CS 513
Applied Machine Learning

Statistics, Algorithms & First Principles
Welcome! 😊

These are the two most important things:

1. Start every module promptly.
2. Ask lots and lots and lots of questions.
CS 513 Applied Machine Learning
Ecampus (Online)
Section 40x  4 credits (approx. 120 hours of online activity)

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Course Web Site: Canvas (https://canvas.oregonstate.edu)

Prerequisites: None. CS 511 & CS 512 strongly recommended, or authentic proficiency in Python, statistics, and linear algebra.

Required Texts: None

Rationale & Primary Learning Outcomes
This course establishes a foundation for learning how to apply statistics, algorithms, techniques and tools to construct machine learning solutions to real-world problems. The course provides the graduate student of Statistics or Data Analytics an opportunity to learn about machine learning concepts, and to create a portfolio that demonstrates the application of machine learning concepts.

Catalog Description: machine learning basics (variance and bias, underfitting and overfitting, etc). Reviews linear algebra and NumPy. Examines k-nearest neighbors, linear classification (perceptron and online learning), and linear and non-linear regression. Explores applications in housing price prediction (Kaggle contest) and text classification (sentiment analysis).

The primary learning outcomes are:

1. Formulate the components of a machine learning algorithm.
2. Contrast training, test, and generalization errors, to identify and interpret underfitting and overfitting, and to use methods to cope with underfitting and overfitting.
3. Formulate and implement a k-NN classifier.
4. Formulate and implement the averaged perceptron classifier.
5. Interpret and extend the perceptron convergence proof.
6. Use linear regression in a real-world prediction task.
7. Use support vector machines and kernels in a real-world classification task.
8. Use linear classifiers in real-world text classification and sentiment analysis tasks.

What is machine learning, and what does it have to do with statistics? What are some common types of problems we can solve with machine learning? How do we synthesize algorithms, statistics, data and code to create and apply machine learning models? What does machine learning have to do with me and with the world?
Expectations
Be professional. This means that we will commit to our learning progress, that we will connect with each other with care and respect, and that our work will be aligned with our learning goals.

Please review the OSU student code of conduct: [https://beav.es/codeofconduct](https://beav.es/codeofconduct)

**Grading**

<table>
<thead>
<tr>
<th>Grading</th>
<th>93-100</th>
<th>90-92</th>
<th>73-76</th>
<th>70-72</th>
<th>C</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>C-</td>
<td>D+</td>
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<tr>
<td>Quizzes</td>
<td>87-89</td>
<td>83-86</td>
<td>67-69</td>
<td>63-66</td>
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<tr>
<td>Midterm Exam</td>
<td>30%</td>
<td>80-82</td>
<td>60-62</td>
<td>D-</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
<td>77-79</td>
<td>C+</td>
<td>0-59</td>
<td>F</td>
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Grades will be recorded in Canvas and should be visible within 72 hours of an assignment’s due date. Rubrics for assignments will be provided by the instructor.

Explorations
Each week, students are expected to spend time with Explorations, which are multimedia (text, video, etc) course materials that introduce topics and resources aligned with our course learning outcomes. Explorations are not exhaustive – they provide an important starting point for further learning and investigation expected of each graduate student.

Assignments
Each week, students apply course concepts to implement a solution to a machine learning problem. These programming assignments extend the lessons in the Explorations and provide students an opportunity to practice and demonstrate understanding. Each assignment takes the form of a Jupyter Notebook, with code written in Python. Assignments are graded upon completion of functional criteria, quality of writing, and accuracy. The instructor will provide assessment rubrics for each assignment.

Assignments are due at 11:59pm Pacific Time on each due date. Be aware of what time zone Canvas is using to display deadlines. If it is not your local time zone, you can set it to be. The Canvas phone app always displays times for the time zone the phone is in. This is important to keep in mind if you will be traveling.

**Pro Tip:** If you submit an assignment *well in advance* of the due date, we will try to provide a grade and early feedback. You may resubmit an assignment as often as you wish before its due date.

Quizzes
Each student will complete one quiz per week. Quizzes are an excellent means of testing, challenging and demonstrating your understanding of the course concepts and the Explorations.

