Northeastern University
College of Engineering

Multidisciplinary Graduate Engineering
Course Syllabus

Course Information
Course Title: Theory and Practical Applications of AI Generative Modeling
Course Number: INFO7380
Credit Hour: 4.0

Instructor Information
Full Name: Yizhen Zhao
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Technical/Course Materials Requirements

- No textbook is required.
- Students are expected to bring their own laptops with Python installed to attend the class.

Course Description/Prerequisite
The course will serve as an extension to the INFO6105 Data Science Engineering Methods and Tools (former INFO7374 Machine Learning in Finance & Python) and cover algorithms pertaining to generative AI. The course focuses on both theory and applications. Students will learn the quantitative models and metrics that drive the success of popular Generative AI applications such as Recurrent Neural Networks (RNN), Long Short-term Memory Model (LSTM), Attention Mechanism, Transformer Models, Convolutional Neural Networks (CNN), Generative Adversarial Networks (GAN) and Reinforcement Learning and Deep Q Learning, etc. Students will also develop hands-on Generative AI projects using popular deep learning cloud computing tools that include TensorFlow and PyTorch. Lectures and coding lab sessions are enriched with case studies and examples ranging from trading, image synthesis, text translation and generation, etc. to showcase the application of generative AI in various fields such as natural language processing, trading, finance, entertainments, etc.

The course includes eight chapters:

- Lecture 1 How Generative AI differs from traditional machine learning methods.
- Lecture 2 Recurrent Neural Networks (RNN)
- Lecture 3 Long Short-term Memory Model (LSTM)
- Lecture 4 Attention Mechanisms
- Lecture 5 Transformer Model

- Lecture 6 Convolutional Neural Networks (CNN) and Generative Adversarial Networks (GAN)
- Lecture 7 Reinforcement Learning and Deep Q Learning
- Lecture 8 Principles of Responsible AI

Student Learning/Course Outcomes (SLOs)

Specialized Knowledge	Broad and Integrative Knowledge	Applied and Collaborative Learning	Civic and Global Learning	Experiential Learning
Generative AI in Finance will study major Generative AI algorithms in the context of finance using Python. The course will also introduce leading Generative AI models used by finance professionals.	*Master the mainstream Generative AI algorithms.*	*Obtain a hands-on experience in working with Generative AI modeling using Python via teamwork.*	*The focus of the course will be on implementation rather than on theories. The methods can be extensively applied in public health, education and other civic learning areas.*	*Understand the implications of algorithm building blocks spanning across matrix analysis, statistics, optimization and stochastic calculus.*

Attendance Policy
Students are expected to complete course readings, participate in class discussions or other learning activities during the unit, and complete written assignments for each unit during the time of that unit.
It is understood that there might be one week when active participation in ongoing class conversations and learning activities might be delayed.
Beyond one-week time, if there is an absence or lateness in participation (1) faculty must be notified in advance; (2) grades will be adjusted accordingly.

Late Work Policy
Students must submit assignments by the deadline in the time zone noted in the syllabus. Students must communicate with the faculty prior to the deadline if they anticipate work will be submitted late. Work submitted late without prior communication with faculty will not be graded.

Grading/Evaluation Standards
Grade Scale

95-100%	A	87-89.9%	B+	77-79.9%	C+	69.9% or below	F
		84-86.9%	B	74-76.9%	C		
90-94.9%	A-	80-83.9%	B-	70-73.9%	C-		

Grade Breakdown:

Category # 1 - 10%

Category # 2 - 80%

Category # 3 – 10%

Course Schedule

Week	Content
Week 1–2	Lecture 1 Introduction to Generative AI Coding Lab: Supervised Machine Learning Unsupervised Machine Learning vs Generative AI
Week 3–4	Lecture 2 Recurrent Neural Networks (RNN) Coding Lab: Applications of RNNs in Natural Language Processing and Trading Lecture 3 Long Short–Term Memory Model (LSTM) Coding Lab: Applications of LSTMs in Natural Language Processing and Trading
Week 5–6	Lecture 4 Attention Mechanism Coding Lab: Recurrent Neural Networks (RNNs) vs Attention Mechanism
Week 7–8	Lecture 5 Transformer Models Coding Lab: Speech Recognition, Text Translation, BERT, Encoder–Decoder structure, Controllable Chatbot Coding Lab: BERT, Large Language Models & ChatGPT: Fine Tuning vs Prompting
Week 9–10	Lecture 6 Generative Adversarial Network Coding Lab: Convolutional Neural Networks (CNN) &

	Generative Adversarial Network (GAN)
Week 11-12	Lecture 7 Reinforcement Learning Coding Lab: Reinforcement Learning and Trading Strategy Design
Week 13	Lecture 8 Introduction to Responsible AI + Review Session
Week 14	Final Exam

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.

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 accommodations 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/.

Library Services

The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for Education specific resources, visit
http://subjectguides.lib.neu.edu/edresearch.

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, member 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.

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.