

STUDY GUIDE

Artificial Intelligence in Healthcare: Introduction to Applications and Techniques

Organised by Semmelweis University



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Erasmus+

1. IDENTIFYING DATA

Course/training name*	Artificial Intelligence in Healthcare: Introduction to Applications and Techniques
Coordinating/host University*	Semmelweis University
Other Universities involved	-
Main Thematic Arena*	Arena 1 - Health & Well-Being
Relation with the above selected Thematic Arena	This comprehensive course introduces participants to the transformative applications of Artificial Intelligence (AI) in healthcare, covering areas such as diagnostics, medical imaging, health data analytics, drug development, and patient care optimization. Through a blend of lectures, hands-on workshops, and project work, students will explore key AI techniques including machine learning, neural networks and natural language processing. Ethical, legal, security, and data privacy considerations in healthcare AI will also be addressed.
Course/training field(s)*	Life sciences, AI
ISCED Code	
Related SDGs	3
Target audience(s)*	University students in medical, life science, data science, or technology-related fields.
Number of ECTS credits allocated	2 ECTS
Other modes of certifications	EUniWell completion certificate

Mode of delivery*	Synchronous
Language of instruction*	English
Semester*	Spring
Course/training dates*	From 3 February to 25 April 2025
Precise schedule of the lectures (Mind the time zone) *	Consultations: Monday 18.00 - 19.30 CET from 3 February to 21 April
Key words (max 5) *	Prompt engineering, virtual assistant, pattern recognition, algorithm, human intelligence
Catch Phrase*	Craft your own virtual assistants and uncover life's hidden patterns.
Prerequisites and corequisites*	A total of 40 points will be allocated for successfully completing the 4 class assignments, and 80 points for properly fulfilling the project work requirements. 0–50 points: Insufficient, 51–63 points: Satisfactory, 64–77 points: Fair, 78–89 points: Good, 90 points and above: Excellent
Number of EUniWell students or staff that can attend the course/training*	50 participants
Course/training application procedure(s)*	EUniWell joint application process

2. CONTACT DETAILS

Department	Department of Virtual Health Guide Methodology
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Name and email of lecturer/trainer*	Dr. Zoltan Lantos - lantos.zoltan@semmelweis.hu
Name and e-mail of the catalogue coordinator*	Eszter Turopoli - turopoli.eszter@semmelweis.hu
Other lecturers/trainers	Jozsef Papp – papp.jozsef@semmelweis.hu Helga Balog - helga@reverb.hu

3. COURSE/TRAINING ABSTRACT*

This course provides an engaging and comprehensive introduction to the application of Artificial Intelligence (AI) in healthcare. Participants will explore key areas where AI is transforming healthcare, including patient diagnosis, medical image recognition, health data analysis, drug development, and patient care optimisation. The course covers foundational topics such as machine learning, neural networks, and natural language processing, equipping students with both theoretical knowledge and practical skills.

Through hands-on projects, students will apply AI methods to real-world health data, gaining insights into current research advancements and the latest developments in the field. The course also emphasises the ethical, legal, and data privacy challenges associated with implementing AI systems in healthcare, fostering critical evaluation skills. The primary aim of the course is to familiarise students with core AI concepts and techniques and demonstrate their application to modern healthcare challenges. Students will gain proficiency in tools and programming languages relevant to AI system development, and learn to address problems such as diagnosis prediction, data analysis, and treatment optimisation.

Educational methods combine literature reviews, lectures, and practical workshops, incorporating entrepreneurial learning approaches to nurture creativity and initiative. Group projects, case studies, and individual assignments further enhance understanding. The course provides a forward-looking perspective on the evolving role of AI in healthcare, making it an ideal choice for students eager to explore future trends in health technologies and their transformative potential.

4. DEVELOPED SKILLS AND COMPETENCES*

1. Technical Skills: AI Fundamentals, Data Analysis and Processing, AI Toolkits and Programming, Model Development and Evaluation
2. Applied Competences: Healthcare Problem Solving, Integration of AI Systems, Prompt Engineering
3. Research and Analytical Skills: Critical Evaluation, Research Literacy
4. Ethical and Legal Awareness: Ethical Decision-Making, Legal Compliance
5. Collaborative and Communication Skills: Teamwork and Project Management, Interdisciplinary Communication, Presentation and Reporting
6. Entrepreneurial and Reflective Skills: Creativity and Innovation, Self-Reflection, Initiative

5. OBJECTIVES AND LEARNING OUTCOMES*

Objectives

To introduce students to the foundational concepts and techniques of Artificial Intelligence (AI) in healthcare.

To provide an in-depth understanding of how AI can address modern healthcare challenges such as diagnosis, medical imaging, and treatment optimisation.

To equip students with the skills to design, implement, and evaluate AI models using healthcare data.

