UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Artificial Intelligence In Neuroscience: Methods And Applications

2627-122R-19

Title

Artificial Intelligence in Neuroscience: methods and applications

Teacher(s)

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Language

English

Short description

The course aims to introduce artificial intelligence methodologies and applications in neuroscience. In the first part key AI concepts in machine learning (supervised vs unsupervised learning; regression, classification, clustering) and deep learning (neural networks, convolutional neural networks, recurrent neural networks) will be covered, and AI analysis pipelines will be presented. Successively, applications in neuroimaging, data and signal analysis will be shown, with a particular focus on MRI, PET, EEG and audio signals in neurological diseases, psychiatry and brain

oncology.
The course adopts a multidisciplinary approach, emphasizing the central role of study design, methodology, and research planning in the development of machine learning and digital health applications with meaningful impact in neuroscience.

The course is divided into four sections:

1. Basis of Machine Learning
    - Model types
    - Supervised models
    - data input and pre-processing
    - feature extraction, feature reduction, feature selection
    - data augmentation

2. Fundamentals of Machine Learning in digital health and differences from traditional statistics

- Objectives, impact, and digital health
- From clinical problems in neuroscience to data-driven solutions; inference vs. prediction
- Data quality, interoperability, and data characteristics; the importance of study design and the research question
- Methodological challenges: the bias–variance trade-off, overfitting, and underfitting
- Performance evaluation metrics for different types of models
- Transparent reporting, reproducibility, best practices, and reporting guidelines

3-4. Examples of Applications in Neuroscience

- Supervised learning
- Clustering
- Hands-on practical session using the Orange software

CFU / Hours

2 CFU / 16 hours

Teaching period

January and February

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | PARTNERSHIPS FOR THE GOALS