ICS C265: ARTIFICIAL INTELLIGENCE

Item	Value
Curriculum Committee Approval Date	11/17/2023
Top Code	070200 - Computer Information Systems
Units	3 Total Units
Hours	54 Total Hours (Lecture Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

In the rapidly evolving technology landscape, understanding artificial intelligence (AI) applications is a critical skill. This course provides an overview of the principles, techniques, and applications of AI. Students will learn about AI concepts, machine learning, neural networks, and real-world AI applications. Using popular software tools and low-code platforms, students will complete hands-on exercises in AI. Whether you are an AI enthusiast, developer, content creator, or researcher, this course equips you with the skills to harness the power of AI. ADVISORY: ICS C120, ICS C123, and ICS C165. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Given a sample dataset, train a model to evaluate the model's performance and visualize the results.
2. Implement a basic chatbot using rule-based or machine learning approaches.
3. Propose strategies for responsible AI development and deployment.

Course Objectives

- 1. Define artificial intelligence, its history, and importance.
- 2. Describe the different types of artificial intelligence systems.
- 3. Provide context for ethical considerations related to the development and use of artificial intelligence.
- 4. Outline various problem-solving methods and search algorithms.
- 5. Explain knowledge representation schemes and the logic and reasoning associated with artificial intelligence systems.
- 6. Provide an introduction to the fundamentals of machine learning, including supervised and unsupervised learning.
- 7. Explain the concepts of neural networks and deep learning.
- 8. Describe image processing and computer vision fundamentals.
- 9. Outline the primary concepts of reinforcement learning.
- 10. Explain the real-world use of artificial intelligence systems and recent advancements.

Lecture Content

Introduction to Artificial Intelligence Defining AI Historical overview Importance and impact of AI Types of AI systems Ethical considerations Problem Solving and Search Algorithms Problem-solving methods Uninformed search algorithms (e.g., depth-first, breadth-first) Heuristic search (e.g., A* algorithm) Adversarial search (e.g., Minimax) Knowledge Representation and Reasoning Propositional and first-order logic Knowledge representation schemes Inference in propositional logic Resolution theorem proving Machine Learning Fundamentals Introduction to machine learning Supervised learning Unsupervised learning Feature engineering Evaluation and metrics Neural Networks and Deep Learning Introduction to neural networks Feedforward neural networks Backpropagation algorithm Activation functions Deep learning architectures (CNNs, RNNs) Natural Language Processing (NLP) Basics of NLP Text preprocessing Sentiment analysis Named entity recognition Language models (e.g., LLM, LSTM, BERT) Computer Vision and Image Processing Computer vision fundamentals Image preprocessing Object detection Image classification Convolutional Neural Networks (CNNs) Reinforcement Learning Introduction to reinforcement learning Markov decision processes (MDPs) Q-learning Deep Q-Net works (DQNs) Ethical and Social Implications Bias and fairness in AI AI in healthcare, finance, and other industries AI and privacy concerns AI ethics and regulations AI Applications and Future Trends Real-world AI applications Recent AI advancements AI and the future of work Discussion on emerging trends in AI

Lab Content

Introduction to AI Tools and Libraries Install and set up popular AI libraries like TensorFlow or PyTorch. Implement a basic machine learning algorithm (e.g., linear regression or k-nearest neighbors) using the chosen library. Load a sample dataset, preprocess the data, and train the model. Evaluate the models performance and visualize the results. Natural Language Processing (NLP) Implement a text tokenization algorithm to break down sentences into words. Perform text preprocessing tasks such as stemming, lemmatization, and stop-word removal. Build a sentiment analysis classifier using a dataset of movie reviews or social media posts. Implement a basic chatbot using rule-based or machine learning approaches. Computer Vision Load and display images using a programming language like Python. Apply basic image processing techniques such as blurring, edge detection, and resizing. Implement object detection using pre-trained models like YOLO (You Only Look Once) or SSD (Single Shot MultiBox Detector). Develop a facial recognition system using Haar cascades or deep learning models. Reinforcement Learning Implement a simple reinforcement learning problem, such as the Multi-Armed Bandit problem. Develop a Q-learning algorithm for solving a grid-world problem. Experiment with deep reinforcement learning using algorithms like Deep Q-Networks (DQN). Design and implement a reinforcement learning agent to play a game, such as Tic-Tac-Toe or Flappy Bird. AI Ethics and Bias Analyze a real-world case study involving ethical implications of AI technology. Discuss bias in AI datasets and algorithms, and explore techniques for bias mitigation. Debate ethical dilemmas related to AI applicati ons in areas like healthcare, autonomous vehicles, or criminal justice. Propose strategies for responsible AI development and deployment. AI Project Select a project topic related to AI (e.g., healthcare, finance, gaming). Define the problem, collect and preprocess data, and choose appropriate AI techniques for the project. Implement the AI solution and evaluate its performance using relevant metrics. Present the project outcomes, challenges faced, and lessons learned to the class.

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

This course will utilize a combination of lecture, hands-on guided assignments, classroom/discussion student interactions, problem solving, quizzes, tests, and troubleshooting assignments to achieve the goals and objectives of this course. All instructional methods are consistent across all modalities.

Reading Assignments

Students will read about artificial intelligence concepts and problem-solving methods. Students will read about machine learning, neural networks, and natural language processing (NLP). Students will read about bias and ethical and social implications of artificial intelligence.

Writing Assignments

Students will complete written reports related to artificial intelligence concepts such as machine learning, neural networks, natural language processing (NLP), and computer vision. Students will complete written reports related to popular AI programming tools and libraries. Students will complete written reports related to bias and ethical and social implications of artificial intelligence.

Out-of-class Assignments

Students will complete written reports related to artificial intelligence concepts such as machine learning, neural networks, natural language processing (NLP), and computer vision. Students will complete hands-on assignments related to artificial intelligence such as installation of popular AI programming tools and libraries.

Demonstration of Critical Thinking

Students will apply critical thinking skills through the implementation of a basic machine learning algorithm (e.g., linear regression or k-nearest neighbors) using the chosen library. Students will demonstrate critical thinking skills by loading a sample dataset, preprocessing the data, and training the model.

Required Writing, Problem Solving, Skills Demonstration

Students will complete written reports related to artificial intelligence concepts such as machine learning, neural networks, natural language processing (NLP), and computer vision. Students will complete written reports related to popular AI programming tools and libraries. Students will complete written reports related to bias and ethical and social implications of artificial intelligence. Students will complete hands-on assignments related to artificial intelligence such as installation of popular AI programming tools and libraries.

Eligible Disciplines

Computer information systems (computer network installation, microcomputer ...: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience. Computer science: Masters degree in computer science or computer engineering OR bachelors degree in either of the above AND masters degree in mathematics, cybernetics, business administration, accounting or engineering OR bachelors degree in engineering AND masters degree in cybernetics, engineering mathematics, or business administration OR bachelors degree in mathematics AND masters degree in cybernetics, engineering mathematics, or business administration OR bachelors degree in any of the above AND a masters degree in information science, computer information systems, or information systems OR the equivalent. Note: Courses in the use of computer programs for application to a particular discipline may be classified, for the minimum qualification purposes, under the discipline of the application. Masters degree required. Computer service technology: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Russell, S.; Norvig, P. Artificial Intelligence: A Modern Approach, 4th ed. Pearson, 2021

Other Resources

1. Coastline Library 2. White papers, security reports, and articles are available at no charge to all students at multiple sites as recommended by the instructor.