Introduction to Artificial Intelligence BE-604

2023 Catalog Description

Introduction to Artificial Intelligence. Credits 3. Pre-requisites: None. This course covers: 1) fundamentals of artificial intelligence**,** 2) solving problems by searching agents, 3) concepts of knowledge, logic, reasoning, and planning in AI, 4) machine learning concepts and different forms of learning and applications, and 5) data privacy and ethics in AI. Students will learn different ways to solve problems by automated searching approaches and using learning agents in machine learning with different applications in medicine. Students are expected to work on a team project and write technical reports.

Pre-requisite by Topic

Graduate Standing

Presentation Format

Face-to-Face (Fall Semester); On-line (Spring Semester)

Maximum Enrollment: 35

GRADING SYSTEM (Subject to change at any time at instructor's discretion)

A – 90-100%; B – 80-89%; C – 70-79%; D – 60-69%; & F - <59%

Texts

1. Stuart Russel and Peter Norving, ***Artificial Intelligence, A Modern Approach***, 4th Edition, Pearson, ISBN: 978-0-13-461099-3.

References

1. Handouts provided by the instructor.
2. Anthony C. Chang, ***Intelligence-Based Medicine***, Elsevier,
   ISBN: 798-012-823337-5

Course Fee

None

Course Director

Ayman El-Baz, Chair and Professor of Bioengineering Department

Course Instructor

Ayman El-Baz, Chair and Professor of Bioengineering Department

Course Objectives

The purpose of this course is to understand introductory artificial intelligence concepts such as searching, knowledge-based, and learning agents. Also, to understand the introductory concepts of reasoning, planning, scheduling, and the AI concerns such as ethics and bias. At the end of the course, the successful student will be able to:

- Study the concepts and the history of artificial intelligence.
- Study problem solving agents through searching.
- Study knowledge-based agents and the concepts of reasoning, automated planning, and scheduling.
- Study different forms of learning and the role of learning agents in machine learning
- Study data privacy and AI concerns such as ethics and bias.

Topics Covered by Class Schedule

1- Concepts and History of Artificial Intelligence (AI)

- The Foundations of Artificial Intelligence
- The History of Artificial Intelligence
- Risks and Benefits of AI
- Intelligent Agents
  - Agents and Environments
  - Good Behavior: The Concept of Rationality
  - The Nature of Environments
  - The Structure of Agents

2- Solving Problems by Searching

- Problem-Solving Agents
- Uninformed Search Strategies
  - Breadth-first search
  - Depth-first search
- Informed (Heuristic) Search Strategies
  - Greedy best-first Search
  - A* (A-Star) search
- Local Search and Optimization
  - Greedy local search (hill-climbing, gradient descent)
  - Simulated annealing
  - Evolutionary algorithms

3- Knowledge, Reasoning, and Planning

- Knowledge-Based Agents
- Logic
- Propositional Logic
- First Order Logic
- Knowledge-Based Representation
- Planning
- Time, Schedules, and Resources

- Probabilistic Reasoning
    - Representing Knowledge in Uncertain Doman
    - Bayesian Networks
    - Time and Uncertainty
    - Hidden Markov Models

4- Machine Learning

- Forms of Learning
    - Supervised Learning
    - Unsupervised Learning
    - Semi-supervised Learning
    - Reinforcement Learning
- Shallow Learning
- Artificial Neural Networks and Deep Learning
- Computer vision and Convolutional Neural Networks (CNN)
- Natural Language Processing and Recurrent Neural Networks
- Transformers

5- Data Privacy and AI Ethics

- Data Privacy in Health Care
- AI Concerns
    - Bias
    - Ethics
    - Safety
    - Legal

Computer Use

MATLAB and/or Python will be used for data processing.

Two 75-minute sessions per week devoted to lecture, discussion and problem solving.

Evaluation

Homework and Testing – 40%; Projects (4) – 60%.

Grading Scale

A – 90-100%; B – 80-89%; C – 70-79%; D – 60-69%; & F - <59%

Class Projects

There will be four projects during the semester and will require you to use MATLAB/Python for data processing. Each project will be done in groups and will consist of a project report and a demonstration of their software.

Homework

Homework assignments will be given every week. The homework questions will be posted on the web with their due dates. Homework assignments will include some MATLAB/Python problems. Posting of new assignments will be announced in class. You must submit your homework solutions during the class period on the due date unless prior permission has been granted to submit otherwise. No late homework assignments will be graded. Homework solutions must be clear and well-written to receive credit.

Professional Component Contribution

Engineering Science: 3 credits, engineering design: 0 credit.

Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure.

Relationship to Program Objectives

1. An ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science and mathematics.
2. An ability to apply engineering design to produce advanced solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors.Developing a recognition of the need for, and an ability to engage in, life-long learning in the field of bioengineering.
3. An ability to develop and conduct appropriate experimentation using scientific methods to collect, analyze and interpret data, and to use engineering judgment to draw conclusions.Developing an ability to use the techniques, skills, and modern tools necessary for the practice of bioengineering.
4. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.