



PROFESSIONAL MASTER IN DATA SCIENCE & ARTIFICIAL INTELLIGENCE (AI) APPLICATIONS

CONTACT US

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INTRODUCTION

Professional Master's in Data Science and Artificial Intelligence Applications

Background and rationale

Data science is concerned with the extraction of useful knowledge from data sets. It is closely related to the fields of computer science, mathematics, and statistics. It is a relatively new term for a broad set of skills spanning the more established fields of machine learning, data mining, databases, and visualization, along with their applications in various fields. In 2012, Harvard Business Review called the data science "The Sexiest Job of the 21st Century."

There is a close relationship between data science and related fields of science and engineering. In AIT's ICT and ISE departments, a large proportion of the teaching and research already concerns data science. Based on the fundamentals of the existing curriculum and a regular 2-year master's program for delivery at AIT as well as in collaboration with the Erasmus+DS&AI consortium, group of European and Asian organizations this one-year program is designed specifically for the professional market in Vietnam.

Due to the COVID-19 pandemic, the program will be delivered online exclusively in the first iteration from August 2021 to January 2022. If the Covid-19 situation is better the offerings may move to a hybrid approach with local faculty in Vietnam and AIT faculty teaching with a mix of remote and in-person instruction or ideally offline mode.

Target students

The program is designed for working professionals who would like to extend their skillset to encompass data science. They would be data analysts, data scientists, IT experts or data and AI professionals who are working for IT companies and corporations, IT and AI departments, labs or centers, IT departments of respective departments of provinces and ministries, teaching in universities or research centers...

The program is initially designed for the Vietnamese professional market with potentials to be be extended to other countries such as Nepal, Myanmar, Thailand, Sri Lanka, India, Pakistan, China, Indonesia, and Malaysia.

Eligibility

The common core (Programming for DS&AI, Data Modeling and Management, Machine Learning, Business Intelligence and Analytics) is designed so that any graduate of a 4-year Bachelor of Science or Bachelor of Engineering program can succeed in the program.

The mathematical background for the common core is undergraduate linear algebra and multivariate calculus (matrices, vectors, and partial derivatives) and basic probability theory (probability mass functions, probability density functions, sampling, and common distributions). The Mathematical Foundations of Data Science course provides a review of this background material and reinforcement of the particular mathematical techniques used in data science.

The assumed IT background is basic IT literacy and ability to write basic programs in any high level programming language. Applicants with no or very little programming experience should take an online course in Python programming, for example on Coursera, before beginning the PMDS.

Applicants should be employed with a company or other organization that can utilize the skills the student will obtain from the program. We expect students to apply the skills learned in PMDS to a problem faced by the company or organization in their industrial project.



Admission Requirements

- 1. Hold a Bachelor degree (from a 4-year program), or its equivalent, in a relevant field of study
- 2. Have above average undergraduate grades
- 3. At least 5.0 IELTS (or equivalent certificate)
- 4. Must be currently working

Curriculum

Number of Courses: 8

Total Credits for Coursework: 24

Project Credits: 6

Total Credit Requirement: 30

Semester 1

Course Code	Course Title	Course Credits	Type	Instructor
AT85.01	Computer Programming for Data Science	3(45-0)	Required	Dr. Chantri Polprasert
AT85.02	Data Modeling and Data Management	3(45-0)	Required	Dr. Chutiporn Anutariya
AT85.03	Fundamentals of Machine Learning	3(45-0)	Required	Dr. Chaklam Silpasuwanchai
A 1 X 5 (1)5	Business Intelligence and Analytics for Professionals	3(45-0)	Required	Dr. Vatcharaporn Esichaikul

Semester 2

Course Code	Course Title	Course Credits	Туре	Instructor
AT85.9001	Data Governance: Strategies, Infrastructure and Framework	3(45-0)	Required	Dr. Chutiporn Anutariya
AT85.07	Human-Computer Interaction for Professionals	3(45-0)	Elective	Dr. Chaklam Silpasuwanchai
AT85.08	Deep Learning for Professionals	3(45-0)	Elective	PMDS Faculty
AT85.06	Data Driven Computer Vision	3(45-0)	Elective	Dr. Cherdsak Kingkan
	Selected Topic in Data Science and Al Applications	3(45-0)	Elective	PMDS Faculty

Project Term

Course Code Course Title	Course Credits	Type	Instructor
AT61.046 Industrial Project	6	Required	PMDS Faculty



AT85.01: COMPUTER PROGRAMMING FOR DATA SCIENCE

Objective:

The course objective is to provide students hands-on programming skills and best practices related to Data Science. It is a tutorial course in which students will develop programming skills in loading, cleansing, transforming, modeling, and visualizing data.

