Last updated: 8/21/2024

Course Information

- **Course number and title:** ECE 57000 – 002/004/EPE Artificial Intelligence
- **CRN:** 34846/27733/29583
- **Meeting day(s) and time(s):** 4:30 pm - 5:20 pm MWF for Section 002, Asynchronous Online Learning for Section 004/EPE
- **Instructional Modality:** Face-to-Face for Section 002, Asynchronous Online Learning for Section 004/EPE. Lecture videos will be posted to Brightspace via Boilercast after the lecture.
- **Course credit hours:** 3.000 Credits
- **Prerequisites (if any):** GR-ECE 30200 & 36800 Req
- **Course web page:**
    - Brightspace page (lecture notes, assignments): https://purdue.brightspace.com/d2l/home/1096443
    - Piazza page (announcements, discussions): https://piazza.com/purdue/fall2024/ece57000

Instructor(s) Contact Information

- **Name of the instructor(s):** Chaoyue Liu
- **Office Location:** BHEE 313A
- **Office Phone Number:** Unknown yet
- **Purdue Email Address:** liu4179@purdue.edu
- **Student consultation hours, times, and location:**
    - BHEE 313A, 10:00am - 12:00pm Wednesdays (first week on zoom)
    - Zoom, 7:00pm - 8:00pm Wednesdays: https://purdue-edu.zoom.us/my/cyliu
- **Name of the instructor(s):** Xiaoqian (Joy) Wang
- **Office Location:** WANG 3061
- **Office Phone Number:** 765-494-2045
- **Purdue Email Address:** joywang@purdue.edu
- **Student consultation hours, times, and location:**
    - Zoom office hours at 2:30pm-4pm Eastern Time Monday/Friday: https://purdue-edu.zoom.us/j/96839326895
    - Or by appointment

Please refer to Brightspace for office hours of teaching assistants.

Course Description

This course will provide a graduate-level introduction to artificial intelligence (AI), which is broadly defined as any method that enables intelligent behavior in computers. Topics may include machine learning, probabilistic methods, representation learning, natural language processing, computer vision, and special topics. The course will cover technical concepts, intuitions, and algorithms and will include basic training in AI research.

Expectations/Prerequisites

This class is oriented towards first-year graduate students. The course will expect knowledge of linear algebra, probability distributions, random variables, and Python programming. If you are not familiar with these subjects, this may not be the right class for you; or, you will be expected to (re-)learn these concepts on your own.

We have posted a **prerequisite quiz** on the class website to help you decide if you have the necessary background for this course or should consider taking it at a future time. This quiz is entirely optional and will not count towards your grade in the class.

This syllabus is required reading and you will be required to know the policies outlined in this syllabus. Questions about the syllabus may appear on quizzes.

Learning Resources, Technology & Texts

- **Textbook:** No required textbook. We will not follow any particular textbook. Related reading will be referred to in lecture notes if appropriate. Below are a few supplemental textbooks that may be useful.
    - (Optional) *Deep Learning* by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2016. –Available for free online at http://www.deeplearningbook.org or physical copy available on Amazon.
    - (Optional) *Machine Learning: A Probabilistic Perspective* by Kevin P. Murphy, 2012. Available online via Purdue's library system: https://ebookcentral.proquest.com/lib/purdue/detail.action?docID=3339490
    - (Optional) *Python Data Science Handbook* by Jake VanderPlas, 2016. Available for reading online at https://jakevdp.github.io/PythonDataScienceHandbook/
- **Use of artificial intelligence (AI) or Large Language Models (LLM) in this course:** You must acknowledge any use of LLMs by documenting which prompts you used and for what. Ultimately you are responsible for all content and you need to acknowledge your use of it, though you will not be penalized if you do. Failure to document your usage of LLMs could result in a failure of the course.
- **Academic Success and/or Tutoring support:** The Helen Bass Williams **Academic Success Center**, provides a variety of proactive, practical and approachable academic support services for you to strengthen your approaches and strategies for learning, including study skills consultations, peer coaching, workshops, and online handouts. Visit the ASC website for more information and to access resources.
- **Purdue Libraries and School of Information Studies support:** I encourage you to visit Ask a Librarian to connect with helpful resources and services provided by the Purdue Libraries and School of Information Studies for course assignments and projects.
- **Brightspace learning management system:** Access the course via Purdue's Brightspace learning management system. Begin with the Start Here tab, which offers further insight to the course and how you can be successful in it. It is strongly suggested that you explore and become familiar not only with the site navigation, but also with the content and resources available for this course. See the Student Services widget on the campus homepage for resources such as Technology Help, Academic Help, Campus Resources, and Protect Purdue.

Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

- The ability to write programs for artificial intelligence techniques.
- The ability to modify or implement one current artificial intelligence research method.
- The ability to write a report on a current artificial intelligence research topic.

Communication Policies

We ask that **all course-related questions be posted to the Piazza** discussion board – your questions may be useful to other students. Piazza is a shared discussion forum, where your question can be answered by the teaching staff or your fellow students! Piazza will be the primary method for disseminating course announcements, so you *must have a Piazza account*. We hope to reply to unanswered questions within 1-2 business days (9am-5pm, Mon-Fri). Note this means that you may not receive an answer on Piazza on the day the assignment is due so I would encourage you to start early and ask early.

If you have a question of a personal nature that you do not want to post on Piazza, then you may email the instructor. **Please include both instructors in the email.** We will endeavor to respond to your emails within two business days (not counting weekends, when responses may be delayed).

ECE 570 teaching staff have no training as first responders. Please call 911 if you have an emergency. Email messages marked as "urgent" or "emergency" will be forwarded to Purdue Police and the Office of Dean of Students.

Instructor Office Hours: We will expect that you have been attending lectures regularly (or if an online student, watching the video lectures) and reviewing the notes before asking questions in office hours. Additionally, we will expect that you have put some effort into understanding the material. **We will give preference to research or conceptual questions** over assignment/debugging questions because assignment questions could be answered by the TAs.

TA Office Hours: You must be able to explain your code to the TA—at least what you are trying to do. **If you cannot explain your code, the TAs will move to the next person**. This will aid in efficiency and ensure that you have tried to understand before asking a question. Also, to be reasonably fair to all students, the TAs plan to use an office hour queue system. The TA will answer 1 main question or code issue for **up to 10 minutes** (but if your 1 question can be answered faster, they will move on before 10 minutes). You can rejoin the queue and they will circle back around when they are able.

Assignments

ECE 570 in Fall 2024 will be evaluated using:

- 25 points: online quizzes
- 25 points: programming assignments
- 50 points: course project
    - checkpoint 1 - paper selection: 5 points
    - checkpoint 2 - literature review
    - preliminary implementation and writeup: 5 points
    - peer review: 5 points
    - project deliverables - term paper + code: 20 points
    - checkpoint 3 - peer review of term paper: 5 points
    - final presentation:
    - final presentation: 5 points
    - monitor+attendance: 5 points

Note: The weights above are approximate. The instructor reserves the right to change the weights later.

Online Quizzes:

There will be weekly short online quizzes throughout the semester. Late submission of quizzes are not taken. Lowest 3 scores are dropped. Most quizzes will focus on recent content but some of them will be review quizzes and can cover any material up to that point. All quizzes will be weighted equally.

Programming Assignments:

There will be 5-6 programming assignments throughout the semester, i.e., one assignment every two to three weeks. Lowest 1 score is dropped. All assignments will be weighted equally. The assignments are meant to reinforce the content and provide hands-on experience with the common tools of AI/ML. **All regrade requests must be submitted on Gradescope**. Regrade requests over email will not be accepted.

Course Project

Here we provide an overview about the course project. We'll post more detailed instructions for each item later in the semester regarding what/how/when to submit.

The course project will require reading several recent AI/ML research papers and reimplementing one of these papers. To ensure progress throughout the semester, you will be required to submit various project checkpoints and peer review other students' work.

