General information	**Name, code and number of credits**	CMS529, Machine Learning and Pattern Recognition**,** 4 KU / 8 ECTS
	Departament	Computer Science
	Program (bachelors, master)	Master
	Semester	Spring 2026
	Subject teacher (s)	PhD, Associate Professor Leyla Muradkhanli
	E-mail:	leyla@khazar.org
	Lecture room	11 Mehseti str. (Neftchilar campus), Room # 301, Saturday
	Advice hours	by appointment
Prerequisites	**Programming**	
Language of instruction	English	
Type of subject (compulsory/elective)	Compulsory	
Resources	**Textbooks** 1. Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python by Sebastian Raschka, Yuxi (Hayden) Liu, Vahid Mirjalili, Packt Publishing, 2022. 2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, O'Reilly Media, 2nd edition, 2019. 3. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020.	
Course description	This course introduces the principles, algorithms, and applications of machine learning (ML). Students will learn theoretical foundations and practical experience through coding assignments and projects.	
Course objectives	The course aims to teach, present and analyze the basics of the modern methods and algorithms for ML. The course introduces the fundamental concepts, algorithms, and applications of ML. It covers supervised, unsupervised, and reinforcement learning, with a focus on theory, implementation, and real-world use cases.	
Learning outcomes	By the end of the course, students will be able to : • understand and implement machine learning algorithms; • implement ML models using Python, scikit-learn, TensorFlow, and PyTorch; • apply data preprocessing and feature transformation techniques; • evaluate and compare models with standard metrics; • apply ML to real-world problems in a project.	
Teaching methods	**Lecture**	x
	Group discussion	x

	Lab exercise	x	
	Simulation	x	
	Case analysis		
	Course paper	x	
	Others		
Assessment	**Components**	**Date/deadline**	**Percentage (%)**
	Midterm Exam		**30**
	Case studies		
	Class Participation		
	Laboratory Work (Assignments)		**20**
	Project		**15**
	Paper Presentation		
	Final Exam		**35**
	Others		
	Total		**100**
Rules (Teaching policy and behaviour)	**Assignments** Five assignments will be during the semester. It includes supervised, unsupervised and reinforcement learning algorithms. The assignments must be submitted in class on the due date. **Project** The project includes problem definition, data collection, preprocessing, modeling, evaluation, and presentation Students should submit 12-15 pages of research paper, program codes and will give 15-minute presentation to the class, in the last week of the semester. **Preparation for class** The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work on relevant problems. We will also have many review sessions throughout the semester. These review sessions will take place during the regular class times. **Withdrawal (pass/fail)** This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least 65% to pass. In case of failure, he/she will be required to repeat the course the following term or year. **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, Midterm and Final Examinations will lead to paper cancellation. In this case, the student will receive a zero (0) without any consideration.		

	Professional behavior guidelines The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. **Ethics** Students should not arrive in late to class. All cell phones must be turned off and stowed away before entering class. Use of any electronic devices is not allowed in the classroom and violators will be punished accordingly.

Tentative schedule

Week	Date	Topics to be covered	Tasks/Resources
1.	21.02.26	**Foundations of Machine Learning** Definition, applications, types of learning (supervised, unsupervised, reinforcement)	Chapter 1 [1] Chapter 1 [2]
2.	28.02.26	**Data Preparation and Processing** Data preprocessing, cleaning, handling missing values. Train-test split, cross-validation, evaluation metrics. Python libraries for data preparation.	Chapter 4 [1] Chapter 2 [2]
3.	07.03.26	**Supervised Learning – Regression** **Linear Regression** Polynomial regression ***Lab. work 1***	Chapter 9 [1] Chapter 4 [2]
4.	14.03.26	**Supervised Learning – Classification** **Logistic Regression** Multiple Logistic Regression	Chapter 8 [1] Chapter 4 [2]
5.	21.03.26	**Holiday**	
6.	28.03.26	**Supervised Learning – Classification** **k-Nearest Neighbors (k-NN) algorithm** ***Lab. work 2***	Chapter 3 [1]
7.	04.04.26	**Supervised Learning – Classification** **Decision Trees** ***Lab. work 3***	Chapter 6 [2]
8.	11.04.26	**Supervised Learning – Classification** **Random Forests**	Chapter 6 [2]
9.	18.04.26	**Midterm exam**	
10.	25.04.26	**Supervised Learning – Classification** **Support Vector Machines (SVM)**	Chapter 5 [2] Chapter 12 [3]
11.	02.05.26	**Unsupervised Learning** **Clustering. k-Means clustering** ***Lab. work 4***	Chapter 10 [1] Chapter 9 [2]

12.	09.05.26	**Unsupervised Learning** **Dimensionality Reduction** Principal Component Analysis (PCA)	Chapter 5 [1] Chapter 8 [2]
13.	16.05.26	**Neural Networks** Perceptron, feedforward neural networks. Backpropagation and activation functions. ***Lab. work 5***	Chapter 11 [1] Chapter 10 [2]
14.	23.05.26	**Reinforcement Learning**	Chapter 19 [1] Chapter 18 [2]
15.	30.05.26	**Applications of Machine Learning** ***Project Presentation***	Chapter 8 [1] Chapter 16 [2]
Final exam			