

# CSCI381 16

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## Course Summary

**Course :** CSCI381 **Title :** Machine Learning  
**Length of Course :** 16 **Faculty :**  
**Prerequisites :** CSCI360 **Credit Hours :** 3

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## Description

### Course Description:

This course provides an overview of types of problems that can be used with machine learning, as well as different variations of machine-learned methods such as supervised/unsupervised, batch/online, etc. The course discusses the main challenges of machine learning, notably the issue of data quality, as well as overfitting and underfitting data. (Prerequisite: CSCI360).

### Course Scope:

The course begins with a basic introduction to Artificial Intelligence and Machine Learning. The concept of AI and ML is discussed as well as the history of AI and ML in detail, followed by an introduction to Data Science and the exploration of quantitative analysis. The course continues with the explanation of data sources, cleaning and transforming data, and understanding relationships in data. Real-Time Analytics, Predictive Analytics, and Intelligent SaaS Applications in introduced.

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## Objectives

- CO1: Discuss artificial intelligence and machine learning.
- CO2: Evaluate data for machine learning.
- CO3: Explain various categorical features as it applies to engineering.
- CO4: Compare various machine-learning algorithms.
- CO5: Describe the process of selecting algorithms for given applications.
- CO6: Explain the importance of Model performance.
- CO7: Explore the job market in artificial intelligence and machine learning.
- CO8: Explain the complete machine learning workflow.

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# Outline

## Week 1: Introduction to Artificial Intelligence

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### Learning Outcomes

- **CO-1: Discuss artificial intelligence and machine learning.**
  - LO-1.1: Discuss the benefits of artificial intelligence and machine learning in applications.
  - LO-1.2: Describe an artificially intelligent system.

### Required Readings

[What is AI?](#)

[What is machine learning?](#)

[Machine Learning vs Artificial Intelligence](#)

[Applications of AI](#)

[Application of ML](#)

### Assignments

### Welcome Discussion

### W1: Introduction to Artificial Intelligence

### Recommended Optional Reading

### Recommended Media

## Week 2: Machine Learning

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### Learning Outcomes

- **CO-4: Compare various machine-learning algorithms.**
  - LO-1.1: Explain different machine learning models.
  - LO-1.2: Explain the different steps of the machine learning workflow.
- **CO-5: Describe the process of selecting algorithms for given applications.**
- **CO-8: Explain the complete machine learning workflow.**

### Required Readings

[The 7 steps of machine learning](#)

[Types of machine learning](#)

[Machine Learning models](#)

### Assignments

### W2: Machined Science Process

### Recommended Optional Reading

### Recommended Media

## Week 3: Prepare the Data

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### Learning Outcomes

#### **CO-2: Evaluate data for machine learning**

LO-2.1: Explain the data transformation process in AI and ML.

### Required Readings

[How is data prepared for machine learning?](#)

[How to do data cleaning - Example](#)

[How to Prepare Data for Machine Learning and A.I.](#)

### Assignments

W3: Public Data

### Recommended Optional Reading

### Recommended Media

## Week 4:

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### Learning Outcomes

- **CO-4: Evaluate data for machine learning.**
  - LO-4.1: Discuss supervised machine-learning algorithms.
  - LO-4.2: Describe classification and regression in AI and ML.
- **CO-5: Describe the process of selecting algorithms for given applications.**

### Required Readings

[Supervised vs. Unsupervised Learning](#)

[Linear Regression](#)

[Logistic Regression](#)

[Decision Tree Classification](#)

[Random Forest Classification](#)

### Assignments

W4: Assignment 1

### Recommended Optional Reading

### Recommended Media

## Week 5: Artificial Neural Networks

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### Learning Outcomes

- **CO-4: Compare various machine-learning algorithms.**
  - LO-4.1: Describe artificial neural networks.
  - LO-4.2: Discuss neurons and synapses connections.

- **CO-5: Describe the process of selecting algorithms for given applications.**

Required Readings

[What is deep learning?](#)

[Neural Networks Explained](#)

[Types of Neural Networks](#)

Assignments

Recommended Optional Reading

Recommended Media

## **Week 6: Unsupervised Learning**

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Learning Outcomes

- **CO-4: Compare various machine-learning algorithms.**
  - LO-1.1: Identify different techniques for unsupervised learning.
  - LO-1.2: Compare unsupervised learning vs. supervised learning.
- **CO-5: Describe the process of selecting algorithms for given applications.**

Required Readings

[Supervised vs. Unsupervised Learning](#)

[Unsupervised Machine Learning Explained](#)

[Unsupervised Learning](#)

[K Means Clustering Algorithm](#)

[Apriori Algorithm Explained](#)

Assignments

W6: Unsupervised Learning

Recommended Optional Reading

Recommended Media

## **Week 7: Feature Engineering**

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Learning Outcomes

**CO-3: Explain various categorical features as it applies to engineering.**

- LO-3.1: Discuss structure informs decisions.
- LO-3.2: Discuss how features are considered predictor variables.
- LO-3.3: Explain the importance of knowing prediction in AI and ML.

