

Machine Learning Methods for Biomedical Data (D012554)

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

Credits 5.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	English	Gent	peer teaching
			seminar
			lecture

Lecturers in academic year 2024-2025

Degroeve, Sven	GE31	lecturer-in-charge
----------------	------	--------------------

Offered in the following programmes in 2024-2025

Master of Science in Biomedical Sciences	crdts	offering
	5	A

Teaching languages

English

Keywords

machine learning, biomedical data analysis, data visualization, AI

Position of the course

Prediction models learned from biomedical data constitute an important part of biomedical research. Increasingly frequently they enter the clinical environment to, among other things, assist with diagnosis (such as medical image interpretation or gene expression classification).

In this course it is taught, in the form of colleges, microteaching and associated practicals, how algorithms can learn from data and how to program that in Python. The emphasis is mainly on the practical application of machine learning. In a machine learning competition, students attempt to program the best model for a specific task.

The course is offered in the first Master Biomedical Sciences and is linked to the Advanced Bioinformatics from the first Master Biomedical Sciences.

Contents

- linear regression, logistic regression
- random forest, gradient boosting
- deep neural networks
- computer vision: convolutional neural networks
- sequence learning: recurrent neural networks
- sequence learning: transformer architectures
- generative models: generative adversarial network (GAN)
- generative models: generative pre-training transformer (GPT)
- model building and evaluation with scikit-learn (Python)

Initial competences

Successfully have completed the Biomedical Analysis I, Biomedical Analysis II, Statistics, Data Analysis I, Informatics I, and Informatics II courses, or have acquired the required competences for these courses through another means.

Successfully have completed the bachelor in Biomedical Sciences or have acquired the acquired competences of this bachelor curriculum through another means.

Final competences

1 Gain insight in the practical treatment and processing of large amounts of data, obtained from the broader life sciences.

- 2 The student is capable of formulating data analysis tasks.
- 3 Gain insight in the available machine learning algorithms.
- 4 Gain insight into the most important parameters in machine learning analyses.
- 5 The student is capable of clearly visualizing the results obtained from a data analysis.
- 6 The student is capable of independently starting and successfully completing a machine learning based data analysis.
- 7 The student is capable of interacting at high level with data analysis specialists.
- 8 The student is capable of writing machine learning applications in Python.

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

Seminar, Lecture, Peer teaching

Study material

None

References

Course content-related study coaching

Support during and after colleges and practicals, and via Minerva

Assessment moments

end-of-term and continuous assessment

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

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

Continuous evaluation:

- Jupyter notebook project (15%)
- Microteaching: teach other students about a machine learning method not discussed during the lectures (15%)
- 2 page report about the obtained Kaggle contest results (20%)

Period-specific evaluation

Closed-book, written exam on 50% of the total score, concerning the subject matter described in the course material and the colleges. The exam consists of both open and MCQ.

Calculation of the examination mark

Continuous evaluation

- Jupyter notebook project (15%)
- Microteaching: teach other students about a machine learning method not discussed during the lectures (15%)
- 2 page report about the obtained Kaggle contest results (20%)

Period-specific evaluation

Written exam on 50% of the total score.