You may take each quiz twice. Quizzes are due at 11:59pm Pacific Time on each due date.
Exams
Each student will demonstrate their level of mastery by completing a midterm exam and a final exam. The midterm exam is not proctored, but the final exam is proctored. Each student is responsible for scheduling and confirming the proctoring for the final exam, and the instructor will provide additional instructions.

Course Structure & Technical Assistance
This course consists of some front matter and ten weekly modules. Each module contains Explorations, a Quiz and an Assignment. Students are expected to complete one module per week.

If you experience any errors or problems while in your online course, contact 24-7 Canvas Support through the Help link within Canvas. If you experience computer difficulties, need help downloading a browser or plug-in, or need assistance logging into a course, contact the IS Service Desk for assistance. You can call (541) 737-8787 or visit the Service Desk online.

Course Schedule
This schedule is a general overview of the topics we will explore and the work we will accomplish each week.

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<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Graded Work</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Machine Learning</td>
<td>Quiz 1, Assignment 1</td>
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<tr>
<td>2</td>
<td>Data Fundamentals</td>
<td>Quiz 2, Assignment 2</td>
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<tr>
<td>3</td>
<td>Classification with k-Nearest Neighbors</td>
<td>Quiz 3, Assignment 3</td>
</tr>
<tr>
<td>4</td>
<td>Classification with Perceptrons</td>
<td>Quiz 4, Assignment 4</td>
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<tr>
<td>5</td>
<td>A Survey of Deep Learning</td>
<td>Quiz 5, Midterm Exam</td>
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<td>6</td>
<td>Linear Regression with Gradient Descent</td>
<td>Quiz 6, Assignment 6</td>
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<tr>
<td>7</td>
<td>Classification with Logistic Regression</td>
<td>Quiz 7, Assignment 7</td>
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<tr>
<td>8</td>
<td>Classification with Support Vector Machines</td>
<td>Quiz 8, Assignment 8</td>
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<tr>
<td>9</td>
<td>Text Classification &amp; Sentiment Analysis</td>
<td>Quiz 9, Assignment 9</td>
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<tr>
<td>10</td>
<td>Reflection &amp; Further Learning</td>
<td>Quiz 10</td>
</tr>
<tr>
<td>11</td>
<td>Exam week</td>
<td>Final Exam</td>
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Late Work Policy
You may submit an assignment within 48 hours of the primary due date. No work is accepted in this course 48 hours after the primary due date. Exceptions may be made if advanced notice is given to the instructor. It is the responsibility of the student to make arrangements prior to any scheduled assignment.
Rules in a nutshell: “no hands.” When viewing the work of others, your hands should not be doing anything, and you should leave the discussion empty-handed.

On Collaboration & Academic Integrity
Students are encouraged to discuss and collaborate as much as possible. However, it is obviously not acceptable to copy another person’s solution. Your work must be your own. In addition, simply copying solutions found online is not acceptable. Be aware that homework assignments, projects and exams will not just focus on producing correct code, but explaining how things work.

Being enrolled in this course means that you pledge to uphold the high standards of academic ethics and integrity expressed by the Oregon State University Student Conduct and Community Standards (https://beav.es/codeofconduct) by which you are bound. In particular, you will not misrepresent the work of others as your own, nor will you give or receive unauthorized assistance in the performance of academic coursework. You should understand that your instructor would report any infraction of academic integrity to the Office of the Dean and that any such matter would be investigated and prosecuted fully. Typically, the penalty is a grade of F in the course.

Examples of Academic Misconduct
Please note the following examples of what is considered inappropriate.

- Viewing another person’s quiz, test, paper, or code while working on your own.
- Directly providing another person a copy, electronic or otherwise, of your work.
- Accepting a copy, electronic or otherwise, of another person’s work.
- Copying and pasting any component of another person’s work into your own.
- Copying solutions found online or otherwise, pasting it into your own work without proper citation.

These scenarios will be considered as academic misconduct except when involving an assigned project partner.

Final Warning & Consequences
Historically, approximately 10% of students enrolled in this course are caught plagiarizing and submitting work that is not their own. We use software tools that measure similarity between submitted work, other student work, and solutions posted on popular web sites (Stack Overflow, Chegg, Brainly, etc.). The instructor is required to submit an academic misconduct report to the College of Engineering. The penalty for infractions is an F course grade and possible removal from the university.

