can choose one from the data repositories we are going to provide to you (see below), or propose your own. In any case, you are expected to hand in a written report. This document should describe the work carried out, its motivation, the problems encountered and the solutions found together with final results and conclusions of your study. More details follow.

To carry out your analysis you should use the language python. Remember that there are many useful packages that extend its basic functionality. Certainly you can find inspiration in the notebooks from our weekly laboratory sessions. If you use code or ideas or any kind of resource from elsewhere you should cite it appropriately. Plagiarism will be prosecuted.

As a first task, you are expected to submit a 1-page project proposal. It should include the composition of your team, the problem that you are going to work on, the reason why you chose it, together with any references of previous work on this problem if applicable, and a title for your project; please include information on the data such as number of rows, columns, and nature of variables (e.g. if categorical, how many levels). Please hand this in no later than **April 12th** through the [racó](#).

Data repositories

The following sites contain a number of very diverse datasets; many correspond to real-world problems. They vary in domain (biology, medicine, economy, etc.), and also in size, type of variables, type of problem (classification or regression), among other things. *Please chose one that interests you!*

- Open ML [<https://www.openml.org/search?type=data>]
- UCI Repository [<http://archive.ics.uci.edu/ml/index.php>]
- UCI KDD Archive [<http://kdd.ics.uci.edu/summary.data.application.html>]
- Statlib [<http://lib.stat.cmu.edu/datasets/>]
- Delve [<http://www.cs.utoronto.ca/~delve/data/datasets.html>]
- School of Informatics (U. of Edinburgh) repository [<http://www.inf.ed.ac.uk/teaching/courses/irds/miniproject-datasets.html>]

Requirements for dataset/problem chosen

1. The dataset of this problem has numerical and categorical variables.
2. The dataset of this problem is not synthetically generated.
3. The dataset of this problem contains more than 10 variables.

4. You need to have enough information about the problem to be able to understand and analyze your results. Just getting random data and feeding it to the machine is not valid.
5. Datasets already pre-processed are not valid. You need a problem which data has any pre-processing work to do.
6. The dataset of this problem contains more than 200 samples.
7. The problem to solve is not one of the simple known problems like the *iris*, *mnist* or *wine*, etc.

Some suggestions for datasets

For those of you who have no preference as to which dataset to use, we propose here a few candidates that fulfill the requirements above.

- [Airbnb Price Determinants in Europe](#) This dataset contains Airbnb rental data for European cities, including characteristics and their effects on price. Several questions can be explored, such as price prediction (regression problem) for all cities involved or per-city.
- [Breast Cancer Dataset](#) The dataset involved female patients with infiltrating duct and lobular carcinoma breast cancer (SEER primary cites recode NOS histology codes 8522/3) diagnosed in 2006-2010. Classification task of patients into survivors or not.
- [Palmer Penguins](#) Penguin species classification. If you chose this dataset, you are required to use the raw dataset provided.
- [NASA Exoplanet Dataset](#) Data was collected by the Kepler mission revealing thousands of planets out of our Solar System. The task is to predict whether an observation is a real candidate for an exoplanet or not (binary classification).
- [Spotify music](#) Multi-class genre classification.

How and what to submit

The final report should include:

1. A brief description of the work and its goals, data available, and any additional information that you may have used.
2. Related previous work (if applicable)
3. The data exploration process, including: pre-processing, feature selection/extraction, visualization, clustering, etc.
4. Modeling methods considered, validation protocol and the reasons why the choices were made.
5. Results obtained with each method used (along with best set of parameters), comparison of results.
6. Final model chosen and an estimation of its generalization performance.
7. Scientific and personal conclusions
8. Possible extensions and known limitations.

Note that the report should not describe explanations seen in class; every table or plot should be appropriately described. The style of the report should resemble what you encounter in a scientific publication. Your code should be **reproducible**; that means using “seeds” if your code is stochastic.

Make sure you include a variety of linear and non-linear methods seen during the course.

All deliveries are to be made exclusively through the [racó](#). An appropriate mechanism will be prepared for every delivery. **Important: only one member of the team should upload the material**

For the final delivery, make sure you include in a compressed file the following:

1. The written report (pdf document). It should not exceed **15 pages**; if you need more space, consider placing the secondary information in a **separate appendix file**.
2. Any script or code you have used (python notebooks, scripts, or any other code)
3. A flat text file with precise instructions on how to execute and reproduce your results.

*Code and report should be submitted **separately** (namely, a *python notebook* is not a report).*

Evaluation

Your final project will be evaluated on the basis of the clarity of your report as well as on its technical quality. Conditions for a good score are:

1. The appropriate use of techniques and methods seen in class
2. Care and rigor for obtaining results (resampling protocol, quality metrics, etc.)
3. Quality of obtained results (generalization error, simplicity, interpretability)
4. Quality of written report (conciseness, completeness, clarity, appropriate format of report etc.)

Special attention will be given to insights into the results obtained, gaining knowledge on the data analyzed and obtaining useful conclusions. All experimental decisions should be appropriately justified (on the resampling protocol or preprocessing, for example). Merely applying the methods to the data and showing the table of results is not enough, there has to be an interpretation of the results obtained.

Key dates

All to be submitted through the [racó](#).

- **April 12th**: project proposals
- **June 12th**: report and code