Introduction to Artificial Intelligence

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EP16.TOKT11121 (AI) Dr. **Nguyen Thi Kim Ngan**

About This Course:

This course aims to deliver a comprehensive overview of Artificial Intelligence, its implications, applications, and the skills to leverage it. The course begins by describing what the latest generation of artificial intelligence techniques can do. After an introduction to some basic concepts and techniques, the course illustrates both the potential and current limitations of these techniques with examples from a variety of applications. We spend some time on understanding the strengths and weaknesses of human decision-making and learning, specifically in combination with AI systems. Exercises will include hands-on application of basic AI techniques as well as selection of appropriate technologies for a given problem and anticipation of design implications. In a final project, groups of students will participate in the creation of a simple AI-based application.

Prerequisite: EP16.TOKT11108 (Fundamental Programming Concepts in Python)

Logistics:

- Lecture format: In-person
- Lecture location: National Economics University 207 Giai Phong street, Bach Mai ward Hanoi, Vietnam.

Grading:

- Participation (20%): Attendance, Homework check, Volunteer for class question. Homework and discussion will be push in LMS. Code uploaded in Kaggle.
- Midterm Exam/Project (20%): Project including presentation and submit report. Criteria: Content Mastery; Problem-Solving Skills; Critical Thinking; Application of Knowledge; Time management
- Final Exam (60%).

Resources:

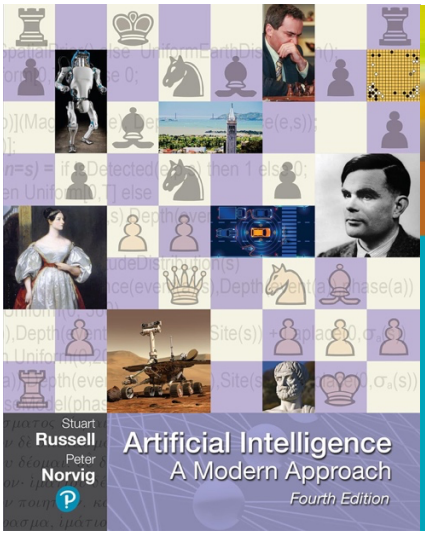
Main textbooks

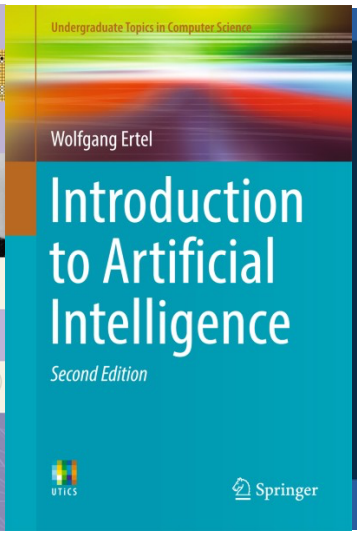
[1] Russell, S. & Norvig, P (2020). Artificial Intelligence: A Modern Approach, Pearson.

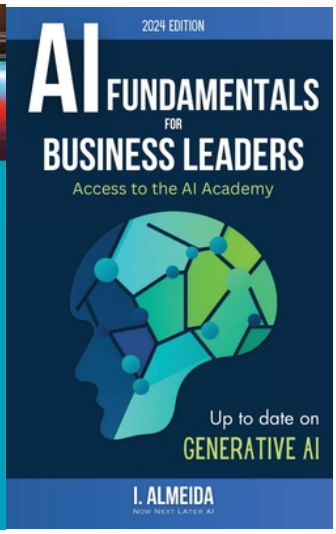
Others

[2] I. Almeida. Artificial Intelligence Fundamentals for Business Leaders: Up to Date With Generative AI (2024 Edition). Now next later AI.

[3] Wolfgang Ertel (2017), Introduction to Artificial Intelligence. Springer.







Other tutorials and references
Updating …

Software
- Python, numpy, sklearn
- Kaggle

Lectures

Week 1

- **Topic: Introduction to Artificial Intelligence; Search Strategies (Breadth-First Search, Depth-First Search)**

- **Materials: Chapter 1–3, lecture slides, sample Python code for search algorithms**

Week 2

- **Topic: Homework review and hands-on exercises on BFS and DFS**

- **Materials: Practice problems, Python notebook for search visualization**

Week 3

- **Topic: Informed Search Strategies (Best-First Search, Hill Climbing, Beam Search)**

- **Materials: Chapter 4, lecture slides, search implementation examples**

Week 4

- **Topic: Practical session on heuristic-based search algorithms**

- **Materials: Coding exercises, performance comparison notebooks**

Week 5

- **Topic: Optimal Search (A*, Greedy Search)**

- **Materials: Chapter 4, slides on heuristic functions and optimality**

Week 6

- **Topic: Implementation and evaluation of A* and Greedy Search**

- **Materials: Python code templates, problem sets**

Week 7

- **Topic: Adversarial Search (Minimax Algorithm, Alpha-Beta Pruning)**

- **Materials: Chapter 5, lecture notes, game tree examples**

Week 8

- **Topic: Practice on game-playing agents using Minimax and Alpha-Beta Pruning**

- **Materials: Lab exercises with Tic-Tac-Toe or similar games**

Week 9

- **Topic: Propositional Logic – Syntax, Semantics, and Inference**

- **Materials: Chapter 7, lecture slides, reasoning examples**

Week 10

- **Topic: Practical exercises on Propositional Logic (Resolution, Inference rules)**

