Fall 2025 Syllabus for

CIV555: ML and AI for Civil Engineering

Civil Engineering
Stony Brook University

August 29, 2025

Course Description

Course prefix, number, and title:	CIV 555, ML and AI for Civil Engineering
Meeting time:	Tu/Th 11:00-12:20
Location:	154 Light Engineering Lab
Course webpage:	mycourses.stonybrook.edu

Instructor Information

Name:	Ruwen Qin, Ph.D.
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Office:	2427 Computer Science Building
Office hours:	Tu/Th 12:45pm-14:45pm or by appointment

Course Description

This course introduces fundamental machine learning methods, including deep learning, for solving civil engineering problems. Through a combination of lectures and hands-on projects, students will learn key methods for data representation, regression, classification, and clustering. Additionally, artificial intelligence techniques such as neural networks, deep neural networks, and reinforcement learning will be introduced. The course emphasizes applications in civil engineering such as intelligent transportation systems, smart cities, water quality monitoring, structural health monitoring, construction automation, and multi-hazard assessment. (3 credits, Letter graded: A, A-, B+, etc.)

The tentative topics and schedule:

- Introduction (1 week)
  - Python Programming Environment
  - Concepts of Machine Learning
- Review (1 week)
  - Linear Algebra
  - Data Understanding, Description, and Summary
- Machine Learning (6 weeks)
  - Feature Extraction
  - Regression
  - Classification
  - Clustering
- Artificial Intelligence (6 weeks)

- Neural Networks
- Convolutional Neural Networks
- Recurrent Neural Networks (tentative)
- Reinforcement Learning (tentative)

Course Materials

Textbook

No textbook is required. References will be provided in the lecture notes of each learning module. Students may read some of the suggested references in depth per their own interest.

Other Materials

Lecture notes, data, and examples will be posted to the course's repository on GitHub. https://github.com/SBU-r/CIV555-FS25

Software

This course mainly uses Python programming. Students can use Google Colab without installing any software on their own computers. Alternatively, students can install Python and Jupyter Notebook to their own computers.

Grading

Grading Basis

Homework:	60%
Course Project:	40%

Grading Basis

This class has pre-defined numerical boundaries that determine the final letter grade:

Letter Grade	A	A-	B+	B	B-	C+	C	F
Score	[100, 92]	(92, 88]	(88, 84]	(84, 80]	(80, 76]	(76, 70]	(70,60]	(60,0]

The Graduate Catalog of Stony Brook University states that grades of "C" or better are passing and a grade of "F" indicates failing work.

Assignments

Homework

The homework assignments are opportunities for students to review and practice course material to determine if they have mastered it. Unlimited attempts are allowed before the submission deadline so that students can update their solution files if needed. If a student made multiple attempts, only the last attempt will be graded and recorded in the gradebook. After a homework is graded, students are encouraged to make corrections and discuss these with the instructor. At the end of the semester, the homework assignment on which a student received the lowest score will be dropped from the calculation of her/his final grade.

Please name all submitted files using this format "You rName_Assignment ID". Python code should be in the format of ".ipynb".

Course Project

The project can be done by a single student or a group of three students. Submissions of the project include a proposal, a presentation, and supporting materials of the project outcomes such as data sources, codes, notes, analysis, and others. The presentation is tentatively scheduled to take place on December 2 (Tuesday) and 4 (Thursday) in class.

The course project has two options:

- Paper review. The paper must have sufficient correlation with this course, but the application domain can be at the student's choice. The paper can be a comprehensive survey paper on ML/AI methods in your study area, or a research paper that develops ML/AI methods for solving a problem in the student's study area.
- Research project. Student(s) can choose a problem of their interest and solve the problem by demonstrating their learning outcomes from this course. Ideally, it is a draft paper that can be submitted to a conference.

Course Policies

Student Accessibility Support Center

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@Stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-and-emergency-services/index.php and search Alarms and Evacuations.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Attendance/Participations

Regular attendance is crucial for success in this course. Students are expected to attend every class, report for examinations, and submit major graded coursework as scheduled. If a student is unable to attend lecture(s), report for any exams, or complete major graded coursework as scheduled due to extenuating circumstances, the student must contact the instructor as soon as possible. Students may be requested to provide documentation to support their absence and/or may be referred to the Student Support Team for assistance. Students will be provided reasonable accommodations for missed exams, assignments, or projects due to significant illness, tragedy, or other personal emergencies. In the instance of missed lectures,

the student is responsible for reviewing posted course materials and finishing missed assignments. Attendance will be tracked, and habitual absence and tardiness may negatively impact the student's grade. To recognize and reward consistent attendance, a bonus system is in place. Students who maintain excellent attendance throughout the semester, attending all classes punctually, will be eligible for an attendance bonus up to 5 points. This bonus may contribute to your overall course grade.

Email Policy

This document sets forth guidelines for email communication in this course. Excessive emails are problematic for our fellow students and instructors. Please be sure you have a legitimate need to send an email.

General rules for emails:

- Send emails to the instructor directly rather than from Brightspace if you send attachments or expect attachments from the instructor
- The instructor will respond to emails sent on a given day no later than the NEXT WORKDAY. If the instructor did not respond to your email by the specified deadline, please don't hesitate to send her a reminder.
- If the subject of the question would be of general interest, the instructor will copy all other members of the class. If you do not want the instructor to copy other members, you must indicate so in the original email.
- Close your email with a proper sign-off (e.g., [your name]).

The instructor will answer email covering the following:

- Questions that arise from difficulty in understanding course material or content
- Request for feedback on graded work
- Private issues related to your participation and progress in the course

The instructor will NOT answer emails for the following:

- Questions already answered in this syllabus, in lectures, and contents posted to the course webpage. Please look in the posted course material in the course webpage first
- Technical questions that would be efficient to discuss face to face during office hours or after class, but difficult to answer in emails
- Lack of clear purpose of why the email was sent
- Question unrelated to the course or of an inappropriate nature
- Being disrespectful, offensive, or using rude language may not receive a response

Policy for Using Generative AI and LLM in Submitted Work

- If AI is used as assistance in any submitted work, students must cite the AI tool(s) used and clearly describe how they were utilized.
- AI tools cannot be used as a complete substitute for the work expected of students. This includes, but is not limited to, generating full solutions, writing entire code segments, or producing major portions of scholarly writing (e.g., essays, reports).
- AI tools may be used for brainstorming ideas, helping to diagnose possible mistakes in coding, polishing text that students have written (e.g., spelling and grammar checks, writing style improvements).