CSIS-502: INTRODUCTION TO MACHINE LEARNING

Effective Term
Fall 2026

BOT Approval Date
05/15/2025

Discipline
CSIS - Computer Sci/Info Systems
Course Number
502

Course Title
Introduction to Machine Learning

Short Title
Machine Learning

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
3.00

Total Units
3.00

Hours

Lecture Contact Hours
48-54
Out of Class Hours Lecture
96-108

Total Contact Hours
48 - 54

Total Out of Class Hours
96 - 108

Total Student Learning Hours
144 - 162

Distance Education
Yes

Distance Education

Distance Education Type
Both Fully Online and Hybrid Online

Fully Online Delivery Requirements:
a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course
b. Any planned face-to-face meetings, such as an orientation or study session, must be optional

c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course

Are you using publisher content?

No

Regular Substantive Interaction

Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

Catalog Description

This course gives students an overview of machine learning fundamentals and its applications. Students will also explore the algorithms and statistical models needed for computers to learn patterns from data to make intelligent decisions. Data modeling topics for supervised and unsupervised learning will also be covered.

Requisites

Prerequisite(s)

Prerequisite(s) (must be taken before)
CSIS-501 (with a grade of C or better)
and CSIS-116E (with a grade of C or better)
and STAT-C1000 (with a grade of C or better)

Codes

TOP Code (CB 03)

0702.00* - *Computer Information Systems

CIP Code

11.0102 - Artificial Intelligence.

Repeatability Code

No

Grading Option

Letter grade OR P/NP

Minimum Qualifications

Minimum Qualifications	And/Or
Computer Information Systems	End

Learning Objectives

Learning Objectives

Learning Objective
1. Assess the mathematical tools for analyzing different artificial intelligence applications.
2. Investigate the use of data modeling, data acquisition, and data exploration to solve fundamental artificial intelligence problems.
3. Evaluate how neural networks can be used for deep learning to improve the accuracy of machine learning.
4. Examine unsupervised learning techniques, including clustering and dimensionality reduction.
5. Evaluate supervised learning algorithms such as linear regression, decision trees, and support vector machines.
6. Validate the use of statistical data analysis models to improve machine learning.
7. Examine the use and effectiveness of common machine learning algorithms.
8. Experiment with the use of artificial intelligence applications to import and process data to solve data science problems.
9. Evaluate the responsible use of machine learning in diverse contexts.
10. Examine the issues of bias and fairness with respect to race and gender in algorithmic decision-making.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will apply unsupervised and supervised learning algorithms to solve common machine learning problems.
2. Students will validate the use of statistical data analysis models and their effectiveness on machine learning algorithms.
3. Students will assess the mathematical tools for data modeling, acquisition, and exploration to solve fundamental artificial intelligence problems.
4. Students will evaluate the responsible use of machine learning and the issues of bias and fairness in algorithmic decision-making.

Content

Course Lecture Content

1. Mathematical tools
   a. Graph, slopes, functions
   b. Probability and statistics
   c. Vectors and matrices
   d. Data visualization
2. Data science toolset
   a. Interactive coding
   b. Numerical computation
   c. Data visualization
   d. Common machine learning libraries
3. Neural Networks
   a. Human neural networks
   b. AI fundamentals on neural networks
   c. Common applications
   d. Model evaluation
4. Machine Learning Algorithms
   a. Supervised learning
   b. Unsupervised learning
   c. Reinforcement learning
5. Principles of core model generalization
   a. Overfitting and under-fitting models
   b. Bias-variance trade-offs
   c. Optimal training data sets
   d. Linear regression models for supervised learning
   e. Const functions

   f. Regularization
   g. Statistical optimization algorithms
6. Mathematical Models
   a. Logistic regression
   b. linear regression
   c. Metrics for classification
   d. Probability theory
   e. Naïve Bayes classifiers
7. Support Vector Machines
   a. Classification problems
   b. Logistic regression
   c. Cost calculation
   d. Regularization
8. Data Fundamentals
   a. Acquisition
   b. Analytics
   c. Visualization
9. Decision Trees
   a. Splitting
   b. Strengths and weaknesses
10. Regression trees
   a. Bootstrapping
   b. Random Forest algorithm
   c. Reducing bias
11. Biases in Machine Learning
   a. Sources of race and gender bias in machine learning
   b. Techniques to Reduce or Mitigate race and gender Bias
   c. Impact of biases on differing demographic groups
   d. Inclusive machine learning solutions

Methods of Instruction

Method

Lecture

Integration

Lectures will be presented with supporting visual materials, such as digital presentations or multimedia. They will introduce conceptual and practical skills such as assessment of mathematical tools, neural networks, deep learning, common machine learning algorithms, and the responsible use of machine learning in diverse contexts.

