CIS 8398: Advanced AI Topics in Business

Course Information

Semester: Fall 2023
Class Hours: Wednesday 5:30pm–9:45pm
Class Location: GSU Buckhead Center, Room TBD
Instructor: Dr. Yu-Kai Lin

- Email Address: yklin@gsu.edu
- Office Hours: By appointment; via WebEx. Etiquette rules:
  1. Please give me at least a **24 hours' notice**. That is, you cannot schedule an appointment that takes place within 24 hours of sending your email.
  2. In the email, you need to provide at least **3 time slots** that work for you, and they need to be on at least **2 different weekdays** and within **normal business hours**.
  3. I will respond to your email within 24 hours to confirm the appointment or propose a different schedule.

Course Description

This course covers various modern topics in the design, development, and evaluation of artificial intelligence (AI) and machine learning (ML) systems for data analytics in business. Example topics include (1) detection and measurement of bias and unfairness in AI/ML models, (2) approaches for explainable AI (XAI), (3) generative AI systems, (4) high-performance and human-in-the-loop ML, and (5) deep learning for computer vision and natural language processing. This course emphasizes hands-on programming and implementation. Students will develop technical skills using a modern programming language to implement methods and systems for these topics.

We emphasize active and experiential learning. To that end, the course materials are designed to deliver a lab-oriented learning experience with plenty of demos and exercises. Teaching in this course is often stylized as (and based on) a Kaggle competition so that students learn the strategies and skills in solving real-world end-to-end data science projects.

Course Objectives

Upon completion of the course, students will be able to:

1. Develop AI and ML systems
2. Implement interpretable and explainable AI systems
3. Construct high performance ML pipelines
4. Apply deep learning methods for image and textual data
5. Discuss the concepts and techniques in generative AI

Recommended Textbooks / Supplementary Materials

1. **R for Data Science, 2nd Edition** (2023; O'Reilly), by Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund. Referred to as **RDS** in Syllabus. Freely available at https://r4ds.hadley.nz/
2. **Hands-On Machine Learning with R** (2020; CRC Press), by Bradley Boehmke and Brandon Greenwell. Referred to as **MLR** in Syllabus. Freely available at https://bradleyboehmke.github.io/HOML/
3. **Deep Learning with R, Second Edition** (2022; Manning Publications), by François Chollet, Tomasz Kalinowski, and J. J. Allaire . Referred to as **DLR** in Syllabus.
4. **Generative Deep Learning, 2nd Edition** (2023; O'Reilly), by David Foster. Referred to as **GDL** in Syllabus.
5. **Explanatory Model Analysis** (2021; CRC Press), by Przemyslaw Biecek and Tomasz Burzykowski. Referred to as **EMA** in Syllabus. Freely available at https://ema.drwhy.ai/
6. **Fairness and Machine Learning** (2019), by Solon Barocas and Moritz Hardt and Arvind Narayanan. Referred to as **FML** in Syllabus. Freely available at https://fairmlbook.org/

Technology and Software Requirements

Because of the lab-oriented teaching style of this course, **students are required to bring their own laptop to every class**. The laptop should have the following software (all free!):

1. R: R is a popular programming language for data analytics. We will learn basic R programming in our labs. The final project and all lab exercises will be based on R.
2. RStudio: RStudio is an environment for R programming with many user-friendly features.

Student Evaluation

Gradable items are listed below. There will be occasional opportunities for extra credit.

- Assignments: 60% (=20%*4; dropping the lowest)
- Course Project: 30%, including:
  - Proposal document and presentation: 5%
  - Comments to other teams' proposal presentations: 5%
  - Responses to peer comments: 5%
  - Project final presentation: 5%
  - Project final submission (report, slides, code, and data): 10%
- Participation: 5%
- Satisfactory CIS 8880 Co-req: 5%

Expectations When Evaluating Assignments / Course Project

Assignments are the most important component in student evaluation. While specific requirements in each assignment will vary, below is a list of common sense rules:

1. You must submit your work to iCollege **before** the deadline.

- You should plan to submit your work at least one hour before the deadline so as to prevent unanticipated network/laptop issues.
- You will receive 0 points if you submit your assignment via email.
- You will lose half of the points for a late submission.
- If a deadline is 5:30pm, it means 5:30:00.000pm. In other words, if your submission is time-stamped at 5:30pm on iCollege, it is already past the deadline and will be considered as a late submission.

