

Machine Learning (E761080)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 1)	Dutch	Gent	practical	0.0h
			lecture	
			independent work	0.0h

Lecturers in academic year 2023-2024

Simoens, Pieter TW05 lecturer-in-charge

Offered in the following programmes in 2023-2024

	crdts	offering
Master of Science in Information Engineering Technology	6	A

Teaching languages

Dutch

Keywords

Machine learning, data science

Position of the course

This course covers basic principles and techniques in the domain of machine learning and data science. Students gain initial knowledge of and hands-on experience with data visualisation and exploration, feature definition and selection, training and evaluation of machine learning models.

Upon completion of the course, students will have the competences to solve new data science problems, including data exploration, selection of an appropriate techniques and critical evaluation of obtained results.

The emphasis is on hands-on experience with commonly used frameworks such as Pandas, Scikit-Learn, Matplotlib, Pytorch and Tensorflow. Students tackle in teams a larger data science project.

Contents

Basic concepts of machine learning

- General overview of techniques and applications
- Features, feature selection
- train/test/validation sets, cross validation, bias/variance
- evaluation metrics (accuracy, precision, recall, ROC, confusion matrix)
- explorative data analysis and data cleaning

Techniques:

- Supervised regression and classification (linear and logistic regression, SVM, naive bayes, decision trees)
- Meta-algorithms: bagging, boosting and ensembles
- Unsupervised learning: clustering, dimensionality reduction and Gaussian Mixture Models
- Basic concepts of deep learning
- Convolutional and Recurrent Neural Networks

Technologies

Python (Scikit-learn), Tensorflow, Pytorch

Initial competences

- Fluent programming in Python
- Knowledge of basic principles of statistics and probability theory at academic level, as obtained in the course "Statistics and Mathematical Data Science"

Final competences

- 1 • Applying modern programming frameworks for machine learning to novel data science problems.
- 2 • Evaluation, implementation and usage of unseen machine learning techniques.
- 3 • Understanding recent scientific advancements in the domain of machine learning

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, Practical, Independent work

Extra information on the teaching methods

Theoretical concepts and principles are introduced in the lectures. More realistic and elaborate examples, as well as programming skills, are introduced in the practicals. Each student delivers at the end of the semester an individual assignment.

Learning materials and price

Slides, Jupyter notebooks

We follow the book of "A. Géron. Hands-on Machine Learning with scikit-learn, keras and Tensorflow (3rd edition)". An electronic version of this book can be freely accessed in the university library.

References

- S. Raschka, V. Mirjalili. Python Machine Learning, 3rd edition, Packt, 2019
- Ethem Alpaydin.; Introduction to Machine Learning, 4th instruction, 2020
- A. Géron, Hands-on Machine Learning with Scikit-learn, Keras, and Tensorflow (2nd edition), 2019
- I. Goodfellow, Y. Bengio: "Deep Learning", 2016.

Course content-related study coaching

Educational team is available during lectures, or an individual appointment can be made.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment, Assignment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

Non-periodic evaluation:

Intermediate reporting and submitted notebooks (individual assignment)

First assesment period:

Written exam

Second assesment period:

Written exam, revision of individual assignment

Calculation of the examination mark

First assesment period:

50% permanent evaluation (individual assignment)

50% written exam

Second assesment period

50% written exam

50% revision of individual assignment

A mark of ten or more out of twenty obtained for the written exam can be transferred between

the assessment periods of the same academic year.

A mark of ten or more out of twenty obtained for the permanent evaluation (individual assignment) can be transferred between the assessment periods of the same academic year. When the student obtains less than 8/20 for the written exam, and/ or for the mark calculated from the individual assignment (permanent evaluation), they can no longer obtain a pass mark for the course unit as a whole. If the total score does turn out to be a mark of ten or more out of twenty, this is reduced to the highest fail mark (i.e. 9/20)

Students who eschew one or more parts of the assessment (exam, individual assignment) can no longer obtain a pass mark for the course unit. Should the final mark be higher than 7/20, it will be reduced to the highest non-passable mark (i.e. 7/20).