DE Adaptations for MOI

Lectures will be delivered using video capture software to embed voice into lecture slides. Larger videos will be broken down into shorter digestible segments. All videos will be closed-captioned with synchronized audio. Transcripts of the lecture will be provided upon request. Any external link within the lecture will have descriptive text explaining the link's destination. Any included Images will have alternate text that provides a detailed description of the image. Any resources or documents will comply with accessibility standards. All lectures will be delivered using the course management system. Within the lectures, students will be encouraged to ask questions through the course management system's discussion board.

Method

Observation and Demonstration

Integration

Live demonstrations, coding exercises, and experiments will be conducted to illustrate machine learning concepts such as supervised learning, linear regressions, statistical models, decision trees, and support vector machines.

DE Adaptations for MOI

Observation and Demonstrations will be presented using pre-recorded video and delivered via the course management system. All videos will be closed-captioned with synchronized text. Any external link within the observation and demonstration will have descriptive text explaining the link's destination. All included Images will have alternate text that provides a detailed image description. Any resources or documents will comply with accessibility standards. Interactive notebooks (e.g., Jupyter) will be used for shared hands-on exercises and delivered via the course management system.

Method

Discussion

Integration

Weekly discussions will be conducted as a means to Examine the use and effectiveness of common machine learning algorithms, evaluate the responsible use of machine learning in diverse contexts, Examine the issues of bias and fairness in algorithmic decision-making, and investigate the use of data modeling, data acquisition, and data exploration to solve fundamental artificial intelligence problems.

DE Adaptations for MOI

Weekly discussions will be administered using the course management system's discussion tool. Images included in discussions will have alternate text provided that provides a detailed image description. Any external link within the discussion will have descriptive text explaining the link's destination. Any resources or documents will comply with accessibility standards.

Methods of Evaluation

Method

Quizzes

Integration

Regular quizzes consisting of multiple-choice, short-answer, and small coding problems will be given to evaluate the student's knowledge of data modeling, data acquisition, linear regression, decision trees, vector machines, and statistical models.

DE Adaptations for MOE

Quizzes will be administered and collected using the quizzes tool within the course management system. Any external link within the assignment will have descriptive text explaining the link's destination. All quizzes will have alternate text provided for images that give a detailed image description. Any resources or documents will comply with accessibility standards. Feedback will be provided via the comments section of the quiz tool.

Method

Exams/Tests

Integration

A midterm and final exam consisting of short answer questions and small coding problems will be given to evaluate the student's understanding of bias and fairness in algorithmic decision-making, clustering, supervised and unsupervised learning, the effectiveness of machine learning algorithms, and analysis using mathematical tools.

DE Adaptations for MOE

Exams will be administered and collected using the quizzes tool within the course management system. Images included in any quiz question will have alternate text that provides a detailed description of the image. If external links are provided, descriptive text will explain the link's destination. Any resources or documents will comply with accessibility standards. Feedback for exams will be provided via the comments section of the quizzes tool within the course management system.

Method

Homework

Integration

Weekly homework assignments consisting of small coding problems will evaluate the student's knowledge of data analysis using mathematical tools, linear regression, decision trees, supervised and unsupervised learning, and neural networks will be given.

DE Adaptations for MOE

Homework assignments will be provided in accessible file formats such as HTML, accessible PDF, and text. Any external link within the assignment will have descriptive text explaining the link's destination. All included Images will have alternate text that provides a detailed image description. Any resources or documents will comply with accessibility standards. Assignments will be delivered via the assignment tool within the course management system. Feedback for assignments will be provided in the comments section of the assignment tool in the course management system.