To foster critical thinking about the ethical, legal, and data privacy implications of AI in healthcare.

To prepare students for the future of healthcare technologies by exploring cutting-edge developments and applications of AI.

To develop hands-on experience through projects and case studies involving real-world healthcare scenarios.

Learning Outcomes

Demonstrate a strong understanding of AI concepts such as machine learning, neural networks, and natural language processing.

Apply AI tools and techniques to solve specific healthcare problems using real-world data.

Develop, evaluate, and optimise machine learning models for healthcare applications.

Critically assess the performance, reliability, and ethical implications of AI systems in healthcare.

Implement AI solutions that comply with healthcare regulations and data privacy standards.

Communicate technical concepts effectively to both technical and non-technical stakeholders.

Collaborate on interdisciplinary projects, showcasing teamwork and problem-solving skills.

Reflect on their learning process and propose innovative solutions to healthcare challenges.

6. COURSE/TRAINING ORGANISATION

UNITS

1.	Basics of Artificial Intelligence
2.	Large Language Models
3.	Neural Networks

4.	Machine Learning
LEARNING RESOURCES AND TOOLS	
Open-access healthcare datasets and simulated datasets. Python Programming Language; TensorFlow and PyTorch AI Frameworks. Large Language Models Personal computer or laptop capable of running AI software and tools.	
PLANNED LEARNING ACTIVITIES AND TEACHING METHODS	
Learning Activities Lectures, Workshops, Case Studies, Project-Based Learning, Self-Paced Study Teaching Methods Blended Learning, Experiential Learning, Collaborative Learning, Entrepreneurial Learning, Formative Assessments, Capstone Projects	

7. ASSESSMENT METHODS AND CRITERIA*	
Practical Assignments: Hands-on tasks requiring implementation of AI techniques. Project Work: Individual projects applying AI methods to real-world health challenges, assessed on technical execution, creativity, and problem-solving. Knowledge and Understanding: Demonstration of a clear grasp of AI concepts, techniques, and their applications in healthcare. Technical Skills: Proficiency in using AI tools and frameworks, as well as implementation of algorithms and models. Problem-Solving Ability: Effective application of AI methods to address specific healthcare challenges and interpret results.	
RECOGNITION*	
ECTS credits	
ADDITIONAL INFORMATION	

8. BIBLIOGRAPHY AND TEACHING MATERIALS

Adam Bohr, Kave Memarzadeh: *Artificial Intelligence in Healthcare*. Academic Press., 2020., ISBN: 9780128184387
Arjab Singh Khuman, Tianhua Chen, Mufti Mahmud, Jenny Carter: *Artificial Intelligence in Healthcare*. Springer, 2022., ISBN: 9789811952715
Dr. Janak Gunatilleke: *Artificial Intelligence in Healthcare: Unlocking its Potential*. N. Janak Gunatilleke, 2022., ISBN: 9781739637408
Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong: *Mathematics for Machine Learning* Cambridge University Press., Cambridge, 2021.

Course e-Textbook and AI Application Guide

9. QUALITY ASSURANCE*

Course Design and Development

Alignment with Semmelweis's educational goals, European frameworks, and industry standards in AI and healthcare.
 Regular updates to course content to reflect advancements in AI technologies and healthcare practices.
 Inclusion of stakeholder feedback from students, faculty, and healthcare professionals during the course development and review process.

Teaching and Learning

Use of diverse and innovative teaching methods to engage students and enhance learning outcomes.
 Continuous professional development for instructors to ensure delivery reflects current industry practices and pedagogical advancements.
 Monitoring and evaluation of teaching methods and resources for effectiveness and relevance.

Assessment and Feedback

Clear, transparent, and consistent assessment criteria aligned with learning outcomes.
 Regular review of assessment methods to ensure they measure student performance accurately and fairly.
 Provision of timely, constructive feedback to support student development and address learning gaps.

Student Support

Accessible support services, including academic advising, technical assistance, and mental health resources.
 Opportunities for students to provide feedback on their learning experience, contributing to continuous improvement.
 Availability of clear guidelines and resources to assist students with course requirements.

External Review

Peer review of course materials and teaching practices by external academic and industry experts.
 Accreditation and alignment with national and international standards in higher education and healthcare AI.

Monitoring and Evaluation

Regular review of student performance metrics, including course completion rates and post-graduation outcomes.
 Collection and analysis of student evaluations, ensuring feedback is used to refine the course.
 Periodic course audits to identify areas for improvement and ensure compliance with institutional policies.

Continuous Improvement

Incorporation of emerging trends, tools, and methods in AI and healthcare to keep the course cutting-edge.
Engagement with research and professional networks to integrate current knowledge and best practices.
Iterative updates based on feedback from stakeholders and industry developments.