Required Readings

[Feature Selection In Machine Learning](#)

[Introduction to Feature Engineering in Machine Learning](#)

## [What Makes a Good Feature?](#)

### Assignments

W7: Feature Engineering

Recommended Optional Reading  
Recommended Media

## **Week 8: Model Evaluation**

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### Learning Outcomes

#### **CO-6: Explain the importance of Model performance.**

- LO-6.1: Discuss the process of deploying AI and ML models into a business.
- LO-6.2: Describe how AI and ML models can change the business processes, supply chain, and inventory management.
- LO-6.3: Discuss how AI can be a game changer for Risk Management.

### Required Readings

#### [Machine Learning Evaluation](#)

#### [Overfitting and underfitting \(part 1\)](#)

#### [Overfitting and underfitting \(part 2\)](#)

### Assignments

W8: Performance of the Model

Recommended Optional Reading  
Recommended Media

## **Week 9: Model Performance**

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### Learning Outcomes

#### **CO-5: Describe the process of selecting algorithms for given applications.**

- LO-5.1: Discuss supervised learning and unsupervised learning recommender systems.
- LO-5.2: Explain how to evaluate a model's performance.
- LO-5.3: Explain how models use the evaluate model to calculate commonly used error statics.

### Required Readings

#### [Quantile-Quantile Plots \(QQ plots\)](#)

#### [Evaluation Metrics for Machine Learning Models](#)

#### [Model Selection in Machine Learning](#)

### Assignments

W9: Assignment 2

Recommended Optional Reading  
Recommended Media

## Week 10: Reinforcement Learning

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### Learning Outcomes

- **CO-5: Describe the process of selecting algorithms for given applications.**
  - LO-5.1: Discuss reinforcement learning.
  - LO-5.2: Implementing game theory as a type of reinforcement learning.
- **CO-8: Explain the complete machine learning workflow.**
  - LO-8.1: Explain genetic algorithms and operations research.

### Required Readings

[Reinforcement Learning With \(Deep\) Q](#)

[Reinforcement Learning](#)

[Genetic Algorithms - Machine Learning](#)

[What Does Machine Learning Offer Game Theory \(And Vice Versa\)?](#)

### Assignments

W10: Learning

Recommended Optional Reading

Recommended Media

## Week 11: Careers in Machine Learning

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### Learning Outcomes

**CO-7: Explore the job market in artificial intelligence and machine learning.**

- LO-7.1: Discuss various careers in AI and ML.
- LO-7.2: Explain the importance of ethics in AI and ML.
- LO-7.3: List some future trends in AI and ML.

### Required Readings

[Andrew Ng Machine Learning Career Advice](#)

[5 free resources to help you get a machine learning job](#)

[Potential of AI and ML](#)

### Assignments

W11: Careers

Recommended Optional Reading

Recommended Media

## Week 12: Machine Learning Applications

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### Learning Outcomes

- **CO-7: : Explore the job market in artificial intelligence and machine learning.**

- LO-7.1: Discuss the automation process to produce and various products.
- LO-7.2: Explain machine learning as it applies to robots.
- **CO-8: Explain the complete machine learning workflow.**
  - LO-8.1: Describe the term agile as it applies to factories.

#### Required Readings

[Using Data Science to Improve Traffic Safety](#)

[machine learning in robotics](#)

[The Advent of AI in Healthcare](#)

[Modeling Road Safety with Machine Learning](#)

[China's industrial robot production surges with AI widely used](#)

[How Hard is AI for Robotic Manufacturing?](#)

#### Assignments

W12: Data Patterns

Recommended Optional Reading

Recommended Media

### Week 13: Ethics

#### Learning Outcomes

- **CO-7: Explore the job market in artificial intelligence and machine learning.**
  - LO-7.1: Discuss ethics in AI.
  - LO-7.2: Explain whether or not we should be building various robots.
- **CO-8: Explain the complete machine learning workflow.**
  - LO-8.1: Describe important ethics issues.

#### Required Readings

[What is AI Ethics?](#)

[Writing the Playbook for Fair & Ethical Artificial Intelligence & Machine Learning](#)

[Ethics of AI: Challenges and Governance](#)

#### Assignments

W13: Self- Driving Cars

Recommended Optional Reading

Recommended Media

### Week 14: Machine Learning and Artificial Intelligence Global Impact

#### Learning Outcomes

- **CO-7: Explore the job market in artificial intelligence and machine learning.**
  - LO-7.1: Discuss the impact of AI and ML on the world.
  - LO-7.2: Explain on AI has had an impact on software applications.

