Miami Dade College

Course Description

CAI3822C | Computational Methods and Applications for Artificial Intelligence 2 | 3.00 credits

This course is designed for students to acquire a deeper understanding of computational methods used in the applications of artificial intelligence (AI) with programming. The topics of this course will be a continuation of those covered in Computational Methods and Applications for Artificial Intelligence I, with added emphasis on case studies using machine learning. Prerequisite: CAI3821C.

Course Competencies:

Competency 1: The student will demonstrate an understanding of data structures used in AI by:

1. Describing the difference between discrete and complex representations of data such as data frames, lists, and arrays and their applications in AI
2. Performing everyday operations on various data structures such as arrays, lists, and data frames using a programming language such as Python

Competency 2: The student will demonstrate an understanding of computational techniques for dimensionality reduction and feature extraction by:

1. Understanding and applying Principal Component Analysis
2. Understanding and applying Singular Value Decomposition
3. Understanding and applying Linear Discriminant Analysis

Competency 3: The student will demonstrate an understanding of computational techniques for classification and optimization by:

1. Describing the fundamentals of decision trees for Machine Learning solutions
2. Describing random forests and their application in Machine Learning
3. Understanding the application of random forest algorithms in feature importance computation
4. Understanding distributional learning and its applications

Competency 4: The student will demonstrate an understanding of computational techniques for evaluating model performance by:

1. Describing Accuracy, Precision, F-1 Score, and Recall and their roles in evaluating model performance.
2. Identifying bias and unbalanced results
3. Describing techniques to address bias and unbalanced results
4. Using computational techniques to address underfitting and overfitting

Competency 5: The student will demonstrate an understanding of computational techniques for optimization by:

1. Understanding gradient descent algorithms to train ML models and neural networks
2. Applying computational methods to optimize machine learning models
3. Describing learning rate
4. Describing different types of gradient descent algorithms
5. Describing the challenges and limitations of gradient descent algorithms
6. Understanding Neural Networks for optimization
7. Describing techniques for Neural Networks training
8. Describing techniques for optimization of Neural Networks

Competency 6: The student will demonstrate an understanding of Supervised and Unsupervised learning methods by:

1. Describing Supervised learning
2. Describing Unsupervised learning
3. Understanding the difference between Supervised and Unsupervised learning
4. Describing the k-nearest neighbors (KNN) algorithm. e) Describing the k-means clustering algorithm

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Use computer and emerging technologies effectively