2. Your work must be original. Do not copy code from other students or from the internet.
   - Academic dishonesty will not be tolerated.
   - You will lose all points if you share your assignment with others.
   - You will lose all points if your assignment is copied from other people.
3. Read and follow the assignment/project instructions carefully.

Expectations When Evaluating the Final Project Submission

1. You must submit your work to iCollege **before** the deadline.
   - You should plan to submit your work at least one hour before the deadline so as to prevent unanticipated network/laptop issues.
   - Submissions made through email will not be graded.
   - You will lose half of the points for a late submission.
   - If a deadline is 5:30pm, it means 5:30:00.000pm. In other words, if your submission is time-stamped at 5:30pm, it is already past the deadline and will be considered as a late submission.
2. Your work must be original. Do not copy codes from other students or from the internet.
   - Academic dishonesty will not be tolerated.
   - You will lose all points if you share your work with others.
   - You will lose all points if your work is copied from other people.
3. Read and follow the project instructions carefully.

Expectations When Evaluating Participation

The instructor encourages everyone to participate in class activities, discussions, and respond to questions from other students. To evaluate participation, we use two main approaches.

First, we will randomly take attendance. We expect **in-person** class attendance (research has shown repeatedly that virtual learning is less effective). GSU has clearly defined what *excused absences* are and what you need to do to seek excused absences for medical reasons (see **Class Attendance** policy under the Course and University Policy Statements section below).

Second, we may occasionally have a quiz at the end of class. The quizzes will be graded based on whether you sufficiently absorb the content in the lecture. The grade is either "satisfactory/PASS" or "unsatisfactory/FAIL".

Expectations When Evaluating CIS 8880 Co-req

MSIS students are encouraged to engage in career development activities such as attending boot camps and Career Advancement Center (CAC) events. As such, CIS 8880 (a zero credit course) has been listed as the co-req of CIS 8398. 5% of your grade in this class is dependent on you completing CIS 8880 with a "satisfactory" grade. If you receive a satisfactory in CIS 8880, you will receive full

points for 5% of this class; if you receive unsatisfactory, you will receive zero points for 5% of this class. There is no partial credit for this evaluation.

To be absolutely clear, CIS 8880 and CIS 8398 are different courses and have different instructors. The CIS 8880 instructor is responsible for grading your participation in CIS 8880–either satisfactory or unsatisfactory, and he/she will forward your CIS 8880 grade to the CIS 8398 instructor. If you have any questions about your CIS 8880 grade, you need to reach out to the CIS 8880 instructor–the CIS 8398 instructor has no control over your CIS 8880 grade.

Final Grade

The final letter grade is based on **total points** you earned in the course. Please note that **iCollege does not support *take-3-out-of-4* calculation for the lab assignment grades**. As such, the grade percentage numbers on iCollege are useless when it comes to our final grading.

The following table will be used to translate total points to final grade:

Total Points	Grade	Total Points	Grade
>= 97	A+	77-79.9	C+
93-96.9	A	73-76.9	C
90-92.9	A-	70-72.9	C-
87-89.9	B+	60-69.9	D
83-86.9	B	< 60	F
80-82.9	B-		

Course Outline

The course outline here provides a general plan for the class. However, the plan is subject to change to accommodate students' learning progress and unexpected events. All changes to the outline will be updated and posted on iCollege.

Wk	Date	Topic	Reading	Assignment	Project
1	Oct 11	R for AI Programming (I)	RDS Ch1-16	A1 assigned	
2	Oct 18	R for AI Programming (II)	RDS Ch17-30	A1 due	Setup team/topic
3	Oct 25	Explainable AI	EMA Ch5-20	A2 assigned	Proposal due
4	Nov 1	High Performance ML	MLR Ch3-12	A2 due	Peer comments due
5	Nov 8	Deep Learning for Images	DLR Ch7-8	A3 assigned	Responses due
6	Nov 15	Deep Learning for NLP	DLR Ch10-11	A3 due	
7	Nov 29	Generative AI	GDL Ch8-13	A4 assigned	
8	Dec 6	Project Presentation		A4 due	Final submission

Course and University Policy Statements

Syllabus Change Policy

This syllabus provides a general guideline for the conduct of this course. However, deviations will be necessary. Updates will be given during the semester and posted online through iCollege.