1. Paper selection

Every student will be required to select, read at least 3 recent research papers in the fields of AI, machine learning, data mining, computer vision, or natural language processing, and reimplement one of them.

Every student's selection of papers must be approved by the course instructor. To submit the selected papers, you need to use a **BibTeX entry** (no other formats will be accepted) for each paper including a URL for downloading a pdf of the paper. For a journal paper, this should contain (at least) the paper title, paper abstract, authors, journal, volume, year, pages and pdf URL. For a conference paper, this should contain (at least) the paper title, paper abstract, authors, conference, year, and pdf URL. You also need to summarize the selected paper along with your plan of reimplementation.

2. Preliminary implementation and writeup

Every student will prepare a writeup covering the following

- Brief overview/background of the topic that your selected papers are about
- Definition of the problem discussed in your selected papers
- Summary and critique of the papers that you have read
- Preliminary implementation details and results
- Proposal for the course project

3. Course Project Deliverables

The course project will be individual. No group projects. However, we encourage you to discuss your papers and project with other students. Explaining your papers or project to someone else can help test your own understanding.

The deliverables contain two parts: 1) project implementation; and 2) term paper.

3.1 Project implementation:

For project implementation, you will be required to do at least one of the following:

- **Reimplement a paper idea:** Implement and evaluate the ideas from at least one paper. If an implementation of the paper is already available (e.g. from the author's website), you must state this in your term paper and compare your implementation to the existing implementation, both in terms of code and performance.
- **Extend an existing idea:** Propose, implement, and evaluate a significant extension of one paper. For this option, you can build off of any existing implementation but your implementation must extend or alter the original idea in a significant way.

Note: The implementation must be nontrivial. A good guideline is that your implementation should be at least four pages of code. Ultimately, we will determine whether or not the implementation meets the non-triviality requirement. You must conduct a substantive evaluation of your implementation to determine how well it solves the intended problem.

3.2 Term paper:

For term paper: You will be required to write a term paper of **six pages** (not including references, acknowledgement, appendix) in LaTeX that is formatted in AAAI two-column, submission style; see the AAAI-25 author kit for details at https://aaai.org/conference/aaai/aaai-25/submission-instructions/. You can include your preliminary writeup (Section 2) in the term paper. The term paper is expected to cover the following:

- Abstract
- Introduction
- Related Work
- Problem Definition
- Methodology
- Experimental Results
- Conclusion and Future Directions

Note: You should **NOT** put your name on the term paper to accommodate the double-blind reviews. See the "Abstract and Paper Submission" section in AAAI-25 at https://aaai.org/conference/aaai/aaai-25/submission-instructions/ for Double-Blind Reviewing Instructions for details.

Note on Large Language Models (LLM) for term paper: We'll follow the policy in AAAI-25 regarding the use of LLM on term paper. The following is from the "Plagiarism & Use of ChatGPT or similar LLMs Policy" section in AAAI-25 at https://aaai.org/conference/aaai/aaai-25/aaai-25-main-technical-call-for-papers/.

"Plagiarism and the Use of ChatGPT or similar LLMs Papers that include text generated from a large-scale language model (LLM) such as ChatGPT are prohibited unless the produced text is presented as a part of the paper's experimental analysis. Note that this policy does not prohibit authors from using LLMs for editing or polishing author-written text.

AAAI'2025 furthermore follows AAAI policy that any AI system, including Generative Models such as Chat-GPT, BARD, or DALL-E, do not satisfy the criteria for authorship of papers published by AAAI and, as such, also cannot be used as a citable source in papers published by AAAI. Authors assume full responsibility for content, including checking for plagiarism and veracity of all text."

4. Final Presentation

You will be required to prepare a presentation (held online via Zoom) to discuss the project that you implemented. Note that this is an individual presentation for your own project. The project presentation is expected to cover the following:

- Problem definition: a brief summary of the problem that your project solved
- Method:
    - If you choose to reimplement a paper, introduce the method that is proposed in the paper
    - if you choose to extend an idea, introduce the method that you proposed to solve the problem
- Implementation: a description of your implementation
- Evaluation: a description and discussion of your evaluation
- (Optional) Any concluding thoughts or future directions.

