CS480 – Introduction to Artificial Intelligence

Topic: Syllabus

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Course

- CS 480
- Introduction to Artificial Intelligence

Instructor

- Dr. Mustafa Bilgic
  - Associate Professor in CS
  - Director of the BS-AI and MAS-AI programs
  - Director of the Machine Learning Laboratory

Agenda

- Course syllabus
- Course logistics
- Pick an office hour that works for most students
- Answer your questions
- Adjourn

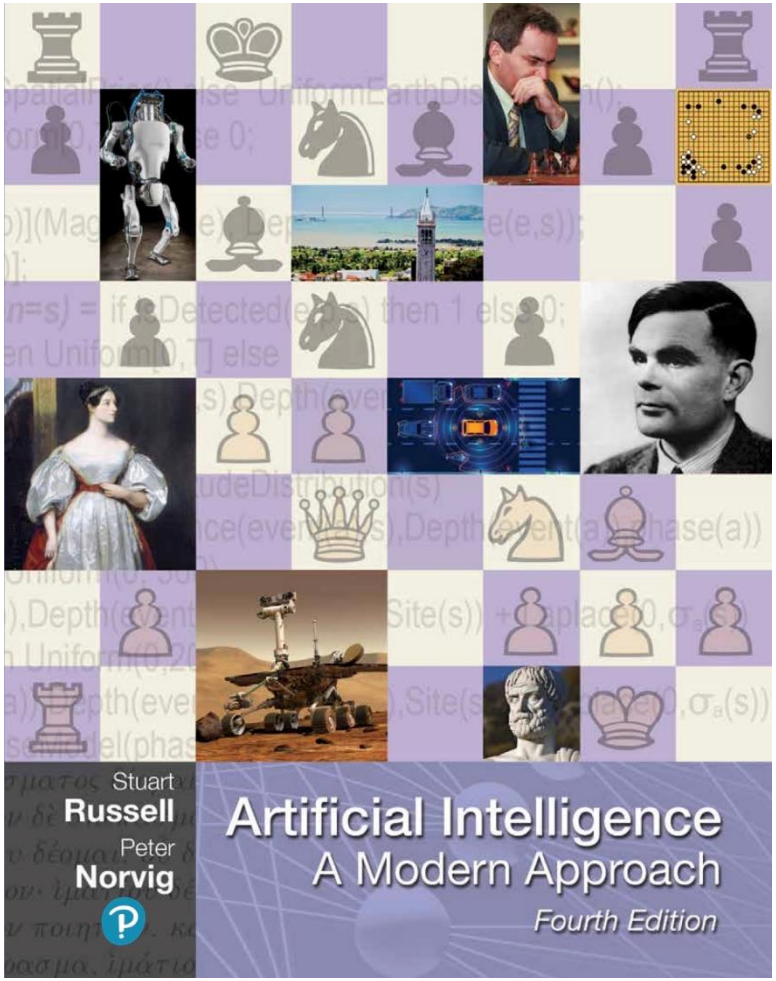
Course Syllabus

Course description

http://bulletin.iit.edu/search/?search=cs+480

Introduction to computational methods for intelligent control of autonomous agents, and the use of programming paradigms that support development of flexible and reactive systems. These include heuristic search, knowledge representation, constraint satisfaction, probabilistic reasoning, decision-theoretic control, and sensor interpretation. Particular focus will be placed on real-world application of the material.

Textbook



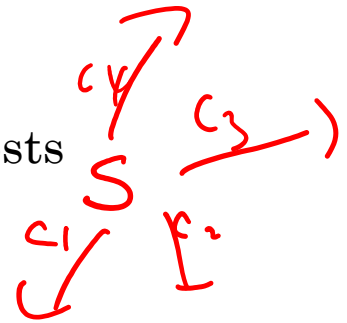
- Artificial Intelligence: A Modern Approach
  - 4th edition
  - by Stuart Russell and Peter Norvig
  - http://aima.cs.berkeley.edu/
- Is it required?
  - No, but it is highly recommended

We'll Cover

- Chapter 1 - Introduction
- Chapter 2 - Intelligent Agents
- Chapter 3 - Solving Problems by Searching
- Chapter 5 - Adversarial Search and Games
- Chapter 6 - Constraint Satisfaction Problems
- Chapter 7 - Logical Agents
- Chapter 8 - First-order Logic
- Chapter 9 - Inference in First-Order Logic
- Chapter 12 - Quantifying Uncertainty
- Chapter 13 - Probabilistic Reasoning
- Chapter 16 - Making Simple Decisions
- Chapter 17 - Making Complex Decisions
- Chapter 19 - Learning From Examples
- Chapter 21 - Deep Learning
- Chapter 22 - Reinforcement Learning
- Chapter 27 - Philosophy, Ethics, and Safety of AI
- Chapter 28 - The Future of AI

Topics

- Define AI and talk about its history
- Talk about "agents" and their PEAS
- Search
  - Given
    - an initial state, a goal state, actions, and costs
  - Find
    - An optimal solution (a sequence of actions)
  - DFS, BFS, …, A*
  - Completeness, optimality, time complexity, space complexity



Topics

- Game playing
  - Two-player games
    - Tic-tac-toe, chess, Go, …
  - Mini-max, alpha-beta pruning
- Constraint satisfaction algorithms
  - Given
    - Variables, domains, constraints
  - Find
    - A solution (complete and consistent assignment)
  - Examples
    - Map coloring, sudoku, class scheduling, …
  - Backtracking search, AC-3, min conflicts

