

Machine Learning Course 2020/2021

Alípio Jorge

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Team

Lecturers

- Alípio Jorge
- Inês Dutra

Objectives

- To understand the **algorithmic fundamentals of machine learning** methods, including some of their **mathematical origins**
- To know what different techniques **have in common**, and how decisions about hyper-parameters affect the **effectiveness** of machine learning methods
- To identify, relate and analyse the most **important machine learning algorithms**
- To understand the evaluation principles of **machine learning** algorithms and models

Working method

- Lectures and hands-on exercises
- Quizzes
- Discussions
- Assignments
- Final Exam

Pre-requirements (prior knowledge) and co-requirements (common knowledge)

- Programming knowledge preferably in R or Python.
- Experienced programmers in other languages should not have any problems.
- Knowledge of data processing with files and in SQL databases
- Knowledge of standard machine learning and data mining tasks and tools
- Knowledge of statistical inference
- Knowledge of basic matrix algebra and calculus

Program

Overall idea

In this course we will - (re) visit fundamental concepts and algorithms for model learning and pattern discovery. - There will be a focus on their justified application and example-driven experimentation.

Program

Topics:

- What is Machine Learning?
- Decision Theory
- Empirical Validation, a ML perspective
- Model Inference
- Learning as optimization - Boosting and SVM, regularization
- Learning as optimization - Representation learning, Recommender systems and matrix factorization, optimizers

Program

Topics:

- Neural Networks - MLPs and CNN
- Autoencoders
- RNN, LSTM and GRU
- ML for NLP
- GANs, Unsupervised Learning
- Semi-supervised, self-supervised and Reinforcement Learning

Books to read

Hastie Trevor; The elements of statistical learning.

Aurlien Gron. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems.

Bishop Christopher; Pattern recognition and machine learning.

Tom M. Mitchell. Machine learning.

Teaching methods and learning activities

Classes

- Partly expositive,
- Individual and group dynamics involving the students (adapted to the inline reality).
- Practical out-of-class work with “classroom” support
- Quizzes
- Writing and presentation work

Teaching methods and learning activities

Always check sigarra

Evaluation Type

- Distributed evaluation with final exam

Assessment Components

- Exam 40%
- Participation 5%
- Assignments 55%

Amount of time required

- 8 hours every week, including classes

Grading

Eligibility for exams

- Participation above zero
- Assignment grade above zero

Calculation formula of final grade

$$F = \min(0.4 \times E + 0.55 \times P + 0.05 \times A; E \times 1.2)$$

- F : Final grade
- E : Exam
- P : Assignments / practical
- A : Participation

And finally

Classification improvement

- The exam grade can be improved (appeal season)
- The assignments / practical / participation grade cannot be improved after submission.

Observations

- All the materials of the UC are in moodle.
- The materials will be all in English, including the exams.
- Classes will be taught in English only if this is convenient.
- Students can participate / respond using Portuguese or English.