- **CO-8: Explain the complete machine learning workflow.**
  - LO-8.1: Describe important security in AI and ML.

Required Readings

[15 Ways Machine Learning Will Impact Your Everyday Life](#)

[The impact of AI on the US Job market](#)

[AI and climate change](#)

[AI in Cybersecurity](#)

[AI in cybersecurity: Pros and cons explained](#)

Assignments

W14: AI and Security

Recommended Optional Reading

Recommended Media

## **Week 15: Risks and Challenges**

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Learning Outcomes

- **CO-7: Explore the job market in artificial intelligence and machine learning.**
  - LO-7.1: Discuss some potential challenges and dilemmas of AI.
  - LO-7.2: Explain how image processing and computer vision and be uploaded to Azure machines for analysis.
- **CO-8: Explain the complete machine learning workflow.**
  - LO-8.2: Describe some risks and issues associated with AI.

Required Readings

[Understanding the Risks of Machine Learning](#)

[The Urgent Risks of Runaway AI](#)

[Risks associated with the use of machine learning models](#)

[Neuroscientist examines the risks of artificial intelligence](#)

[What are the top 10 challenges of machine learning?](#)

Assignments

W15: Risks of AI

Recommended Optional Reading

Recommended Media

## **Week 16: Final Project**

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Learning Outcomes

- **CO-1: Discuss artificial intelligence and machine learning.**
- **CO-2: Evaluate data for machine learning.**



- **CO-3: Explain various categorical features as it applies to engineering.**
- **CO-4: Compare various machine-learning algorithms.**
- **CO-5: Describe the process of selecting algorithms for given applications.**
- **CO-6: Explain the importance of Model performance.**
- **CO-7: Explore the job market in artificial intelligence and machine learning.**
- **CO-8: Explain the complete machine learning workflow.**

#### Required Readings

No readings this week.

#### Assignments

W16: Final Project

Recommended Optional Reading

Recommended Media

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## Evaluation

Discussions - 40%

Assignments - 60%

#### Grading:

Name	Grade %
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## Materials

**Book Title:** Various resources from the APUS Library & the Open Web are used. Please visit <http://apus.libguides.com/er.php> to locate the course eReserve.

**Author:** No Author Specified

**Publication Info:**

**ISBN:** N/A

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## Course Guidelines

This course requires a time management plan and the self-discipline to follow it. You are responsible for managing your time, completing assignments on time, completing the readings, and making inquiries as needed to complete the course effectively. This requires dedication and diligence on the part of each student.

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## Communications

## Student Communication

To reach the instructor, please communicate through the MyClassroom email function accessible from the Classlist of the Course Tools menu, where the instructor and students email addresses are listed, or via the Office 365 tool on the Course homepage.

- In emails to instructors, it's important to note the specific course in which you are enrolled. The name of the course is at the top center of all pages.
- Students and instructors communicate in Discussion posts and other learning activities.
- All interactions should follow APUS guidelines, as noted in the [Student Handbook](#), and maintain a professional, courteous tone.
- Students should review writing for spelling and grammar.
- [Tips on Using the Office 365 Email Tool](#)

## Instructor Communication

The instructor will post announcements on communications preferences involving email and Instant Messaging and any changes in the class schedule or activities.

- Instructors will periodically post information on the expectations of students and will provide feedback on assignments, Discussion posts, quizzes, and exams.
- Instructors will generally acknowledge student communications within 24 hours and respond within 48 hours, except in unusual circumstances (e.g., illness).
- The APUS standard for grading of all assessments (assignments, Discussions, quizzes, exams) is five days or fewer from the due date.
- Final course grades are submitted by faculty no later than seven days after the end date of the course or the end of the extension period.

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## University Policies

Consult the [Student Handbook](#) for processes and policies at APUS. Notable policies:

- [Drop/Withdrawal Policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)
- [Academic Dishonesty / Plagiarism](#)
- [Disability Accommodations](#)
- [Student Deadlines](#)
- [Video Conference Policy](#)

## Mission

The [mission of American Public University System](#) is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.

## Minimum Technology Requirements

- Please consult the catalog for the minimum hardware and software required for [undergraduate](#) and [graduate](#) courses.
- Although students are encouraged to use the [Pulse mobile app](#) with any course, please note that not all course work can be completed via a mobile device.

## Disclaimers

- Please note that course content – and, thus, the syllabus – may change between when a student registers for a course and when the course starts.
- Course content may vary from the syllabus' schedule to meet the needs of a particular group.