MD-2068, CHIŞINĂU, STR. STUDENŢILOR, 9/7, TEL: 022 50-99-63, www.utm.md

ARTIFICIAL INTELLIGENCE FUNDAMENTALS

1. Subject Information

Faculty	Computers, Informatics and Microelectronics				
Department	Software Engineering and Automation				
Academic Degree	Cycle I, bachelor's degree				
Study Program	Software Engineering				
Study Year	**Semester**	**Exam type**	**Formative category**	**Optional category**	**ECTS credits**
IV year	VII	E	S – Specialty subject	A – optional course	5

2. Total estimated time

Total curriculum hours		**Of which**				
		Auditorium hours			**Individual work**	
		Course	**Seminar**	**Laboratory work**	**Study of theoretical materials**	**Project**
Full-time study	**150**	45	--	30	75	--

3. Prerequisites

According to study curriculum	To achieve the objectives of this course, students must possess skills acquired in previous subjects: computer programming, data structures and algorithms, formal and automatic languages and object-oriented programming.
According to competences	According to the competences, among the essential prerequisites are the application of programming languages, modeling and development environments, methodologies for software development etc.

4. Conditions for carrying out the educational process

Course	Students should be provided with a well-illuminated and ventilated auditorium, where they have the ability to hear the teacher and take notes comfortably.
Laboratory work	Students should be provided with a PC / laptop with internet connection, which is able to run their projects in a programming language of choice.

5. Competences

Professional competences	• CP2 Application Design and Development; • CP5 Solution Implementation; • CP7 Sistems engineering.
Transversal competences	Identifying, describing and carrying out organized activities in a team with the development of communication and collaboration skills, as well as assuming different roles (executive and leadership).

6. Course objectives

Scope	The goal is for students to gain a comprehensive understanding of the AI field, including its future trajectory and key milestones. This foundation will help them grasp crucial concepts and apply their knowledge practically to develop AI systems.
Objectives	Course objectives include defining algorithms based on constraints within models that address perception, reasoning and action.

7. Course content

Teaching Activity Topics	Number of Hours Full-Time Study
Course Topics	
T1. Goal Trees and Problem Solving	3
T2. Goal Trees and Rule-Based Expert Systems	3
T3. Depth-First, Hill Climbing, Beam Search	3
T4. Optimal, Branch and Bound, A* Search	3
T5. Games, Minimax and Alpha-Beta Search	3
T6. Interpreting Line Drawings	3
T7. Search, Domain Reduction	3
T8. Nearest Neighbors, SVMs	3
T9. Identification Trees, Disorder	3
T10. One-shot Learning	3
T11. Neural Networks	3
T12. Genetic Algorithms	3
T13. Natural Language Processing	3
T14. Ensemble Learning	3
T15. Boosting	3
Total Course:	**45**
Laboratory Work Topics	
LL1. Expert Systems	6
LL2. Intelligent Searching Algorithms	4
LL3. Domains and Constraints	4
LL4. Learning	4
LL5. Processing Images with OpenCV and CNNs	6
LL6. Natural Language Processing and chat-bots	6
Total Laboratory Work:	**30**

8. Bibliography

Main	• Artificial Intelligence: A Modern Approach (4th Edition). By Stuart Russell and Peter Norvig. Pearson, 2020. ISBN 978-0134610993. • Are Expert Systems Dead? By Simon J Preis. https://towardsdatascience.com/are-expert-systems-dead-87c8d6c26474. Accessed Oct. 2024 • AI Search Algorithms With Examples. By Pawara Siriwardhane. https://medium.com/nerd-for-tech/ai-search-algorithms-with-examples-54772c6d973a. Accessed Oct. 2024 • Predicting Moves in Chess using Convolutional Neural Networks. By Barak Oshri and Nishith Khandwala. https://cs231n.stanford.edu/reports/2015/pdfs/ConvChess.pdf. Accessed Oct. 2024 • Learning Hand-Eye Coordination for Robotic Grasping with Deep Learning and Large-Scale Data Collection. By Sergey Levine et. al. https://arxiv.org/pdf/1603.02199. Accessed Oct. 2024