Assignments

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Choose a dataset from a reputable source or a platform like Kaggle. Ensure the dataset has a mix of categorical and numerical features and a target variable for prediction. Load the data set into your preferred machine learning environment and perform exploratory data analysis to show an understanding of the characteristics of the data. In the analysis, include statistical data and visualizations and any data correlations. Identify and handle missing values in the dataset. Implement appropriate strategies such as imputation or removal.
Provide clear documentation of your code and analysis. Include comments to explain the rationale behind each step and articulate any assumptions or decisions made during the process.

How assignment will be adapted in online format

Assignments will be distributed and collected through the assignments tool of the course management system. Any external link within the assignment will have descriptive text explaining the link's destination. If images are included as part of the assignment, they will have alternate text provided that provides a detailed description of the image. All videos will be closed-captioned with synchronized audio. Any resources or documents will comply with accessibility standards. Feedback on the assignment will be given in the comments section of the grade book for the assignment, which is part of the course management system.

Assignment Type

Writing

In-class and/or outside of class

In-class
Outside of class

Formative or Summative

Summative

Assignment

Select a research paper or article that discusses a machine learning application in everyday life. Choose a paper that is accessible and relevant to a general audience. The paper should be recent (within the last five years) and published in a reputable conference or journal.
Write a concise literature review summarizing the main concepts, methodologies, and findings presented in the selected paper. Ensure that you provide enough context for readers who may not have an extensive background in machine learning.
Apply the concepts learned in the course to critically analyze how machine learning was used in the real-world scenario presented in the paper. Discuss the problem addressed, the data used, and the machine learning techniques applied. Evaluate the effectiveness of the approach and its potential impact.

Relate the machine learning application discussed in the paper to everyday life. Discuss how the technology presented in the paper could affect people's daily activities, habits, or decision-making processes.
Consider the practical implications of the machine learning application for community college students. Discuss how the technology might be relevant to their studies, career aspirations, or personal lives. Reflect on your insights and critiques of the paper. Discuss whether the machine learning application is feasible, ethical, and beneficial for everyday life. Provide evidence to support your reflections.
Create a concise presentation summarizing the key points of your literature review, application analysis, and critical reflections.

How assignment will be adapted in online format

Assignments will be distributed and collected through the assignments tool of the course management system. Any external link within the assignment will have descriptive text explaining the link's destination. If images are included as part of the assignment, they will have alternate text provided that provides a detailed description of the image. All videos will be closed-captioned with synchronized audio. Any resources or documents will comply with accessibility standards. Feedback on the assignment will be given in the comments section of the grade book for the assignment, which is part of the course management system.

Assignment Type

Reading

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Read Chapter 1 of A Guide for Thinking Humans by Melanie Mitchell. This reading introduces the foundational concepts of AI, including key definitions and the history of AI development. It also covers the basics of neural networks and deep learning, helping students understand how AI systems process information.

Be prepared to discuss how Melanie Mitchell defines artificial intelligence and the key differences she highlights between human and machine intelligence. In what ways do neural networks mimic the human brain, and where do they differ?
What challenges in training neural networks does the reading discuss, and how do these challenges impact the development of AI?

How assignment will be adapted in online format

Assignments will be distributed and collected through the assignments tool of the course management system. Any external link within the assignment will have descriptive text explaining the link's destination. If images are included as part of the assignment, they will have alternate text provided that provides a detailed description of the image. All videos will be closed-captioned with synchronized audio. Any resources or documents will comply with accessibility standards. Discussions for the reading assignment will be facilitated using the course management system's discussion board.

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Summative

Assignment

Choose a sample machine learning model (e.g., a classifier, a regression model, etc.) and identify potential sources of racial and gender bias in its design, data, and output.

Propose strategies to mitigate the identified biases. These might include data processing techniques (data augmentation or debiasing), algorithmic changes (e.g., fairness constraints, regularization techniques), or post-processing adjustments, e.g., adjusting decision thresholds to ensure fairer outcomes).

Reevaluate your model's performance after implementing the bias mitigation strategies. Use fairness metrics such as demographic parity, equal opportunity, or disparate impact to assess your strategies' effectiveness in promoting fairness.

Submit your code and a short technical report (500–750 words) explaining your model improvements, the bias mitigation techniques used, and their effectiveness based on your evaluation.

