DS-221 Introduction to Data Science and Artificial Intelligence

Credit Hours: 2-0

Prerequisite: None

Course Objectives

This course introduces students to the foundational concepts of **Data Science and Artificial Intelligence (AI)**. Students will explore the data science process from data collection and wrangling to exploration, visualization, and interpretation, while also understanding the broader scope of artificial intelligence and its synergy with data-driven decision making. The course covers statistical inference, data management, data ethics, and the societal impact of AI technologies. Python will be used as the primary tool for hands-on analysis, data visualization, and interacting with AI APIs.

Course Contents

- Foundations of Data Science and Artificial Intelligence
- Big Data, the AI revolution, and the evolution of data-driven intelligence
- Skillsets for data scientists and AI practitioners
- Statistical inference: populations, samples, distributions, and basic modeling
- Exploratory Data Analysis (EDA): concept, process, tools, and graphical techniques
- SQL and enterprise data access and management
- Data wrangling: data collection, cleaning, and transformation
- APIs, web scraping, and real-time data acquisition
- Feature engineering and extraction in AI systems
- Social network data structures and graph-based data analysis
- Basic concepts in symbolic and statistical AI

- AI applications in data science (e.g., recommendation systems, sentiment analysis)
- Data visualization principles and communication of results
- Ethics, bias, transparency, and fairness in AI and data science
- The future of AI and the evolving role of data scientists and AI professionals

Course Outcomes

By the end of the course, students will be able to:

- Define and explain the roles and applications of data science and artificial intelligence
- Conduct exploratory data analysis using appropriate tools and visualizations
- Apply statistical reasoning to interpret data and infer conclusions
- Retrieve and manage data using SQL and Python-based tools
- Perform basic data wrangling, feature generation, and interaction with AI APIs
- Understand the basic principles of social network and graph data analysis
- Explain the ethical challenges associated with AI systems and data usage
- Discuss current and future trends in data science and artificial intelligence

Textbook

- Cathy O'Neil and Rachel Schutt. *Doing Data Science: Straight Talk from the Frontline*. O'Reilly, 2014.

Reference Books

1. Wil van der Aalst. *Process Mining: Data Science in Action*. Springer, 2016.
2. Philippe J.S. De Brouwer. *The Big R-Book: From Data Science to Learning Machines and Big Data*. Wiley, 2020.
3. Stuart Russell and Peter Norvig. *Artificial Intelligence: A Modern Approach*. Pearson, 2020. *(Selected chapters only)*

4. Ethem Alpaydin. *Introduction to Artificial Intelligence*. MIT Press, 2020. *(Supplementary reading)*

Weekly Breakdown

Week	Section	Topics
1	Chap 1	Introduction: What is Data Science? What is Artificial Intelligence? History and Trends
2	1.2	AI vs Data Science: Intersections and Differences. Real-world Applications
3	2.1	Statistical Thinking: Populations, Samples, Probability Distributions
4	2.2	Statistical Inference and Introduction to Statistical Models
5	2.3	Exploratory Data Analysis (EDA): Plots, Graphs, Summary Statistics
6	2.4	The Data Science Process and Philosophy of EDA
7	3.1	Introduction to SQL and Enterprise Data Management
8	4.1, 4.6	Data Wrangling I: Web Scraping, Working with APIs, JSON/XML
9		**Mid Semester Exam**
10	4.7	Data Wrangling II: Cleaning and Structuring Raw Data
11	5.1	Feature Generation and Extraction in AI-Driven Systems
12	7.5-7.6	Basics of Social Network Data, Introduction to Graph Structures
13	7.7-7.8	Visualizing Graph Data and Understanding Network Properties
14	9.1–9.3	Data Visualization: Tools, Dashboards, Principles for Insight Communication
15	9.4–9.6	Data Science and AI Ethics: Fairness, Bias, Privacy, and Responsible AI

16	16.1–16.5	The Future of Data Science and AI: Skills, Opportunities, and Global Trends
17		**Review Session**
18		**End Semester Exam**