

# Course Title: Applied AI and Agentic Systems for Environmental Sciences

**Semester:** Fall 2026

**Format:** Lecture + Lab

**Credits:** 3 (2 hrs lecture, 2 hrs lab per week)

**Prerequisites:** Introductory Programming (Python or R), Statistics, or Instructor approval

**Instructor:** Hafez Ahmad

**Office Hours:** [TBD]

## Course Description

This course introduces applied artificial intelligence with a focus on agentic AI systems for environmental and Earth science applications. Students will learn how autonomous and semi-autonomous AI agents can analyze environmental data, interact with models and tools, and support decision-making under uncertainty. Emphasis is placed on practical implementation, interpretability, and responsible deployment of AI in hydrology, water quality, agriculture, and climate-related systems.

## Course Learning Objectives

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

1. Explain core machine learning concepts and agentic AI principles relevant to environmental data.
2. Design and implement AI models for time series, spatial, and spatiotemporal environmental datasets.
3. Develop agent-based workflows that integrate sensors, remote sensing data, and environmental models.
4. Evaluate model performance, uncertainty, and interpretability in applied environmental contexts.
5. Build an end-to-end agentic AI project that supports environmental forecasting or decision-making.

## Weekly Schedule (Lecture + Lab)

Week	Lecture Topic	Lab Exercise
1	Introduction to Applied AI in Environmental Sciences	Python environment setup, data access, reproducible workflows
2	Environmental Data Types and AI Readiness	Working with hydrologic, climate, and water-quality datasets
3	Supervised Learning for Environmental Prediction	Regression and classification using environmental data
4	Unsupervised Learning and Feature Engineering	Clustering and dimensionality reduction
5	Model Evaluation and Uncertainty	Cross-validation and uncertainty estimation

6	Introduction to Agentic AI Systems	Designing agent workflows and task orchestration
7	Reinforcement Learning Concepts	Decision-making under environmental uncertainty
8	Midterm Review and Assessment	Applied midterm exercise
9	Multi-Agent Systems for Environmental Monitoring	Coordinated agents for sensor networks
10	Integrating AI with Remote Sensing and GIS	Agent-driven satellite data analysis
11	AI for Water Quality and Hydrologic Forecasting	Building AI-based forecasting agents
12	AI for Agricultural and Land Management	Crop stress and irrigation decision agents
13	Explainable and Responsible AI	Model interpretability and ethics
14	Deployment of Agentic AI Systems	Operationalizing AI workflows
15	Project Presentations	Student project presentations
16	Final Exam / Assessment	Practical and written assessment

## Assessments

- Lab assignments (8) – 40%
- Midterm exam – 15%
- Final project (proposal, report, presentation) – 25%
- Quizzes and participation – 10%
- Final exam – 10%

## Textbooks and Resources

- Géron, A. (2023). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly.
- Sutton, R. S., and Barto, A. G. (2018). *Reinforcement Learning: An Introduction*. MIT Press.
- Python scientific computing libraries (NumPy, Pandas, Scikit-learn)