



## CSYE7105 High-Performance Parallel Machine Learning & AI FALL 2024

### Course Information

Course Title: High Performance Parallel Machine Learning & AI  
Course Number: CSYE7105  
Term and Year: Fall 2024  
Credit Hours: 4  
CRN: 13969  
Course Format: On-Ground

### Instructor Information

Instructor: Professor Handan Liu. Ph.D.  
Email Address: [h.liu@northeastern.edu](mailto:h.liu@northeastern.edu)  
Office Hours: every Monday 10:30AM -11:30AM, in person, office room shown on Canvas

### Instructor Biography

<https://coe.northeastern.edu/people/liu-handan/>

### Teaching Assistant Information

- Lokeshwaran Venugopal Balamurugan, [venugopalbalamurug.l@northeastern.edu](mailto:venugopalbalamurug.l@northeastern.edu)  
Office Hours: Wednesday 3-5 PM, Saturday 3-6 PM, in person and/or online  
office room shown on Canvas
- Rishika Gurram, [gurram.ri@northeastern.edu](mailto:gurram.ri@northeastern.edu)  
Office Hours: Tuesday 11 AM-1 PM, Thursday 2-4 PM, in person and/or online  
office room shown on Canvas

### Help and Support

- We will use **Teams class group** as a main tool to help and support you. TAs will maintain this group.

- Post/send questions or concerns via Teams class group. TAs and I will respond you asap.
- You also can get help and support in TA hours and my office hours.

### Course Prerequisites

DAMG 6105 with a minimum grade of B or INFO 6105 with a minimum grade of B

### Course Description

The objective of this course is to understand the principles of high-performance computing and the practice of the emerging parallelism-based machine learning paradigm. We will learn high-performance parallel architectures and parallel programming models. And we will explore the parallelism of machine learning and deep learning to achieve high-speed and high-performance on heterogeneous cluster architectures, as well as the applications to a variety of domains, including image classification, speech recognition, and natural language processing, etc.

### Course Learning Outcomes

- Understand high-performance parallel architectures and parallel programming models.
- Understand HPC supercomputing cluster and how to operate on NEU Discovery cluster.
- Grasp how to parallelize and implement data science and machine-learning approaches on multiple-CPU architectures.
- Grasp how to use high-performance parallel deep learning approaches to achieve acceleration on multiple-GPU architectures.

### Required Tools and Course Textbooks.

There are no specific required books for this course.  
Course materials are curated and created by me.

### Grading/Evaluation Standards

#### Grading Schemes

#### Northeastern Grading Schema Template

Name	Range	Name	Range
A	100% to 94%	C	<77% to 74%
A-	<94% to 90%	C-	<74% to 70%
B+	<90% to 87%	D+	<70% to 67%

<b>B</b>	<b>&lt;87% to 84%</b>	<b>D</b>	<b>&lt;67% to 64%</b>
<b>B-</b>	<b>&lt;84% to 80%</b>	<b>D-</b>	<b>&lt;64% to 60%</b>
<b>C+</b>	<b>&lt;80% to 77%</b>	<b>F</b>	<b>&lt;60% to 0%</b>

### Grading Breakdowns:

This course consists of 5 homework assignments, 1 hands-on operation test, 3 quizzes, a research project and attendance:

Assignments	5 homework assignments	25%
Hands-on Test	1 hands-on operation test on HPC Cluster	10%
Quizzes	3 open-book quizzes for 3 sections	30%
Research Project	Including Paper and Presentation	30%
Attendance	Quickly Attendance	5%

**For additional details and policies for students, see Canvas.**

### 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](mailto: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\\_cTIAbH7ZRaaW0Ki](https://neu.co1.qualtrics.com/jfe/form/SV_cTIAbH7ZRaaW0Ki)

### **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/uahcs>.

### **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](mailto: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](mailto: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.