1 Instructor Information

Instructor of Record

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Teaching Assistants

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2 Course Description

Machine learning describes the development of algorithms that can modify their internal parameters (i.e., "learn") to recognize patterns and make decisions based on example data. These examples can be provided by a human, or they can be gathered automatically as part of the learning algorithm itself. This course will introduce the fundamentals of machine learning, will describe how to implement several practical methods for pattern recognition, feature selection, clustering, and decision making for reward maximization, and will provide a foundation for the development of new machine learning algorithms.

3 Co-conducted Course

Due to high demand, the School of Information is offering two sections of the co-convened ISTA 421/INFO 521 this semester. The primary instructor for section 001 is Clayton Morrison, and the primary instructor for section 002 is Adarsh Pyarelal. In order to streamline instruction and deliver comparable learning experiences to both the sections, we will be taking the following steps:

- The course content, assignments, and exams will be synchronized between the sections as much as possible.
- TA resources will be partially pooled. Specifically:
  - Students can attend office hours run by TAs from both sections.
  - TAs from both sections will engage in answering questions on Piazza.
  - The TAs from both sections will discuss the design of homework assignments and exams with the instructors.
  - However, in general, *TAs will only grade assignments and exams for students in their own section*.

4 Course Prerequisites

- Calculus I (derivatives) and II (integrals) (Math 129), Linear Algebra (Math 313).
- Programing experience (at least 3 courses; the language used in the course is Python 3).
- Introduction to statistics and discrete and continuous probability (ISTA 311 recommended).

5 Course Format and Teaching Methods

Lectures

The primary mode of instruction in this course will be in-person lectures.

Assessment

Assessment will be conducted both in-person (midterm exam) and online (homework assignments, final project).

Course content

- *Lecture slides* The lecture slides will be posted on D2L in PDF format.
- *Schedule*
  - For section 001, the course schedule will be posted at https://ml4ai-2023-fall-ml.github.io/schedule.html.
  - For section 002, the course schedule will be included in the syllabus PDF on D2L.
  - Note that the course schedule may be slightly adjusted at times during the semester, depending on how much material we are able to cover during the lectures. The instructors will communicate all such changes via D2L announcements.

Piazza

This term we will be using Piazza for asynchronous class discussions. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and the instructors. Rather than emailing questions to the teaching staff, we encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Class signup link: https://piazza.com/arizona/fall2023/ista421info521

6 Assessments

Type	Description	% of final grade
Assignments	Written Homework & Programming Exercises, assigned approximately every week.	60%
Midterm	In-class midterm exam	20%
Final assignment	Final project	20%

7 Course Objectives

The objective of this course is to introduce the core methods used in modern machine learning, gain experience implementing these methods as algorithms in a programming language (Python), and use and evaluate them on data.

8 Expected Learning Outcomes

By the end of this course, all students will be able to:

- Identify standard machine learning methods appropriate for different applications (regression, classification, clustering).
- Write programs that can identify parameters of a model based on training data.
- Compare and contrast the performance of different learning algorithms applied to different types of problems.

By the end of this course, graduate students will also be able to:

- Design, write, and evaluate machine learning programs that solve real-world problems.

9 Competencies

School of Information Competencies addressed by this course:

Undergraduate

- **F1.2** – Students will demonstrate facility using basic research methods, for example: research design; statistics and analysis; organization, identification, and location of data and information including open- and closed-access sources; and/or presentation of findings in oral, written and multi-media form, including proper use of and citation of sources.
- **DAISBS2.2** – Students will establish the ability to exercise the four key techniques of computational thinking (decomposition, pattern recognition, abstraction, and algorithms) in solving information and data challenges.

MS Information Science/MS Data Science

- **MSINFO1/MSDS1**: Students will establish the ability to exercise the four key techniques of computational thinking: decomposition, pattern recognition, abstraction, and algorithms.
- **MSINFO2/MSDS2**: Students will obtain the skills of collecting, manipulating, and analyzing different types of data at different scales, and interpreting the results properly.
- **MSINFO3/MSDS3**: Students will acquire the skills to communicate the results of their work to interdisciplinary teams, using appropriate visualizations, multi-media, or artistic performance.

10 400/500 Co-convened Course Information

This is a co-convened course that includes undergraduates (ISTA 421) and graduate students (INFO 521). Graduate students will receive additional and alternate problems, and therefore need to earn more total points for many of the assignments; this reflects the expected higher level of competency and preparation of graduate students.

11 Required Texts and Materials

The required texts for this course are all available to you at no cost. We list them below, along with acronyms that we will use to refer to them in the course schedule.

Acronym	Description
FCML	Simon Rogers and Mark Girolami (2016). A First Course in Machine Learning, Second Edition. Chapman & Hall / CRC Press. This is available for free through the UA Library [link]. Be sure to use the Second Edition.
M4ML	Mathematics for Machine Learning [PDF]
ISLR	An Introduction to Statistical Learning [PDF]

12 Final Examination or Project

There will be no in-class final examination for this course. Instead, there will be a final project, which will contribute towards 20% of your grade. The final project will be due at 5 pm on [TODO: Add date].

