IE 7374 Machine Learning in Engineering

Course Overview	This course covers practical algorithms and the theory for machine learning from a Variety of perspectives. Topics include supervised learning (generative, discriminative learning, parametric, non-parametric learning, deep neural networks, support vector Machines), unsupervised learning (clustering, dimensionality reduction, kernel methods). The course will also discuss recent applications of machine learning, such as computer vision, data mining, natural language processing, speech recognition and robotics. Students will learn the implementation of selected machine learning algorithms via **python** and **TensorFlow**.
Prerequisites	Introduction to Probability and Statistics, Linear Algebra (**important**). **Comfortable with python programming language, being able to write functions and understand the basics (loops, statements, and conditions).**
Objectives	To learn theory and application of machine learning techniques. To learn how to evaluate the performance of machine learning models. To implement machine learning models using python programming and TensorFlow. To design and validate a machine learning problem.
Textbooks	1. [CB] Christopher Bishop, Pattern recognition and machine learning. [Required] 2. [KM] Kevin P. Murphy, Machine Learning: A Probabilistic Perspective. [Required]
Syllabus	**Supervised Learning** • Linear regression, overfitting, regularization, sparsity • Bias-variance tradeoff • Logistic regression • Naive Bayes • Perceptron • Neural networks and deep learning: DNNs, CNNs • SVM and kernels **Unsupervised Learning** • Clustering: k-means, mixture models, expectation maximization, k-medoids, spectral clustering • Dimensionality reduction: PCA, Kernel PCA • Matrix and tensor factorization • Topic modeling • Model selection
Homeworks	Homework and Lab Assignments (10)
In-class problems	10 in class problems for additional points – **Not mandatory**

Project Schedule	Project - Posting Date **September 30th** Submission Date **December 4th**
Course Evaluation	HomeWorks and Lab Assignments - 40% Exams - 30% Final Project - 20% Attendance – 10% In-class problems – 10% (Additional) Class Participations – 5% (Additional)
Software	Python and TensorFlow **Install Python and Jupyter notebook for Mac/Windows:** Follow the instructions in the link below to install Python and Jupyter notebook for Mac/Windows. All the steps remain same as shown in the video except the Python and Jupyter notebook version. Mac version: https://www.youtube.com/watch?v=daVgEXjv6DE Windows version: https://www.youtube.com/watch?v=5mDYijMfSzs

Grading	**Subject to change based on the overall class performance**
Evaluation Policy	1. Unless otherwise specified, all homework and assignments are due for submission at 03:00 pm on the day they are due. Late submission of homework will receive penalty. For a two-day delay, grades will be cut by 10%. Beyond two days past the deadline, the submission will not be accepted. 2. Discussion between students for homework and projects is not permissible. Each submission must be an outcome of individual effort.

Academic Integrity	A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors. Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the full academic integrity policy.
Recording of Classes	This course, or parts of this course, may be recorded for educational purposes. These recordings will be made available only to students enrolled in the course, instructor of record and any teaching assistants assigned to this course.
Student Accommodations	Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodation through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability. For more information, visit http://www.northeastern.edu/drc/getting-started-with-the-drc/.
Diversity and Inclusion	Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice. It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Your suggestions are encouraged and appreciated. Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion.
TITLE IX	Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.

	Northeastern' s Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff. In case of an emergency, please call 911. Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus
Contact	**Instructor Email: r.mohammadi@northeastern.edu** **TAs Contact: TBD** **TAs office hours: TBD** **TA office location: TBD**

1. All homework and projects will be delivered by the instructor via Canvas LMS
2. Students need to submit homework and projects via Canvas
3. Submission formats will be outlined for each homework and project.
4. Students can access Canvas via https://my.northeastern.edu/ website
5. There are good resources in https://my.northeastern.edu/ to help you get used to Canvas tool
6. Lectures in the form of videos will be uploaded twice a week
7. For personal (private) communication it is best to ask questions via Microsoft Teams. Type the name "Ramin Mohammadi" in the search bar of Teams. Then click on the profile and send your questions.
8. Students can also email the instructor r.mohammadi@northeastern.edu
9. Students attending the online class from abroad need to notify in advance if some tools are restricted in their home country. This will enable the instructor to create alternate mechanisms to deliver the class content