Syllabus of CIVL 4100R - Practical Machine Learning for Smart Infrastructure Systems

Syllabus

Instructor

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Course description

This course covers fundamental machine learning concepts and hands-on experience about smart infrastructure system applications. Lectures will cover the "full stack" of machine learning, including data cleaning and pre-processing, machine learning, and reinforcement learning. The covered topics include: collecting and processing real-world project data, detecting abnormal data, and imputing missing data; analyzing the data with a variety of machine learning methods including linear & logistic regression, decision tree, SVM, unsupervised learning (clustering, PCA), and advanced machine learning methods (ensemble learning and deep learning). Last, we will introduce reinforcement learning to build autonomous infrastructure systems that learn to make good decisions.

One key feature of this course is its application-driven nature. All applications of this course are about smart infrastructure systems. Through those applications, students will know how ML can be applied in their future career and research.

Calendar

Date	Lecture	Lecture Topic	Quiz	Project
5th Feb.	1	Course introduction, machine learning		
12th Feb.		*Lunar New Year's Day*		
19th Feb.	2	Data, Pandas & Time series data		
26th Feb.	3	Data visualization	Q1	
4th Mar.	4	Conventional ML models: Linear model, SVM, Trees		
11th Mar.	5	Supervised learning summary, Hyper-parameter tuning, ensemble learning	Q2	P1: Thermal preference prediction
18th Mar.	6	Neural Networks I		
25th Mar.	7	Neural Networks II & Pytorch	Q3	P1 due
1st Apr.		*Mid-term break*		
8th Apr.	8	Convolutional Neural Networks		P2: Structural defects detection
15th Apr.	9	Time series prediction I		
22th Apr.	10	Time series prediction II & Recurrent Neural Networks	Q4	P2 due
29th Apr.	11	Unsupervised learning		P3: Building load prediction
6th May	12	Reinforcement learning	Q5	
				P3 due

Grading

- Project: 25%*3 = 75%
- In-class quiz: 5%*5 = 25%

Projects

A total of three projects will be released to help you practice and apply the concepts learned in lectures. The project will be due on 23:59 PM Friday on the project due week.

Project late policy

All assignments must be turned in on time (deadline is 23:59 pm on the due date). We will allow a total of five late days (weekends and holidays counted) cumulatively. We will not make any additional allowances for late assignments: the late days are intended to provide for exceptional circumstances, and students should avoid using them unless absolutely necessary. Any assignments that are submitted late (with insufficient late days remaining) will not be graded.

Integrity

Cheating is strictly not allowed for either assignments or exams.

All projects should be done individually. You are allowed to discuss the project with other students, but not allowed to copy solutions/codes or share your solutions/codes with other students who haven't completed the project already. Cheating on projects or in-class quiz results in 0 points, so you really do not want to cheat.

Please, do your own work. Thank you!

Citizenship

A diversified, inclusive and equitable environment would benefit everyone of our community. For exceptionally rude or disrespectful behavior toward the course staff or other students, your final grade will be lowered by up to a full letter grade (e.g., from an A- to a B-) at the discretion of the course instructors. You don't need to be concerned about this policy if you treat other human beings with even a bare minimum of respect and consideration and do not engage in behavior that is actively harmful to others.

Office hour

- Time: 4-5 pm every Wed.

- Venue: Room 3564 for Walter Zhe Wang