How assignment will be adapted in online format

Assignments will be distributed and collected through the assignments tool of the course management system. Any external link within the assignment will have descriptive text explaining the link's destination. If images are included as part of the assignment, they will have alternate text provided that provides a detailed description of the image. All videos will be closed-captioned with synchronized audio. Any resources or documents will comply with accessibility standards. Feedback for the assignment will be given via the comments section in the grade book.

Course Materials

Textbooks

Probabilistic Machine Learning: An Introduction (Adaptive Computation and Machine Learning series)
Kevin P. Murphy
MIT Press
978-0262046824
March 2023

Class Size Information

Class Size

35

Class Size Category

B - Facilitated learning 35

Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

This course will use inclusive teaching practices to accommodate diverse learning styles and preferences. It will incorporate a mix of instructional methods, such as lectures, discussions, hands-on projects, and collaborative activities.
Examples and case studies used in assessments will represent a variety of industries and demographic contexts. The societal impact of machine learning technologies on different communities will be prominent in discussions.

The course is infused with an inclusive discussion environment, where diverse viewpoints will be respected, and students can share their thoughts and experiences related to machine learning.
All course materials (e.g., slides, readings, and online resources) will be provided in alternative formats for students with different learning needs.

Diversity will be infused into the course through lectures and guided practice assignments. Students will discover the sources of race and gender bias in data sets, models, and algorithms. This will also include how biased data can lead to unfair outcomes, particularly for underrepresented groups.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

Assignments will have clear and detailed instructions. A rubric will be provided that outlines expectations and evaluation criteria. This will ensure transparency and fairness in grading.
The learning resources in the class will include captioned videos, alternative text for images, and readable fonts and colors for text. This will ensure that the material presented complies with accessibility standards.
Constructive and actionable feedback will be provided to support ongoing improvement. Feedback will focus on areas of development rather than mistakes to promote a growth mindset.
Machine learning topics that consider the impact of machine learning on different communities will be discussed. Diverse perspectives on ethical considerations will be acknowledged.

Interactions

Explain how the course will incorporate student-to-student interaction.

Collaborative demonstrations and guided practice will facilitate diverse student interactions, allowing them to develop and implement machine-learning models, neural networks, and machine-learning algorithms.

The course discussions will encourage students to share experiences and insights on supervised learning and racial and gender bias in machine learning, machine learning algorithms, and mathematical models.

Regular collaborative problem-solving workshops will be given, in which students work in small groups or complete hands-on exercises to solve machine-learning problems such as regression, decision trees, racial and gender bias in algorithms, and neural networks.

Explain how the course will incorporate instructor-to-student interaction.

This course will incorporate instructor-to-student interaction by providing detailed, individualized feedback on assignments, exams, and projects to demonstrate students' understanding of image processing techniques, feature extraction, racial and gender bias in computer vision, and neural networks.

This course will also offer regular individual meeting times and opportunities for students to receive one-on-one help with various computer vision topics outside of class. Additionally, interactive lectures will feature live demonstrations, question-and-answer sessions, and real-time computer vision exercises. These exercises will help students connect theoretical knowledge of concepts such as Image processing, feature extraction, feature matching, and 3D vision with practical Implementation and provide immediate feedback and clarification of concepts.

Explain how the course will incorporate student-to-content interaction.

Both live and pre-recorded lectures will be given, emphasizing interaction, incorporating small coding problems, quizzes, and open-ended discussions on Neural Networks, Machine learning algorithms, trees, and Mathematical models. At the end of major milestones in the course, self-assessment quizzes will be given, allowing the student to gauge their progress on mathematical tools, data science tools, support vector machines, and the basis of machine learning. Within the reading material test, your knowledge quizzes will be placed so the student can test their understanding of the material presented.

Explain how the course will incorporate student-to-self interaction (metacognitive).

The class assignments are geared toward critical thinking and problem-solving in topics such as image processing, image classification, feature extraction, and homography. They will encourage students to reflect on their problem-solving approach and consider alternative solutions.
The course content will have several self-evaluation quizzes to gauge students' understanding of course material topics such as 3D computer vision, object detection and location, neural networks, and image segmentation.
The self-evaluation quizzes will offer immediate feedback to help students identify topics they have mastered and those that need further study.

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