Topics

Ch 7, 8, 9

- Knowledge representation and reasoning
  - Propositional logic
  - First-order logic
  - Various inference algorithms
    - Resolution, forward chaining, backward chaining
- Uncertainty and decision-making

Ch 12, 13, 16, 17

  - Probability theory
  - Utility theory
  - Bayesian networks
  - Influence diagrams
  - Making decisions

Topics

- Machine learning
  - Definitions
  - Supervised learning
    - Decision trees, naïve Bayes, logistic regression, neural networks, deep learning
  - Reinforcement learning
- Ethics
  - Fairness, accountability, transparency, safety, …
- Future of AI

Notes (ch 19, 20, 21, 22)

ch 27

ch 28

What this course is NOT

- Not a machine learning course
- Not a deep learning course
- Not a gaming course
- Not an applications course

Fundamentals vs "that shiny thing"

- The list of applications of AI is changing and growing fast
- We will not chase the latest and greatest
- We will learn
  - The fundamentals of AI
  - An introduction to AI
  - About some applications of AI
  - How to distinguish hype from reality in the news
  - Programming some of the fundamental AI algorithms

Related CS Courses

- http://bulletin.iit.edu/courses/cs/
- 400-level
  - CS 422, CS 429, CS 481, CS 482, CS 484
- 500-level
  - CS 512, CS 522, CS 529, CS 577, CS 578, CS 579, CS 580, CS 581, CS 582, CS 583, CS 584, CS 585
- Some courses are offered more frequently than others
  - https://docs.google.com/document/d/1kiI3FAEZFC4C1wilkYMJF-KHy-m4BG2jL-pbZNiXehI/edit

584

CS 484 – Introduction to Machine Learning

- An introduction to machine learning concepts and algorithms, including classification, clustering, and regression. Topics include k-means clustering, nearest neighbors classification, decision trees, naive Bayes, logistic regression, support vector machines, and neural networks. Special focus will be on practical aspects of machine learning, including data preparation, experimental design, and modern tools for building machine learning systems. Basic probability theory knowledge is required.

Course Objectives and Outcomes

- Define Artificial Intelligence
- Describe and critique the Turing test
- Develop PEAS (Performance, Evaluation, Actuators, Sensors) descriptions of artificially intelligent agents
- Compare and contrast search algorithms using the following criteria: completeness, optimality, time complexity, and space complexity.
- Implement and evaluate search algorithms to create a sequence of actions that take an agent from an initial state to a goal state.
- Create admissible heuristics for the A* algorithm.
- Implement minimax and alpha-beta pruning algorithms for playing two-player games.
- Implement backtracking search for solving constraint satisfaction algorithms.
- Apply the resolution algorithm to propositional logic and first-order logic knowledge bases.
- Apply variable elimination algorithm to compute probabilities in a given Bayesian network.
- Describe probabilistic independencies in a given Bayesian network.
- Apply the maximum expected utility principle to identify the optimal action in a given influence diagram.
- Compute the value of information for various nodes of an influence diagram.
- Explain the differences among the three main styles of machine learning: supervised, unsupervised, and reinforcement.
- Apply value iteration and policy iteration algorithms to a problem described as a Markov decision process.
- Develop, apply, and evaluate deep learning models for an image classification task.
- Explain the ethical considerations of deploying an AI system.

Course Logistics

Online, In-person, Synchronous, …?

- Three sections: V01, V02, B01
- I do not see any difference between the sections
- All sections will be online
- Synchronous lectures live
  - Tuesdays/Thursdays 9:40am-10:55am (US Central)
  - Blackboard collaborate ultra (zoom?)
- Recording?
  - Lectures will be recorded and made available through Blackboard Collaborate Ultra

Websites

- Blackboard
  - Assignments, participation, lecture videos, calendar
  - https://blackboard.iit.edu/
- GitHub
  - Slides
  - https://github.com/cs480-f20/CS480
- Piazza
  - Questions and answers
  - https://piazza.com/class/ke4w8b74oci7np

GRADING

Participation	10%
Written Assignments	20%
Programming Assignments	20%
Midterm Exam	20%
Final Exam	30%

Participation (10%)

- Blackboard discussion board
- One discussion topic per week
- 1 point per week

Written Assignments (20%)

- Tracing algorithms, calculating probabilities, logical reasoning, …
- Examples from previous years
  - Trace A*, trace alpha-beta pruning, solve CSP, find out max utility action, …
- 4-5 written assignments

Programming Assignments (20%)

- Python 3.x
- Implement and apply an algorithm to a toy/real problem
- Examples from previous years
  - Implement A*, alpha-beta pruning, simple decision-making algorithms, …
- Use git to push your code to a GitHub repository
- 3-4 programming assignments

Late Submission Policy

- 5-minute grace period
- After that, every late minute will cost you a point

Exams

- A midterm (20%) and a final (%30)
- Like written assignments
- I haven't worked out the logistical details yet

Office (Virtual) Hour

- Survey to pick an hour that works for most

Academic honesty

- If you violate the academic honesty (such as unauthorized/undocumented collaboration, cheating, etc.), then depending on the severity of the violation, it can result in
  - zero points on the respective assignment,
  - E in the course,
  - suspension of your enrollment at the university,
  - expulsion from the university.
- Full guidelines are available at: https://web.iit.edu/student-affairs/handbook/fine-print/code-academic-honesty

Americans with Disabilities Act (ADA) Policy

- Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources
- https://web.iit.edu/cdr

Questions?