LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Datadriven hälsa
Data-driven Health

BMEN35, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED BME
Date of Decision: 2023-04-13

General Information

Elective for: BME4-sbh, D4, E4-ss, F5, Pi4
Language of instruction: The course will be given in English

Aim

The course provides basic knowledge in the field of artificial intelligence and machine learning for applications in medicine and health. The course covers the chain from medical databases via algorithms to regulations and requirements for diagnostic software.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to and understand and have an overall picture of how machine learning and artificial intelligence can be designed for different medical issues.
- be able to apply the most common methods to real problems and real medical signals (Python)
- know and understand how special requirements and regulations for diagnostic systems and other medical devices affect the design and validation process.

Competences and skills
For a passing grade the student must

- be able to understand the characteristics of the most common machine learning methods.
- be able to understand what settings need to be made for different methods.
- be able to understand how properties of medical training and validation data affect the

performance of the methods.
- be able to choose the appropriate method for a described situation.
- be able to overview the consequences of different method choices and evaluation strategies that can be chosen for different types of problems
- be able to use available toolboxes for machine learning and in this way solve practical problems in Python.

Judgement and approach
For a passing grade the student must

- have the ability to analyze and evaluate different machine learning algorithms, as well as interpret and describe their inherent principles.
- have insight into how the transparency and generalizability of different methods make them more or less suitable in different medical contexts.

Contents

Areas covered are:

- Introduction of artificial intelligence in healthcare applications

- Overview of machine learning algorithms and methods

- How to choose ML methods for different applications

- How to select settings and optimize performance

- How to evaluate performance

- Regulatory, social, ethical and legal issues regarding artificial intelligence in medicine

-State-of-the-art AI that is applied to important medical fields such as ECG, neurology, biomedical imaging, heart sound, oncology, diabetes, etc.

Practical work:

- Introduction to Python / Jupyter / Colab (basics, linear algebra, plotting)

- Linear models

- Measurement values and visualization

- Trees and knn

- Ensemble methods

- Neural networks (shallow, MLP, introduction to Keras / Tensorflow)

- Deep Neural Networks (CNN)

- Deep Learning (LSTM / RNN)

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The grade is based on the exam in the end of the course.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0122. **Name:** Written Exam.
Credits: 6. **Grading scale:** TH. **Assessment:** Written Examination.
Code: 0222. **Name:** Computer Assignments.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Computer assignments

Admission

Assumed prior knowledge: EITF75 Digital signal processing OR EITA50 Signal processing in multimedia OR EITF15, BMEF25 Digital signal processing - theory and applications OR BMEA05 Signals and systems OR EITG10 Systems, Signals and Discrete Transforms EDAA50 Programming, a first course OR EDAA45 Introduction to programming
The number of participants is limited to: No

Reading list

- Marcus Österberg and Lars Lindsköld: AI for Better Health. 2020.
- Andreas Lindholm, Niklas Wahlström, Fredrik Lindsten, and Thomas B. Schön: Machine Learning - A First Course for Engineers and Scientists. Cambridge University Press, 2021.
- Asam Bohr och Kaveh Memarzadeh: Artificial Intelligence in Healthcare. Academic press, 2020, ISBN: 978-0-12-818438-7.
- Lei Ting och Maryellen L Giger och James K Min: Artificial Intelligence in Medicine, Technical Basis and Clinical Applications. Academic press, 2020, ISBN: 978-0-12-821259-2.

Contact and other information

Course coordinator: Martin Stridh, martin.stridh@bme.lth.se
Course coordinator: Christian Antfolk, christian.antfolk@bme.lth.se
Course homepage:
http://www.bme.lth.se/course-pages/datadriven-halsa/datadriven-health/