



# MACHINE LEARNING

## Course Information

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**Course:** CIS-471-01FTE: MACHINE LEARNING

**Semester:** Fall 2025

**Location:** Library 128

**Schedule:** Monday, Wednesday, Friday: 10:00 AM - 10:50 AM

**Credits:** 3

## Instructor Information

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**Instructor:** Dr. Chad Redmond

**Office:** Library 416

**Email:** credmond@mercyhurst.edu

**Phone:** (814) 969-2269

## Office Hours

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**Days/Times:** Monday, Wednesday, Friday: 11:00 AM - 12:10 PM

**Location:** Library 416 (My Office)

### Evening

**Hours:** Monday, Wednesday: 8:15 PM - 9:30 PM

### Evening

**Location:** Cyber Security Labs

## Course Description

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An introduction to fundamental machine learning algorithms and their practical applications through hands-on web development. Students will explore key machine learning concepts including k-means clustering, k-nearest neighbors, decision trees, random forests, ensemble learning methods, and recommender systems. The course emphasizes practical implementation using GitHub, GitHub Codespaces, and GitHub Copilot for collaborative development and AI-assisted programming. A central component of the course involves building interactive web applications that demonstrate and visualize machine learning concepts, allowing students to gain both theoretical understanding and practical experience in deploying machine learning solutions.

## Recommended References

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### **1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems**

[https://www.amazon.com/Hands-Machine-Learning-Scikit-Learn-TensorFlow/dp/1492032646/ref=sr\\_1\\_4](https://www.amazon.com/Hands-Machine-Learning-Scikit-Learn-TensorFlow/dp/1492032646/ref=sr_1_4)

### **2. Data Science from Scratch: First Principles with Python**

[https://www.amazon.com/Data-Science-Scratch-Principles-Python/dp/1492041130/ref=sr\\_1\\_1](https://www.amazon.com/Data-Science-Scratch-Principles-Python/dp/1492041130/ref=sr_1_1)

# Learning Objectives

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## Machine Learning Fundamentals:

- Understand and implement k-means clustering algorithms for unsupervised data grouping and pattern recognition
- Apply k-nearest neighbors (KNN) classification and regression techniques to solve prediction problems
- Build and optimize decision trees for classification and regression tasks with interpretable results
- Implement random forests and ensemble learning methods to improve model accuracy and reduce overfitting
- Design and develop collaborative filtering and content-based recommender systems

## Development Tools & Collaboration:

- Demonstrate proficiency in using GitHub, GitHub Codespaces, and GitHub Copilot for machine learning project development
- Utilize AI-assisted programming techniques to accelerate model development and debugging
- Apply version control best practices for collaborative machine learning projects

## Web Application Development:

- Build interactive web applications that demonstrate machine learning concepts and algorithms
- Create data visualizations and user interfaces that effectively communicate ML model results
- Deploy machine learning models through web-based platforms for real-world accessibility

**Practical Implementation:**

- Evaluate model performance using cross-validation, confusion matrices, and other assessment techniques
- Handle real-world data challenges including preprocessing, feature selection, and missing data
- Apply ethical considerations and bias detection in machine learning model development and deployment

# Grading

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## Grade Components:

- Quiz 1: 75 points
- Quiz 2: 75 points
- Quiz 3: 75 points
- Quiz 4: 75 points
- Final Exam: 100 points
- Attendance: 100 points
- Participation: 100 points

**Total Points: 600**

## Grade Scale:

Grade	Points Required
A	550-600
B+	500-549
B	400-499
C+	350-399
C	300-349
D+	250-299
D	200-249
F	Below 200

## Tentative Schedule

Date	Day	Topics
August 20	Wednesday	Orientation to GitHub, Codespaces, and Copilot
August 22	Friday	Building a Simple Web Application
August 25	Monday	K-means Clustering Algorithm
August 27	Wednesday	Elbow Method
August 29	Friday	K-means in Three Dimensions
September 1	Monday	Labor Day (no class)
September 3	Wednesday	Color Space Visualization
September 5	Friday	Color Space Visualization with Image Upload
September 8	Monday	Image Segmentation
September 10	Wednesday	Practice Quiz
September 12	Friday	Quiz 1