Do Not Submit Complete Work!
If you cannot figure out a few parts of an assignment, then please submit incomplete work rather than looking up solutions online. Avoid the temptation of merely completing an assignment by looking up solutions online.
Communication Channels
Please communicate with the Instructor and GTAs via Ed Discussions. You can expect a response here in less than 24 hours, often much sooner.

You may also email your Instructor, who will respond to your email within 32 hours.

How to Succeed in This Course
This course is asynchronous (no lectures/meetings), online (no physical room), and a graduate-level computer science course. Each student is expected to be an independent learner. However, online and independent does not mean alone. Each student should:

- Start with the Explorations as an introduction to what we must independently learn
- Dig deeper independently, connect with other content, with students and instruction staff
- Ask questions to attain clarity and understanding
- Practice and assess with Quizzes and Assignments
- Ask questions when you get stuck

We encourage you to focus on building knowledge and skills, and not on points and grades. To build knowledge and skills takes work, and work takes time – so give yourself the time to do the work. Building knowledge and skills requires facing many unknowns – so ask lots and lots of questions.

How to Get Help
Getting stuck is an essential step in the learning process. To get unstuck, try these steps:

1. Don’t panic. Step away from a problem for a few minutes or even a day.
2. Review the Explorations. They are relevant to our learning and assignments.
3. Visit the course communication tools and search to see if your question has an answer there already.
4. Ask questions using the course communication tools, where your fellow students can answer and help.
5. Attend live, scheduled Student Hours / Help Sessions.

For getting help with life, course policies, or to request extensions in advance, communicate with the Instructor.
Academic Calendar
All students are subject to the registration and refund deadlines as stated in the Academic Calendar: [https://registrar.oregonstate.edu/osu-academic-calendar](https://registrar.oregonstate.edu/osu-academic-calendar).

Academic Coaching
Academic Coaching is a series of conversations designed to help enhance your well-being and academic performance. Coaching appointments last about 45 minutes, and take place with a peer coach who is trained to listen and ask thoughtful questions. Common discussion topics include time management, test preparation, test taking, procrastination and stress reduction. Coaching appointments are individualized, so discussions focus on your unique experiences, strengths, challenges, and goals, allowing you to identify and implement personal solutions to challenging issues or areas of performance.

Additional information can be found online at: [success.oregonstate.edu/academic-coaching](https://success.oregonstate.edu/academic-coaching). Appointments can be made online at: [coolkidsgetcoached.acuityscheduling.com/schedule.php](https://coolkidsgetcoached.acuityscheduling.com/schedule.php). Appointments can be completed on your own device from anywhere. The library also has equipment and space to complete appointments.

Statement Regarding Students with Disabilities
Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at [https://ds.oregonstate.edu/home](https://ds.oregonstate.edu/home). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Religious Observance
Oregon State University strives to respect all religious practices. If you have religious holidays that conflict with any of the requirements of this class, please see me immediately so that we can make alternative arrangements.

Excused Absences for University Extracurricular Activities
Students participating in an officially sanctioned, scheduled, university extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work.

Ecampus Reach Out for Success
University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it’s important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at [oregonstate.edu/ReachOut](https://oregonstate.edu/ReachOut). Ecampus students are always encouraged to discuss issues that impact your academic success with the Ecampus Success Team.
ecampus.oregonstate.edu/services/student-services . Email ecampus.success@oregonstate.edu to identify strategies and resources that can support you in your educational goals.

If you feel comfortable sharing how a hardship may impact your performance in this course, please reach out to the course Instructor.

Mental Health
Learn about counseling and psychological resources for Ecampus students:
counseling.oregonstate.edu/main/ecampus-students. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).

Financial Hardship
Any student whose academic performance is impacted due to financial stress or the inability to afford groceries, housing, and other necessities for any reason is urged to contact the Director of Care for support (541-737-8748).

Student Bill of Rights
OSU has twelve established student rights. They include due process in all university disciplinary processes, an equal opportunity to learn, and grading in accordance with the course syllabus: https://asosu.oregonstate.edu/advocacy/rights