13 Grading Scale and Policies

Grade categories and proportions

Grading will be based on programming exercises and written assignments (Assignments), one in-class midterm (Midterm) and a final assignment (Final Assignment). **Points** will be assigned to each according to the estimated amount of effort based on the exercise difficulty. Graduate students will receive additional and alternate problems, and therefore need to earn more points total for many of the assignments; this reflects the expected higher level of competency and preparation of graduate students.

Grading Scale

Grade	Range
A	$90\% \leq$ cumulative points
B	$80\% \leq$ cumulative points $\leq 90\%$
C	$70\% \leq$ cumulative points $\leq 80\%$
D	$60\% \leq$ cumulative points $\leq 70\%$
E	cumulative points $\leq 60\%$

Late Work Policy

- Assignments are due by the date/time specified.
- No examinations may be taken after the examination date.
- Assignments will generally be submitted as PDF documents and code files that are committed and pushed to the course GitHub Classroom repository. We may also use the course D2L assignment turn-in for some assignments.
- In case of emergencies affecting turning work in on time, you must contact the instructor immediately.

14 Classroom Behavior

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

- *Please be considerate*: Please disable your mobile device ringer or sound notifications. If you get an urgent call, please quietly leave the lecture hall to conduct it. Screens are distracting! If you want to use a laptop or tablet for taking notes, please sit toward the side and back of the class in order to not disrupt other students.
- *Asking questions*: During class, feel free to ask questions whenever they occur to you. Raise your hand if you have a question; politely interrupt if the instructor does not appear to have noticed your hand. The instructor may ask you to hold off on your question for a few moments.
- *Answering questions*: The instructors frequently ask questions of the class during lectures to judge the level of understanding. Some students really like answering questions, sometimes to the point of discouraging anyone else from answering. If you are an eager answerer, pace yourself; let someone else answer an easy one once in a while, and save the hard ones for yourself.

15 Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview. Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560

16 Academic Integrity in this course

This policy agreed upon by faculty in the UArizona iSchool applies in addition to the Dean of Students' Code of Academic Integrity.

Students in courses at the UArizona iSchool are expected to maintain rigor in their academic performance with intent to learn, practice, and overcome challenges toward personal growth and enrichment. As future professionals in digital environments, iSchool students are also expected to exercise transparency and integrity in collaborations and in the use of tools and resources that may aid completion in assignments for our courses.

Consider the following practices **prohibited** in this course, unless the instructor has specifically written instructions or permission to do otherwise:

- Posting a question on an online site such as Chegg.com, and copying and pasting some or all of the response into an assessment

- Posting an assessment from the course on online sharing sites such as Course Hero. Aiding other students in violation of academic integrity is also a violation, and is potential copyright infringement.
- Generating and submitting, in whole or in part, text or code through Artificial Intelligence such as ChatGPT, QuillBot, and text summarizers
- Using, in whole or in part, computer code not written by the student (for example, from another student, a book, or the internet) in an assignment or project. This includes using such code in modified or unmodified form.
- Searching for solutions to projects or assignments on the internet or through other tools, when your instructor intended for you to learn the solution through exercises (e.g. Googling for the solution to a question on an assignment).
- Simultaneously submitting the same assignment as another student enrolled into the course without prior permission from the instructor

In any cases in which this course requires or permits students to use practices in the list above, clear written instructions will specify the tools allowed or required, so students can be certain they are working as instructed.

See the UArizona iSchool Academic Integrity Policy, the UArizona Code of Academic Integrity and Syllabus policy for more information.

Generative AI Usage

- You are allowed to use generative AI tools such as ChatGPT, Bard, and Perplexity to help with your homework assignments.
- You are **not** allowed to use generative AI tools for your your final project.
- Be aware that many AI companies collect information; do not enter confidential information as part of a prompt. Large language models (LLMs) may make up or hallucinate information. These tools may reflect misconceptions and biases of the data they were trained on and the human-written prompts used to steer them. You are responsible for checking facts, finding reliable sources, and making a careful, critical examination of any work that you submit. Your use of AI tools or content must be acknowledged or cited. If you do not acknowledge or cite your use of an AI tool, what you submit will be considered a form of cheating or plagiarism. Please use the following guidelines for using/acknowledging/citing generative AI in your assignments.
  - If you use generative AI to help with an assignment in any way, you **must** provide a link to the transcripts of the relevant conversations.
  - Do **not** copy-paste code or text directly from answers provided by generative AI tools. You can use generative AI tools to help you understand the material better, but any code or writing you turn in must be **your own work**.

Note that the midterm exam will be **in-class, and on paper**—so if you do not actually understand the material, you will do poorly.

Sanctions for plagiarism

- Any student found to have committed plagiarism (including violating the rules on generative AI usage listed above) will receive an automatic 0 for the entire assignment or exam, and will be reported to the Dean of Students.
- Any student found to have committed plagiarism on more than one occasion will receive an automatic failing grade for the class, and will be reported to the Dean of Students with more severe sanctions recommended.

17 University Policies

All university policies related to a syllabus are available at:
https://catalog.arizona.edu/syllabus-policies.

18 Additional support

- Math and writing tutoring is available via the Think Tank.
- iSchool peer tutoring center (programming, general help, etc). Peer tutors cover core ISTA courses (ISTA 116, 130, 131, 350, 331). For assistance with other ISTA courses, please contact them on the tutoring center's Slack in the #general info channel to ask whether any of the tutors can provide tutoring.)