Date	Day	Topics
September 15	Monday	K-Nearest Neighbors
September 17	Wednesday	K-Nearest Neighbors in Three Dimensions
September 19	Friday	Distance Between Points in Any Dimensions
September 22	Monday	Iris Dataset
September 24	Wednesday	Training and Test Sets
September 26	Friday	Cosine Similarity and the Curse of Dimensionality
September 29	Monday	Collaborative Filtering
October 1	Wednesday	Movie Dataset
October 3	Friday	Matrix Factorization
October 6	Monday	Quiz 2
October 8	Wednesday	Midterm Re-cap
October 10	Friday	Fall Break (no class)
October 13	Monday	Decision Trees
October 15	Wednesday	Predictions and Class Probabilities



Date	Day	Topics
October 17	Friday	Gini Impurity and Entropy
October 20	Monday	CART Algorithm
October 22	Wednesday	Overfitting and Regularization
October 24	Friday	Regression with Decision Trees
October 27	Monday	Regression with Decision Trees
October 29	Wednesday	Decision Tree Practice
October 31	Friday	Quiz 3
November 3	Monday	Voting Classifiers
November 5	Wednesday	Voting Classifiers
November 7	Friday	Bagging
November 10	Monday	Bagging
November 12	Wednesday	Out of Bag Evaluation
November 14	Friday	Random Forests
November 17	Monday	Feature Selection
November 19	Wednesday	AdaBoost

Date	Day	Topics
November 21	Friday	AdaBoost
November 24	Monday	Gradient Boosting
November 26	Wednesday	Thanksgiving Break (no class)
November 28	Friday	Thanksgiving Break (no class)
December 1	Monday	Gradient Boosting
December 3	Wednesday	Quiz 4
December 5	Friday	Re-cap

## Academic Honesty Policy

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Students are expected to adhere to Mercyhurst University's Academic Honesty Policy. Please review the complete policy at:

<https://www.course-catalog.com/mercyhurst/C/2023-2024/content/academic-affairs/academic-honesty/41>

## ADA Accommodations & Accessibility

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Mercyhurst University values inclusion and is committed to the goal of providing equal opportunities for all. It is our policy and practice to create accessible learning environments consistent with federal and state law.

Students who are currently eligible should verify as instructed and contact me to discuss how their accommodations will be implemented in this class.

Students who have not been determined eligible, but have a temporary limitation (e.g., broken leg) or permanent medical, physical, sensory, learning, cognitive, or mental health disability issue that requires accommodations, should contact the ADA Coordinator to make a request. Requests for accommodations can be made at any time throughout the calendar year and at any point in a student's enrollment.

Please contact Susan Reddinger, ADA Coordinator and Compliance Officer, at [ada@mercyhurst.edu](mailto:ada@mercyhurst.edu), 814-824-2362, or in Old Main 300. Additional information can be found on the student hub <https://lakersmercyhurst.sharepoint.com/sites/StudentsHub> under the Services tab.

Students with questions about Academic Support, please refer to the Hub <https://lakersmercyhurst.sharepoint.com/sites/StudentsHub> and select the Academic Resources tab, then Academic Support for more information.

## Title IX

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Mercyhurst is committed to providing an environment free from sex discrimination, including sexual harassment and sexual violence. Please refer to the HUB: <https://lakersmercyhurst.sharepoint.com/sites/StudentsHub> and select the Resources tab, then Title IX – Sexual Respect from the dropdown for more information.

If you would like to file a sexual misconduct complaint, please contact Ann Miller, Title IX Coordinator and Compliance Officer, [titleix@mercyhurst.edu](mailto:titleix@mercyhurst.edu), 814-824-2363, Egan Hall 311. Please be aware that in compliance with Title IX, educators must report incidents of sexual assault/harassment, stalking, domestic/dating violence, sex discrimination, and hostile environment harassment. If you disclose any of these situations in class, in papers, or to a faculty or staff member personally, they are required to report it to the Title IX Coordinator (or any of the Deputy Title IX Coordinators).