Northeastern
College of Engineering

INFO 6106 Neural Methods
SPRING 2025

Course Information
Course Title: Neural Methods
Course Number: INFO6106
Term and Year: Spring 25
Credit Hour: 4
CRN: Click or tap here to enter text.
Course Format: Click or tap here to enter text.

Instructor Information
Full Name: Dino Konstantopoulos
Email Address: dino.k@northeastern.edu
Office Hours: TBD

Instructor Biography
Dino worked for a US Federal Lab for a decade and a half before joining Northeastern in 2018. Dino specializes in Data Science and Machine Learning, Natural Language, Algorithms, and DevOps. When Dino isn't in a class or tinkering on his laptop, he is usually on a very slim boat on the river Charles thinking about old problems and new solutions.

Teaching Assistant Information
Full Name: TBA
Email Address: TBA
Office Hours:TBD

Course Prerequisites
Please review the academic catalog to identify any course prerequisites

Course Description
AI researchers break down intelligence into two forms: *Fluid intelligence* is about devising new methodologies for solving problems. Humans excel in that form of free-thinking. *Crystallized intelligence* is about applying proven methodologies and algorithms to solving problems. Machines trained on WWW data and programmed by humans excel in that one. Machines programmed by machines don't exist yet; even github Copilot suggests code uploaded by humans.

Machine learning (ML) is about leveraging crystallized intelligence to build models that statistically relate columns of a spreadsheet to other columns with a formula so that when new rows of the former columns are observed, cells in the latter columns can be predicted. This is called *supervised training*. There are many types of Machine

learning algorithms, some are particularly effective with some types of data, such as images, or natural language. But they all adopt a statistical approach to come up with the formula, in other words, they learn from observations rather than abstract theories about matter, the human epistemological approach to knowledge. And so ML is a distillation of human knowledge, rather than artificial knowledge. The intelligence programmed, by humans into Machines is about accessing, word by word, the most popular answer for each human prompt.

Probably the mpst successful Machine Learning model is the neural model, which mirrors in some regards how biological brains make sense of the world, learn from experience, and make predictions. They usually require more observations than other models and many people feel that the resulting models are less explainable, generating fear that neural models may one day take over the world from humans. But there is no one "Skynet". Instead, there are about 2 billion independent computers in the world, and if anyone of them bothers you, better to turn it off.

This course is an introduction to the field of Machine Learning, concentrating on feedforward, recurrent, convolutional, and Transformer-based neural models. In the beginning, we will learn simpler machine learning methods that have proven successful in practical applications, which includes decision trees and Support Vector Machines. After a couple of weeks, we focus entirely on deep neural models, feedforward, recurrent, and convolutional layers, leading to the most successful model of them all: The Transformer model. We will also cover basic issues that confront machine learning methods, such as trust and interpretability. With the successful completion of the course, the student will feel ready to apply for AI and ML jobs in the life sciences, financial, advertising, social Web, and ML-to-consumer industries.

Course Learning Outcomes

This course is a hands-on coding class. Theory and code will be presented in jupyter notebooks, and students will build on the code presented in class to complete their homework. Homework will be weekly and team-based. The midterm and the final exam will consist of a written job-hiring interview session. The final proect is a choice between a predefined dataset and a more open-ended research project in computer vision.

Required Tools and Course Textbooks.

Textbook: The Science of Deep Learning, Iddo Drori, Cambridge University Press.

Course Schedule/Topics Covered.

Class Modules:
Decision Trees and Random Forests
Support Vector Machines
Probabilistic Classifiers and Naive Bayes Classifiers
Feedforward and Dense Neural networks
How Embeddings organize knowledge
Recurrent Neural networks
Convolutional Neural networks
Transformer Neural networks
Diffusion networks
Interpretability and Trust
Reinforcement Learning
Leading industry Models and HuggingFace Transformers

Assignment Grading
The grading in the class is divided up as follows:
Assignments 30%
Mid-Term Exam 30%
Final Projects (teams) 30%
Final Exam 10%

Grading Scale

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

Attendance/Late Work Policy

Attendance Policy

Students registered in MGEN courses (INFO, CSYE, and DAMG) are allowed **a maximum of 2 absences per course, with 3 or more absences resulting in an automatic 'F' for that course.** Students are expected to inform their instructors of any absences in advance of the class; if a student is sick long-term or experiences a medical issue that prevents class attendance, it is strongly encouraged that they speak with their Academic Advisor (coe-mgen-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. Should a student anticipate being unable to attend 3 or more classes, they should discuss their situation with their Academic Advisor to explore other types of leave in accordance with the University's academic and global entry expectations. International students should review the Office of Global Services webpage to understand their visa compliance requirements.

Teaching Assistants (TAs) or Instructional Assistants (IAs) will be present at each class to collect student attendance.

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.

End-of-Course Evaluation Surveys
Your feedback regarding your educational experience in this class is particularly important to the College of Engineering. Your comments will make a difference in the future planning and presentation of our curriculum.

At the end of this course, please take the time to complete the evaluation survey at **https://neu.evaluationkit.com**. Your survey responses are **completely anonymous and confidential**. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your Northeastern University Mail account notifying you when surveys are available.

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.

MGEN Student Feedback
Students who would like to provide the MGEN unit with anonymous feedback on this particular course, Teaching Assistants, Instructional Assistants, professors, or to provide general feedback regarding their program, may do so using this survey: https://neu.co1.qualtrics.com/jfe/form/SV_cTlAbH7ZRaaw0Ki

University Health and Counseling Services
As a student enrolled in this course, you are fully responsible for assignments, work, and course materials as outlined in this syllabus and in the classroom. Over the course of the semester if you experience any health issues, please contact UHCS.

For more information, visit https://www.northeastern.edu/uhcs.

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 https://drc.sites.northeastern.edu.

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 https://library.northeastern.edu
Network Campus Library Services: Northeastern University Library Global Campus Portals

24/7 Canvas Technical Help
For immediate technical support for Canvas, call 617-373-4357 or email help@northeastern.edu

Canvas Student Resources: https://canvas.northeastern.edu/student-resources/

For assistance with my Northeastern e-mail, and basic technical support:
Visit ITS at https://its.northeastern.edu
Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

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.

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 **https://www.northeastern.edu/ouec** for a complete list of reporting options and resources both on- and off-campus*.