

Óbudai Egyetem Neumann János Informatikai Kar			Semester 2. of the curriculum 2025-2026			
Name of the subject:	Code of the subject:	Credits:	Hours per semester:			
				lec	sem	lab
Autonomous Intelligence in Practice -- An Interdisciplinary and Systems Intelligence Approach	NBVSIAEMLF	5	part-time or	25	25	0
			full-time	40	40	0
Responsible person for the subject: Dr. habil. Zrubka Zsombor János			Classification: habilitált egyetemi docens			
Subject lecturer(s): Prof. Fei-Yue Wang, PhD Yuchen Li, PhD Jingwei Ge, PhD Weiwei Ding, PhD						
Prerequisites: Bsc						
Way of the assessment:			midterm mark			
Course description						
Goal:	The course aims to deliver the principles of Autonomous Intelligence and to equip students with the theoretical foundations and practical skills required to design, analyze, and implement autonomous intelligent systems embedded in physical environments.					
Course description:	<p>This course equips students with a comprehensive understanding of Autonomous Intelligence, focusing on the principles and system architectures that enable intelligent behavior to emerge through continuous interaction between perception, cognition, action, and the physical world. The course explores embodied and embedded intelligent systems operating in real-world environments, emphasizing physical platforms such as robots, manipulators, and autonomous embedded systems rather than purely software-based agents.</p> <p>Students will gain hands-on experience in designing and implementing autonomous intelligent systems by integrating learning, reasoning, and control, using modern AI techniques including large language models, reinforcement learning, multimodal perception, and sensorimotor learning. The course also introduces systems and parallel intelligence approaches for deploying autonomous intelligence in complex, large-scale, and dynamic environments. Emphasis is placed on building closed-loop, adaptive, and goal-directed autonomous systems capable of robust operation under physical constraints, uncertainty, and real-world interaction, with critical analysis of applications such as robotics, autonomous manipulation, and human-machine collaboration.</p>					

Lecture schedule	
Education week	Topic
1	Online introduction
2.	1:1 mentoring and consultation of students working on their chosen topics, developing draft manuscripts
3.	
4.	
5.	<p>March 16-20.</p> <p>This week provides an overview of Autonomous Intelligence and embodied intelligent systems, introducing key architectural concepts that integrate perception, decision-making, learning, and actuation. Students will study how intelligent behavior is realized in physical systems such as mobile robots, robotic arms, and navigation platforms operating in indoor and outdoor environments.</p> <p>Examples including Vision-and-Language Navigation (VLN) and robotic manipulation are used to illustrate the integration of multimodal perception, language grounding, planning, and control. The week combines conceptual foundations with practical labs that prepare students for subsequent modules and the final project.</p> <p>Day 1 – Recap on AI Agents Day 2 – Automated Perception Methods and Generative AI Day 3 – Decision Planning Day 4 – Vision Languge Action and Vision Language Navigation Day 5 – Multi-Agents in Vision Language Action</p>
6.	1:1 mentoring and consultation of students working on their chosen topics, developing draft manuscripts
7.	
8.	
9.	
10.	
11.	
12.	<p>March 16-20.</p> <p>The final week focuses on applying Autonomous Intelligence to real-world embodied systems through practical experiments, case studies, and student projects. Students will explore applications in robotics, navigation, and manipulation, and evaluate system performance in realistic physical or simulated environments.</p> <p>The week includes guided discussions of recent research papers, helping students understand current advances and open challenges in autonomous and embodied intelligence. Final project presentations provide an opportunity for reflection on system design, experimental results, and future directions.</p>
13.	

	<p>Day 1 – Real-World Applications of Autonomous Systems</p> <p>Day 2 – Overview of SOTA Papers on Autonomous Systems</p> <p>Day 3 – Simulating Autonomous Intelligent Systems</p> <p>Day 4 – Demonstration of Simulation to Reality (Sim2Real)</p> <p>Day 5 – Overview of Student Projects</p>
14.	Submission of final assignments, feedback
Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	Draft manuscript prepared for submission.
Assessment schedule	
Education week	Topic
7.	Online test on Week 5 Theoretical Materials
13.	Project presentation
14.	Draft manuscript
Method used to calculate the <i>mid-term grade</i> (to be filled out only for subjects with mid-term grades)	
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Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	
Type of the exam (to be filled out only for subjects with exams)	
-	
Calculation of the exam mark (to be filled only for subjects with exams)	
-	
Final grade calculation methods:	
<p>The final grade will be calculated using the following scale:</p> <ul style="list-style-type: none"> • 0-49 points: Failed • 50-62 points: Satisfactory • 63-74 points: Mediocre • 75-86 points: Good • 87-100 points: Excellent 	
References	
Obligatory :	<ul style="list-style-type: none"> • Materials provided in the e-learning system
Recommended:	<ul style="list-style-type: none"> • Extra reading material provided by the lecturer

Other
references:

- Qinghai Miao, Fei-Yue Wang: Artificial Intelligence for Science (AI4S) Frontiers and Perspectives Based on Parallel Intelligence. 2024, Springer Nature Switzerland, Cham