College of Engineering Department of Civil Engineering



CE 548 Master of Science in Civil Engineering

Credit and Contact hours	3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory)		
Required, or Elective	Elective		
Course Description	This course aims to introduce the students to the fundamentals of machine learning (ML) and artificial intelligence (AI) and their applications in the transportation sector. Students will get exposed to a wide range of AI applications related to road safety, micro mobility and sustainability. Topics include: exploratory data analysis, regression analysis, classification and clustering algorithms. Moreover, students taking this course will gain hands-on experience of design, and implementation of a technical project using real-world transportation datasets.		
Prerequisites or Co- requisites	None		
Course Learning Outcomes	Students completing this course successfully will be able to: Course Learning Outcomes (CLOs) CLO1. Recognize the fundamentals of machine learning (ML) and artificial intelligence (AI) and their applications in transportation sector. K1 CLO2. Compare different ML algorithms considering strengths and limitations. K1 CLO3. Evaluate datasets for ML algorithms. S2 CLO4. Determine the most appropriate ML algorithm for a given dataset. S1 CLO5. Perform ML algorithms using Python with a real-life dataset with a high level of autonomy and responsibility. V2 CLO6. Collaborate effectively and professionally with a team in solving a real-life problem. V2	Related Student Outcomes (SO)SO1SO1SO3SO2SO7SO7	
Student Outcomes related to this Course	 SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems. SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors. SO 3 Investigate scientific research problems independently or through teamwork using critical thinking, appropriate techniques, advanced tools, and management principles. SO 7 Effectively manage, individually or in groups, specialized tasks and activities in coursework, projects, assignments, and research work with a high level of autonomy and responsibility. 		

	List of Topics	Related CLOs	
Topics Covered	1. Introduction to Machine Learning & Introduction to PYTHON - PART I	CLO 1	
	2. Introduction to Machine Learning & Introduction to PYTHON - PART II	CLO 2	
	3. Classification/Regression: linear and logistic regression	CLO 2,3	
	4. Classification: Support Vector Machines	CLO 3	
	5. Classification/Regression: Decision Trees	CLO 2,4	
	6. Classification/Regression: LSBoosting and Random Forest	CLO 3	
	7. Classification: Neural Network Learning	CLO 3,4	
	8. Clustering: K-NN and K-means	CLO 4	
	9. Clustering: Hierarchical and GMM	CLO 4	
	10. Dimensionality reduction: PCA	CLO 4	
	11. Diagnosing ML algorithms	CLO 1,5	
	12. Project presentations	CLO 1,6	
	13. Reinforcement learning (if possible)	CLO 1,6	
	14. Heuristic algorithms (if possible)	CLO 1,2,6	
Textbook(s)	• Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to		
and Other	Data Mining, Addison-Wesley, First Edition, 2005.		
Required	• James G, Witten D, Hastie T, Tibshirani R. An introduction to statistical		
Material	learning. New York: springer; 2013 Jun.		
Grading System	Weekly quiz	10%	
	Weekly lab assignment	25%	
	Group Project/Term Paper	25%	
	Final Exam	40%	
Instructors	Dr. Mohammed Hamad O Almannaa		
Date of Review	November, 2024		