Presentation Monitor: Every student is expected to monitor another presentation. The monitor is responsible for proposing at least two discussion questions and initiating class discussion after the presentation.

5. Peer Review

Like most machine learning and artificial intelligence conferences, this process will be double blind: reviewers will not know the identity of authors and vice versa. To support this, like all conferences, you should **NOT** put your name on the term paper submission or on your reviews. Also, like conferences, reviews will be confidential.

Every student will be required to read several other students' preliminary writeup and term papers and prepare conference-style reviews, primarily indicating clarity and the quality of the implementation effort. The exact format for the review will be announced later in the semester.

Missed or Late Work

Deadlines of all assignments are 11:59pm Eastern Time on the due date, unless otherwise announced.

- One day late: 90% of original score
- Two days late: 80% of original score
- More than two days: 0%

DRC Accommodations

If you would like to use your DRC accommodations, **you must send us an email request at least 2 business days before the due date** to arrange for the accommodations. If we receive a notification from DRC, we will add the time extension on Gradescope for quizzes. However, any other accommodation must be explicitly requested by the student.

Grading Scale

The maximum grade cutoffs for this course are given below. Grades *will not be rounded*: an 89.99 is a B, and a 90.01 is an A. Thresholds may be lowered globally for the entire class at the instructors' discretion.

Letter grade	Minimum range
A	90
B	80
C	70

D	60
F	0

A student's grade is determined by only the student's ***demonstrated performance in this course***. No other factors will be used in grading. The instructors do not "bump up" students' grades. The instructors will not change a student's grade for any of these reasons:

- "I am very close to X. Can you give me X?"
- "I have good grades in other courses. Can you give me a good grade?"
- "I work very hard."
- "I spent a lot of time."
- "I really enjoy this course."
- "Please give me more assignments."
- "My dog is ill."
- "My cat is ill."
- "My flower is ill."
- "My roommate is ill."
- "I come to your office hours often."
- "If I get a bad grade, my parents will be angry at me."
- "If I get a bad grade, I will be angry at myself."

Any request to change a student's grade will be discarded. No exception will be given.

If a student needs special accommodation, the student should communicate with the Office of Dean of Students. The instructor will accept assignments from a student ***only if*** the Office of Dean of Students explicitly informs the instructors to give the student special accommodation. When the Office of Dean of Students says, "It is the instructor's discretion", the Office of Dean of Student rejects the student's request and the instructors are not authorized to accommodate the student's request.

Required Materials

Google Colab Pro ($10 per month, $40 for semester) is required for the assignments in this course. (However, see notes below about how to possibly use free Colab.)

While the free version of Google Colab may be enough for the assignments, we cannot guarantee the availability of the free version, especially GPU resources. Therefore, if you would like to save money, we would suggest using Colab free and avoid using the GPU runtime on Colab until you are done debugging your code. If you run into compute issues, you can then buy $10 of compute units as needed instead of the Colab Pro monthly subscription.

You are also free to use your own Python notebook environment for completing the assignments, but the TAs will only support the Colab environment. **The TAs will not be able to help with your Python environment setup**.

Attendance Policy

Students are expected to attend all class periods in person (or remotely if an online student) per Purdue's academic regulations. If a student misses a class, **the student** is still responsible for knowing all missed content including any announcements.

For the project presentation class periods, attendance (via Zoom) will be required and could affect your final project grade. These will be virtual presentations in Zoom breakout rooms to accommodate the large number of project presentations and encourage active participation. If you are an online student and cannot make these times because of work or other constraints, please let the instructors know.