Class Website on iCollege

This website includes a copy of this syllabus (and any subsequent updates or changes), lecture slides, lab notes, readings, and information about the final project. It is your responsibility to check this website frequently for announcements and updates. Copies of class handouts and presentation slides will be posted on the class website before each week's classes (if not earlier). You may find it helpful to use these to take notes during class.

Class Attendance

Excused absences include university-sponsored events, legal obligations, and religious observances (see http://codeofconduct.gsu.edu/). These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

When seeking excused absences for medical reasons, students should submit documentation to https://deanofstudents.gsu.edu/student-assistance/professor-absence-notification/ . Professors will then be notified by the Dean of Students of any excused absence without the need to manage medical information individually.

Regardless of whether an absence is excused or unexcused, the student is responsible for making up all work that is missed. No make-up assignments will be given except for exceptional cases that are approved by the instructors or university policy.

Academic Integrity

Plagiarism, duplicate individual assignments, or individual assignments that have been completed in collaboration with another person are violation of academic integrity. Team projects that draw upon the work of others without proper references or do not make a substantial original intellectual contribution will be considered plagiarism. Exams completed with assistance from another student or an unauthorized resource are also violations of academic integrity. Students cannot receive credit for academically dishonest work.

Anyone found to have committed or facilitated academic dishonesty will receive (1) a grade of "zero" on the assignment/project/quiz, (2) **a minimum of one letter grade deduction on the final course grade (example: going from A- to B-)**, and (3) a charge of academic dishonesty filed with the Dean's office. Be sure to protect your intellectual property from theft - both the person copying an assignment and the person supplying the copy will be penalized equally!

Team work is a collaborative effort; therefore, it is the responsibility of all team members on team projects to verify that the work performed by teammates does not violate academic integrity policies. More information about academic dishonesty can be found in the GSU student handbook.

Generative Artificial Intelligence Tools

Generative AI tools, such as ChatGPT, are designed to assist in creating and analyzing text, code, video, audio, and other multimedia. Use of these resources in your coursework comes with benefits and risks. In this course, the rules for generative AI usage are as follows:

> During this course, you will be asked in some activities to use generative AI tools. Any work you submit that has incorporated AI-generated content should indicate which parts

of the work are yours and which parts were generated or informed by AI and which prompts were given.

Any unapproved use within the course might be considered a breach of academic honesty. While exercising responsible and ethical engagement with AI is a skill you may hone over time, your unique human insights, critical thinking, and creative contributions remain pivotal to your learning experiences and success.

Unauthorized Public Posting and Distribution of Course Materials

GSU policy prohibits students from posting instructor-generated materials on external sites.

The selling, sharing, publishing, presenting, or distributing of instructor-prepared course lecture notes, videos, audio recordings, or any other instructor-produced materials from any course for any commercial purpose is strictly prohibited unless explicit written permission is granted in advance by the course instructor. This includes posting any materials on websites such as Chegg, Course Hero, OneClass, Stuvia, StuDocu and other similar sites. Unauthorized sale or commercial distribution of such material is a violation of the instructor's intellectual property and the privacy rights of students attending the class, and is prohibited.

Disabilities or Special Needs

Students who wish to request accommodation for a disability may do so by registering with the Office of Disability Services. Students may only be accommodated upon issuance by the Office of Disability Services of a signed Accommodation Plan and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought. Please inform the instructor if you have a disability or special need that requires accommodation.

Grade Appeal and Reassessment

It is important to recognize that a grade reflects others' judgment of your work. In this sense, some grading is inevitably subjective. Of course, any grade you receive on an assignment is subject to appeal. However, score changes are at the discretion of the instructor. It is important to understand that your score may go up or down based upon a complete review of the work in question. It is usually the case that changing a few points on an assignment rarely makes a difference in the final grade. Time is much better spent discussing and clarifying the information content presented in the course. However, if you would like to appeal your grade, you must submit the appeal in writing to me within one (1) week of receiving the graded work.

If a request is made for any assignments to be reassessed, please recognize that it will be possible to retain, gain, or lose points in the reassessment process. Make any reassessment requests by email within one (1) week of grading. Please make a follow-up appointment (preferably email) to meet the instructor during office hours for review of the results of any reassessment.

Student Feedback to Instructor and Continuous Improvement

I am committed to continuous improvement of my teaching. Please feel free to speak with me about any aspect of the course. I will consider your feedback and suggestions carefully to hopefully make this course a positive and effective learning experience for you.

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take the time to fill out the online course evaluation.