- **Materials: Logic problem sets, Python-based logic solvers**

Week 11

- **Topic: First-Order Logic – Representation and Inference**

- **Materials: Chapter 8–9, lecture notes, ontology examples**

Week 12

- **Topic: Practice on First-Order Logic reasoning and implementation**

- **Materials: Exercises using FOL solvers or Prolog**

Week 13

- **Topic: Introduction to Neural Networks (Perceptron, Single-layer Neural Models)**

- **Materials: Chapter 18, lecture slides, TensorFlow/PyTorch notebooks**

Week 14

- **Topic: Hands-on training for single-layer neural networks**

- **Materials: Lab notebook on classification tasks using perceptron**

Week 15

- **Topic: Supplementary Topics – Computer Vision, NLP, Clustering, Regression, Classification, GPU Computing, and MLOps. Overview of the AI Project Pipeline (from data labeling to model evaluation).**

- **Materials: Overview slides, project templates, demo notebooks**

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Assignments:

- Homework: Upload after each class. Submit your work in LMS. Homework correction will be given next session.
- Students who volunteer to do exercises will get extra points.

HOMEWORK 0 *{HTTPS://ELEARNING.FDA.EDU.VN/MOD/FORUM/DISCUSS.PHP?D=14}*
HOMEWORK 1 *{HTTPS://ELEARNING.FDA.EDU.VN/MOD/FORUM/DISCUSS.PHP?D=16}*
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HOMEWORK 5 *{HTTPS://ELEARNING.FDA.EDU.VN/MOD/FORUM/DISCUSS.PHP?D=24}*
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Course Project:

1. General Requirements

Each team selects one topic from the provided project list.

The project consists of two main parts:

1. Presentation: to be delivered next week.

2. Report: due one week after the presentation date.

3. Submit the presentation and report (all are .pdf files) via email or Zalo.

4. There are award for best presentation and best report.

Project workflow:

Identify a real-world problem.

Model it as a search problem (state space search).

Apply at least 2–3 search algorithms (BFS, DFS, Greedy, A, etc.).

Implement and test with code.

Compare results (expanded nodes, time, solution quality).

Relate findings back to the real-world context.

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2. Presentation

Duration: 10–12 minutes per team.

Suggested structure:

1. Introduction: Present the real-world problem.

2. Problem Formulation: Model it as a search problem (states, goal, operators, heuristics).

3. Algorithms: Briefly describe the algorithms used (with pseudo-code or demo).

4. Experiments & Results: Show outputs and comparisons.

5. Discussion: Interpret the meaning in the real-world context.

After the presentation, the instructor and other teams will ask questions.

Each team must record both the questions and their answers → to be included in the "Response to Reviewers" section of the report.

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3. Report:

Suggested Structure:

1. Introduction

Real-world background of the problem.

Why this problem is relevant and important.

2. Problem Formulation

Search problem representation: states, goal, operators, heuristics.

3. Algorithms

Description of applied algorithms (with pseudocode).

4. Experiments & Results

Input data / test cases.

Comparison table (expanded nodes, runtime, solution depth).

Visual examples if possible.

5. Discussion

Analysis of results, strengths and weaknesses of methods

Insights into the real-world application.

6. Response to Reviewers

List of questions asked during the presentation.

Written answers to these questions.

7. Conclusion

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4. Example

Topic: 8-Puzzle

Purely theoretical version:

"Initial state → Goal state. Apply BFS, GBFS (heuristic = misplaced tiles), A (heuristic = Manhattan distance). Compare number of expanded nodes and solution depth."

Real-world interpretation:

The 8-Puzzle can be modeled as seat arrangement in an international conference.

There are 9 chairs (8 delegates + 1 empty spot).

The organizer must arrange guests so that each delegate sits in the correct assigned seat.

Valid operation = swapping a delegate with an adjacent empty chair.

Goal = correct seating arrangement with the fewest moves.

Sample introduction section for the report:

"In international conferences, the correct arrangement of delegates according to diplomatic protocols is essential. We can model this seating arrangement task as the 8-Puzzle problem, where each tile represents a delegate and the empty tile represents an unoccupied chair. The objective is to reach the final correct arrangement with minimal movements. In this study, we apply classical search algorithms (BFS, GBFS, A) and compare their performance in terms of solution depth and number of expanded nodes, thereby evaluating the effectiveness of AI search methods for real-world organizational tasks."

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5. Notes

Creativity is required: Every project must be grounded in a real-world scenario (politics, society, traffic, healthcare, environment, education, etc.), not only in abstract puzzles.

The Response to Reviewers section is mandatory. This is what makes your project unique compared to standard coursework.

Teams are encouraged to use visualizations, simulations, or examples to make the application clearer.

People:

- Dr. Trong-Nghia Nguyen {image: Dr.TrongNghiaNguyen.jpeg }

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  Member of the Business AI Lab (BAI LAB) research group, lecturer at the Department of Data Science and Artificial Intelligence, School of Technology, National Economics University. Graduated with a Bachelor's degree in Information Technology from the University of Science - Hue University, (2018). Graduated with a Master's degree in Computer Science from Hanoi University of Science and Technology, (2021). Graduated with a PhD in Computer Science from Chonnam National University, Korea (2025).

  Image: Dr.TrongNghiaNguyen.jpeg

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