DEPARTMENT OF MICROBIOLOGY, TUMOR AND CELL BIOLOGY

C1F5223, Artificial Intelligence and Machine Learning for Biomedical and Clinical Research, 3 credits (hec)

Artificiell intelligens och maskinlärande för biomedicinsk och klinisk forskning, 3 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by The Committee for Doctoral Education on 2023-12-05, and was last revised on 2026-02-05. The revised course syllabus is valid from autumn semester 2026.

Responsible department

Department of Microbiology, Tumor and Cell Biology, Faculty of Medicine

Prerequisite courses, or equivalent

At least 1,5 credits from a course in basic statistics.

Purpose & Intended learning outcomes

Purpose

To increase knowledge about Machine Learning (ML) and Artificial Intelligence (AI) applications in biological and medical research, introduce first-hand experience and skills with different frameworks. The course requires no preliminary programming skills as well as no preliminary expertise in ML and AI. This course is given at a basic/novice level with no expertise in ML/AI and preliminary programming skills required, though experience in data analysis using RStudio/MatLab or similar analytic environment is an advantage.

Intended learning outcomes

After the completed course, the participants will be able to describe and discuss general aspects of ML and AI in a biomedical or medical context including ethical dilemmas and challenges. Practically, they should be able to prepare and analyse different data types related to own research, such as texts, omics, genomic sequences, images etc. using a range of ML and AI exploration and classification techniques as well critically analyse the outcome and estimate

performance.

Course content

Basic information about AI and ML, multivariate dataset preparation, classic methods of univariate and multi-dimensional analysis (Principal Component Analysis, Linear Discrimination Analysis, Factor Analysis), variable selection and sparse regression models (lasso regression, ridge regression, elastic net), supervised and unsupervised learning with neural networks, federated learning, performance estimation methods.

Forms of teaching and learning

The course consists of lectures, group discussions, and hands-on labs. Previous experience from practical experience applying modelling in a computer-based environment (e.g. in R, SAS, STAT, Matlab or Python), is strongly recommended.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

All planned activities including lab and group works are mandatory. Absence has to be compensated with a report on the lab work, which student will have to do.

Forms of assessment

The student will be examined by their (a) labs accomplishment (b) final project report and (c) written reviews of projects of 2 other students.

Course literature

Both classic and up-to-date articles and websites will be recommended.