

Samsung Innovation Campus: Artificial intelligence

Course Objectives

- Understand the foundational math behind data science and machine learning: linear algebra, probability and statistics.
- Be able to do data preprocessing with the Python libraries (NumPy and Pandas) for the execution of optimal machine learning models and data visualization.
- Explore supervised and unsupervised learning and be able to apply the most suitable machine learning algorithm.
- Learn to process textual data to derive high quality information from text and apply new insights to real-world business (NLP)
- Learn to apply foundation models to real-world problems through hands-on practice and comparisons across AI platforms.
- Understand the ethical challenges of AI and apply responsible AI principles and risk management when using GenAI.
- Build and train deep neural networks, use the deep learning libraries such as TensorFlow and Keras to gain proficiency, as well as handle various deep learning techniques.
- Be able to use Hugging Face and the Pipeline API to run large language models, fine-tune them for specific tasks, and make them smaller and faster with lightweight techniques.

Course Breakdown

- ✓ Lecture + Capstone Project
- ✓ Lecture covers most subject areas in general concepts of each technology.
- ✓ Focuses on building fundamental capabilities of AI modeling on a concrete foundation of mathematics, including linear algebra, probability and statistics.
- ✓ Introduces A to Z in Machine Learning tools, from NumPy to Keras, and techniques including CNN and practice with hands-on exercises.
- ✓ Offers real-world problem-solving experience as a capstone project, handling open-source data with participants' own AI
- ✓ Builds practical prompt engineering skills, from the basics to advanced techniques, through guided exercises.
- ✓ Introduces a range of foundation models and platforms, with side-by-side comparisons and hands-on practice.
- ✓ Gives hands-on practice with Hugging Face, from ready-made pipelines to fine-tuning, optimising and extending large language models for real-world applications.

Lecture Guide

Course Content
Week 1: Introduction to Artificial Intelligence
- Unit 1. The Concept of Artificial Intelligence
- Unit 2. Applications of Artificial Intelligence
- Unit 3. Techniques in Artificial Intelligence

- Unit 4. Artificial Intelligence: Trends and Markets
- Unit 5. Course Roadmap
Week 2: Math for Data Science
- Unit 1. Introduction
- Unit 2. Basic Math for Data Science
- Unit 3. Understanding Data Science: Vector
- Unit 4. Understanding Data Science: Matrix
- Unit 5. Understanding Deep Learning: Derivatives
- Quiz
Week 3: Exploratory Data Analysis: NumPy Arrays for Optimized Numerical Computation and Pandas
- Unit 1. NumPy Array Data Structure for Optimal Computational Performance
- Unit 2. Optimal Data Exploration Through Pandas
- Unit 3. Pandas Data Preprocessing for Optimal Model Execution
- Unit 4: Data Visualization for Various Data Scales
- Quiz
Week 4: Probability and Statistics
- Unit 1. Understanding of Probability
- Unit 2. Understanding of Statistics I
- Unit 3. Understanding of Statistics II
- Unit 4. Statistical Hypothesis Testing
- Quiz
Week 5: Machine Learning 1 – Supervised Learning
- Unit 1. Machine Learning Based Data Analysis
- Unit 2. Application of Supervised Learning Model for Numerical Prediction
- Unit 3. Application of Supervised Learning Model for Classification
- Unit 4. Decision Tree
- Unit 5. Naïve Bayes Algorithm
- Unit 6. KNN Algorithm
- Unit 7. SVM Algorithm
- Unit 8. Ensemble Algorithm
- Quiz
Week 6: Machine Learning 2 – Unsupervised Learning
- Unit 1. Text Mining
- Unit 2. Text Preprocessing
- Unit 3. Language Model
- Unit 4. Natural Language Processing with Keras
- Quiz
Introduction to Artificial Intelligence
- Unit 1. The Evolution and Fundamentals of GenAI
- Unit 2. Fundamentals of Text Generation Models (LLMs)
- Unit 3. Overview of Code, Image, and Video Generation Models
- Quiz
Week 7: Natural Language Processing and Language Models for Text Mining
- Unit 1. Text Mining

- Unit 2. Text Preprocessing
- Unit 3. Language Model
- Unit 4. Natural Language Processing with Keras
- Quiz
Prompt Engineering Basics
- Unit 1. What is Prompt Engineering and Why is it Important?
- Unit 2. Learning the Basics of Using Prompts
- Unit 3. Prompt Engineering Techniques I
- Unit 4. Prompt Engineering Techniques II (Advanced)
- Quiz
Week 8: Neural Network and Deep Learning
- Unit 1. Basics of Neural Network
- Unit 2. Basics of TensorFlow
- Unit 3. Deep Learning Methods using TensorFlow and Keras
- Quiz
Foundation Models and Platforms
- Unit 1. Exploring Diverse Foundation Models
- Unit 2. Understanding the Internal Components of Models
- Unit 3. Practical Strategies for Applying Foundation Models
- Unit 4. Comparative Analysis and Hands-on Practice Across Platforms
- Quiz
Week 9: Various Deep Learning Topics
- Unit 1. CNN Model
- Unit 2. RNN for Sequential Data Modeling
- Unit 3. Generative Adversarial Neural Network to Create Non-Existent Images
-Quiz
AI Ethics and Responsibility
- Unit 1. Understanding AI/GenAI Ethics
- Unit 2. Ethical Challenges of AI
- Unit 3. Responsible AI principles and Risk Management
- Unit 4. Discussion, Role-Play & Reflection Activities
- Quiz
Week 10: Practical Use and Fine-Tuning of Large Language Models
- Unit 1. Using Hugging Face and the Pipeline API
- Unit 2. Fine-Tuning Large Language Models
- Unit 3. Model Optimization and Lightweight Techniques
- Unit 4. Applications and Extensions
- Quiz

Capstone Project Guide

Course Content
Week 11: Starting an AI Project
Project Preparation
Design Thinking

Week 12: AI Capstone Project Tutorial
Using a Ready-made CNN Model
AI Application Cases
During the capstone project, student's project activities take more time than lectures itself. Please expect up to 80 hours to complete the whole project.
Team Building
Topic Planning
Team Building
Capstone Project Action Plan
Action Planning
WBS Planning
Preliminary Presentation
Presentation
Presentation
Prototyping & Testing (1st iteration)
Data Wrangling
Modeling
Testing
Prototype Presentation
Presentation
Presentation
Prototyping & Testing (2nd iteration)
Data Wrangling
Modeling
Testing
Prototyping & Testing (2nd iteration)
Data Wrangling
Modeling
Testing
Final Presentation
Final Report Creation
Presentation
Final Presentation

Course Assessment:

The scoring assessments of the students will follow the below criteria:

Criteria	Weight
Quiz - Quiz will be placed at the end of each week - Approximately 5 ~ 20 questions per quiz	40 %
Capstone Project - Project is measured based on the quality of final product, presentation and teamwork	60 %
Participation - Participation is measured by the instructor throughout the course	+α
Total	100%

Certification:

The students will be eligible for a certification when both qualifications below are met.

Qualification	Cut-off Rate
1. Attendance higher than	90 %
2. Total grade for assessment higher than	50 %
► Certified when both qualifications are met	-