COURSE DESCRIPTION CARD - SYLLABUS

Course name
ARTIFICIAL INTELLIGENCE IN CLINICAL PRACTICE

Course

Proposed by Discipline
Information and communication technology

Year/Semester
II/3, III/5

Type of studies
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
4

Tutorials

Projects/seminars

Number of credit points

1

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Knowledge: very basic understanding of algorithms, ability to read and understand very simple blocks of computer pseudo-code, understanding of basic statistics.

Skills: ability to transfer knowledge between domains, and to apply learned patterns to different domains.

Social competencies: thinking outside the box to solve various problems using available textual resources.

Course objective

The main aim of the course is to present the latest methodological developments associated with clinical applications of artificial intelligence (AI), to discuss the opportunities AI methods bring to clinical practice, and also to discuss related risks and challenges, both ethical and organizational. The course focuses on data-driven machin learning (ML) techniques, however, it also covers selected solutions employing formal representation of the domain knowledge.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:
1) global achievements, covering theoretical foundations as well as general and selected specific issues that are relevant to clinical applications of AI, [P8S_WG/SzD_W01]
2) key developmental trends related to AI in clinical practice. [P8S_WG/SzD_W02]

Skills

A PhD student who graduated from doctoral school can:
1) use acquired knowledge from clinical AI to creatively identify, formulate and solve complex decision problems, [P8S_UW/SzD_U01]
2) critically analyze and asses scientific research results in clinical AI, together with their contribution into knowledge development. [P8S_UW/SzD_U02]

Social competences

A PhD student who graduated from doctoral school is ready to:
1) acknowledge the importance of AI methods in solving broady understood decision problems in clinical practice (e.g., related to diagnosis, prognosis and management). [P8S_KK/SzD_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W02	A short test covering the lecture material at the end of the course	Over 50% of points to pass
U01, U02	A short test covering the lecture material at the end of the course	Over 50% of points to pass
K03	A short test covering the lecture material at the end of the course	Over 50% of points to pass

Programme content

1. ML techniques for the analysis of multi-modal data, combining images, texts, and tabular data, and of temporal and longitudinal data.
2. Distributed techniques of ML (including federated learning) ensuring confidentiality at the level of data and obtained decision models.
3. Explainable AI (XAI) techniques to explain the general structure of developed models and to justify recommendations for specific problems.
4. Clinical decision support using domain knowledge in the form of formal models (e.g., ontologies) and related inference methods.

5. Ethical and organizational issues related to the application of AI techniques in clinical practice, such as autonomous solutons or fit to the existing workflow.

Teaching methods

Lecture: multimedia presentation including illustrations and examples.

Bibliography

Basic

1. Wang F, Preininger A. AI in Health: State of the Art, Challenges, and Future Directions. Yearb Med Inform. 2019 Aug;28(1):16-26. doi: 10.1055/s-0039-1677908.

2. Stahlschmidt SR, Ulfenborg B, Synnergren J. Multimodal deep learning for biomedical data fusion: a review. Brief Bioinform. 2022 Mar 10;23(2):bbab569. doi: 10.1093/bib/bbab569.

3. Rieke N, Hancox J, Li W, Milletarì F, Roth HR, Albarqouni S, Bakas S, Galtier MN, Landman BA, Maier-Hein K, Ourselin S, Sheller M, Summers RM, Trask A, Xu D, Baust M, Cardoso MJ. The future of digital health with federated learning. NPJ Digit Med. 2020 Sep 14;3:119. doi: 10.1038/s41746-020-00323-1.

4. Fuhrman JD, Gorre N, Hu Q, Li H, El Naqa I, Giger ML. A review of explainable and interpretable AI with applications in COVID-19 imaging. Med Phys. 2022 Jan;49(1):1-14. doi: 10.1002/mp.15359.

Additional

1. Shortliffe EH. Artificial Intelligence in Medicine: Weighing the Accomplishments, Hype, and Promise. Yearb Med Inform. 2019 Aug;28(1):257-262. doi: 10.1055/s-0039-1677891.

2. Panch T, Mattie H, Celi LA. The "inconvenient truth" about AI in healthcare. NPJ Digit Med. 2019 Aug 16;2:77. doi: 10.1038/s41746-019-0155-4.

Breakdown of average student's workload

	Hours	ECTS
Total workload	26	1.0
Classes requiring direct contact with the teacher	6	0.5
Student's own work (literature studies, preparation for tutorials, project preparation) [1]	20	0.5

[1] delete or add other activities as appropriate