	• GoalsEye: Learning High Speed Precision Table Tennis on a Physical Robot. https://arxiv.org/pdf/2210.03662. Accessed Oct. 2024 • Playing Atari with Deep Reinforcement Learning. By Volodymyr Mnih et. al. https://arxiv.org/pdf/1312.5602. Accessed Oct. 2024 • ImageNet Classification with Deep Convolutional Neural Networks. By Alex Krizhevsky, Ilya Sutskever and Geoffrey E. Hinton. https://papers.nips.cc/paper_files/paper/2012/file/c399862d3b9d6b76c8436e924a68c45b-Paper.pdf. Accessed Oct. 2024 • Very Deep Convolutional Networks for Large-Scale Image Recognition. By Karen Simonyan and Andrew Zisserman. https://arxiv.org/pdf/1409.1556. Accessed Oct. 2024 • Going Deeper with Convolutions. By Christian Szegedy et. al. https://arxiv.org/pdf/1409.4842.pdf. Accessed Oct. 2024 • Sequence to Sequence Learning with Neural Networks. By Ilya Sutskever et. al. https://papers.nips.cc/paper_files/paper/2014/file/a14ac55a4f27472c5d894ec1c3c743d2-Paper.pdf. Accessed Oct. 2024 • Decoding Transformers: The Heart of Large Language Models. By Avijit Swain. https://medium.com/@avijitswain11/decoding-transformers-the-heart-of-large-language-models-06aa33acf1d3. Accessed Oct. 2024 • Attention Is All You Need. By Ashish Vaswani et. Al. https://arxiv.org/pdf/1706.03762 . Accessed Oct. 2024 • Zephyr: Direct Distillation of LM Alignment. By Lewis Tunstall et. al. http://arxiv.org/pdf/2310.16944 . Accessed Oct. 2024 • Latent Diffusion Models. By Robin Rombach et. Al. https://arxiv.org/pdf/2112.10752. Accessed Oct. 2024 • Synthetic data is the future of Artificial Intelligence. By Moez Ali. https://moez-62905.medium.com/synthetic-data-is-the-future-of-artificial-intelligence-6fcfd2ce1a14. Accessed Oct. 2024 • Consensus and subjectivity of skin tone annotation for ML fairness. By Google Research. https://research.google/blog/consensus-and-subjectivity-of-skin-tone-annotation-for-ml-fairness/. Accessed Oct. 2024 • Deceptive Tricks in Artificial Intelligence: Adversarial Attacks in Ophthalmology. By Agnieszka M Zbrzezny and Andrzej E Grzybowski. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10179065/. Accessed Oct. 2024 • If it's what I wanted that's great, but if it's not, I just wasted time": Unpacking the perceived costs/benefits of ML enhanced developer tooling. By Ambar Murillo et. al. https://storage.googleapis.com/gweb-research2023-media/pubtools/7130.pdf. Accessed Oct. 2024
Supplementary	• Artificial Intelligence (6.034). By Patrick Winston. ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010. Accessed Oct. 2024 • Machine Learning Specialization. By Andrew NG. www.coursera.org/specializations/machine-learning-introduction. Accessed Oct. 2024

9. Generative AI use

Permission for use	The use of generative AI in assignments and projects is permitted, provided that students adhere to the following rules: • Generative AI may be used to generate ideas, text structures, or code, but all generated materials must be reviewed and adjusted by the student to ensure that they meet academic requirements; • Any use of generative AI must be declared in the appendix section of each paper, using the phrase: "During the preparation of this paper, the author used [INSTRUMENT/SERVICE NAME] for the purpose of [REASON]. After using this tool/service, the author has

	reviewed and edited the content as necessary and takes full responsibility for the content of the paper.".
Usage restrictions	Students should not consider generative AI as a reliable source for information, as it does not provide clear references or documented sources: • Direct citation of AI-generated content in academic papers as a primary source is not permitted; • The activities in which the use of generative AI is prohibited are teacher-specified and are usually midterm and final assessments or ones that do not involve professional skill development activities.

10. Course evaluation

Midterm		Current Evaluation	Individual Study	Exam
M1	**M2**			
15%	15%	15%	15%	40%
Minimum standard of performance Attendance and activity in lectures and laboratory works; A minimum grade of "5" on each of the midterms and laboratory assignments; Knowledge of basic models and algorithms applied in the field of AI.				

11. Evaluation criteria

Activity	Evaluation components	Evaluation method, evaluation criteria	Activity mark weight	Course evaluation weight
Midterm 1	Theoretical component, topics T1 -- T7	Test / MOODLE	66%	**15%**
	Theoretical component LL1 – LL3	Test / MOODLE Discussions during laboratory works	34%	
Midterm 2	Theoretical component, topics T8 – T15	Test / MOODLE	66%	**15%**
	Theoretical component LL4 – LL6	Test / MOODLE Discussions during laboratory works	34%	
Current Evaluation	Practical component LL1 – LL6	Discussions during laboratory works	100%	**15%**
Individual Study	Topic research	Presentation	66%	**15%**
	Practical component LL1 – LL6	Discussions during laboratory works	34%	
Exam	Theoretical component T1 – T15	Test / MOODLE	75%	**40%**
	Practical component LL1 – LL6	Discussions during laboratory works	25%	