Course Schedule

Week	Topic & Readings	Course Project	Programming Assignments
Week 1	*Introduction to artificial intelligence, How to select papers*		
Week 2	*Machine learning basics: Review of linear algebra and probability*		
Week 3	*Machine learning basics: Training an ML model, Logistic regression as the first example*		Assignment 1: training an ML model
Week 4	*Machine learning basics: Training an ML model, Logistic regression as the first example*	Paper selection due	
Week 5	*Deep learning basics: Fully connected neural network*		
Week 6	*Deep learning basics: CNN*		Assignment 2: neural network
Week 7	*Deep learning basics: transformer*	Preliminary implementation and writeup due	
Week 8	*Density estimation*		Assignment 3: CNN
Week 9	*Dimensionality reduction*	Peer review due	
Week 10	*Clustering*		Assignment 4: transformer
Week 11	*Deep generative models*		
Week 12	*Deep generative models*	Project deliverables: term paper + code due	
Week 13	*Special topics*		Assignment 5: representation learning
Week 14	*Project presentations*	Peer review due	
Week 15	*Project presentations*		
Week 16	*Project presentations*		Assignment 6: generative models

* Schedule and assignments subject to change. Any changes will be posted in the learning management system.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the

opportunity for the university to investigate the concern. More details are available on our course Brightspace under University Policies and Statements.

Academic Integrity Policy for Programming Assignment and Quiz

Unless expressly allowed, you are expected to complete all assignments and quizzes by yourself. However, you are allowed to discuss general issues with other students (concepts, programming techniques, clearing up confusion about requirements, etc.). You may discuss particular algorithmic issues on Piazza (but do not copy code!). *All students found sharing solutions will be reported to the Dean of students.* Punishments for academic dishonesty are severe, including receiving an F in the course or being expelled from the University. By departmental rules, all instances of cheating will be reported to the Dean.

Academic Integrity Policy for Course Project

Because each project should be unique, we will allow more freedom in collaborating or discussing the course project code. You can help each other debug or discuss the actual code. Both students will likely learn from this exercise. However, the student associated with the project should be the one actually writing all the code. Your project implementation should be your work. Additionally, no student should feel any obligation to help another student.

If you let others view your code and help in any substantial way, you must acknowledge their help in your term paper under an "Acknowledgements" section at the end of the term paper (e.g. "John Doe helped me debug my code."). If there is any doubt, please discuss with the course instructor before engaging in that activity.

Nondiscrimination Statement

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies and Statements.

Accessibility

Purdue University is committed to making learning experiences accessible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let us know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try Therapy Assistance Online (TAO), a web and app-based mental health resource available courtesy of Purdue Counseling and Psychological Services (CAPS)**.** TAO is available to all students at any time by creating an account on the TAO Connect website, or downloading the app from the App Store or Google Play. It offers free, confidential well-being resources through a self-guided program informed by psychotherapy research and strategies that may aid in overcoming anxiety, depression and other concerns. It provides accessible and effective resources including short videos, brief exercises, and self-reflection tools.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 a.m.- 5 p.m.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions in West Lafayette with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is free and can be done on BoilerConnect.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS offices in West Lafayette or Indianapolis.

Emergency Preparedness

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

A link to Purdue's Information on Emergency Preparation and Planning is located on our Brightspace under "University Policies and Statements." This website covers topics such as Severe Weather Guidance, Emergency Plans, and a place to sign up for the Emergency Warning Notification System. I encourage you to download and review the *Emergency Preparedness for Classrooms document*.

The first day of class, I will review the **Emergency Preparedness plan for our specific classroom**, following Purdue's required Emergency Preparedness Briefing. Please make note of items like:

- The location to where we will proceed after evacuating the building if we hear a fire alarm.
- The location of our Shelter in Place in the event of a tornado warning.
- The location of our Shelter in Place in the event of an active threat such as a shooting.

Disclaimer

Some instructions in this syllabus are adapted from Prof. David I. Inouye's ECE57000 syllabus in Fall 2023.

The syllabus is subject to change. The instructors reserve the right to make changes in order to ensure the integrity of the course and fairness among students, or for other purposes that the instructors deemed necessary.