Learning Outcomes:

Students, on successful completion of the course, will be able to

- Prepare data for further analysis using data analytic tools
- Manipulate data sets programmatically
- Perform exploratory data analysis programmatically
- Apply basic text processing techniques to unstructured data sets
- Visualize data sets effectively
- Perform basic statistical analyses programmatically
- Build data-driven predictive models

Prerequisites:

None

Course Outline

1. Fundamentals

- a. Python programming
- b. The Python toolset

2. Working with data

- a. Numerical computation using NumPy
- b. Data manipulation using pandas
- c. Exploratory data analysis

3. Data visualization

- a. Matplotlib
- b. Pandas

4. Statistics

- a. Random variables
- b. Probability distributions
- c. Hypothesis testing using SciPy and stats models

5. Machine learning tools

a.Scikit-learn

Laborary Session(s):

Each topic is a series of tutorial sessions.







AT85.02: DATA MODELING AND DATA MANAGEMENT

Objective:

The course emphasizes on emerging data models and technologies suitable for managing different types and characteristics of data. Professionals will develop skills in analyzing, evaluating, modeling and developing database applications with concerns on both technical and business requirements.

Learning Outcomes:

Students, on successful completion of the course, will be able to

- Explain data modeling and management concepts.
- Design and organize various types of data using a relational and non-relational data models.
- Analyze the characteristics and requirements of data and select an appropriate data model.
- Identify, implement and perform frequent data operations (CRUD: create, read, update and delete)
 on relational and NoSQL databases.
- Describe the concepts and the importance of big data, data security, privacy and governance.
- Describe the concepts and the importance of data engineering and data visualization.

Prerequisites:

None

Course Outline

1. Recall: Relational Data Model and Management

- a. Relational Model Concepts
- b.SQL
- c. Relational Database Design and Normalization
- d.Relational Database Management Systems (RDBMSs)

2. NoSQL Data Modeling and Management

- a. NoSQL Concepts and Characteristics
- b. Major Categories of NoSQL Data Models
- c. NoSQL Database Design
- d. NoSQL Features and Operations

3. Data Distribution

- a. Data Shading and Replication Models
 - b. CAP Theorem

4. Transaction Processing and Consistency Models

- a. Transaction Processing Concepts
- b.ACID Model
- c.BASE Model

5. Large Scale Data Handling

- a. Big Data characteristics
- b. Big Data Modeling and Management

6. Applications and Case Studies

7. Data Engineering

- a. Business Understanding
- b. Data Acquisition and Understanding
- c. Data Cleansing
- d.Data Preparation, Transformation and Feature Engineering

8. Introduction to Related Topics

- a. Data Security
- b. Data Privacy and Legal Issues,
- c. Data Governance: Social and Ethical Issues, Biasness (gender, religions, etc.)

Tutorial Session(s):

Tutorial sessions on NoSQL data stores, tools, CRUD operations, and API development/usage.





AT85.03: FUNDAMENTALS OF MACHINE LEARNING

Objective:

The course introduces professionals from a variety of science and engineering backgrounds to the fundamentals of machine learning and prepares them to perform R&D involving machine learning techniques and applications. Students learn to design, implement, and evaluate intelligent systems incorporating models learned from data.

Learning Outcomes:

Students, on successful completion of the course, will be able to:

- Formulate a practical data analysis and prediction problem as a machine learning problem.
- Plan for data acquisition considering the characteristics of the data set required for a particular machine learning problem.
- Train and test supervised regression and classification models, unsupervised learning and density estimation models, and reinforcement learning models.
- Integrate a trained machine learning model into an online software system.

Prerequisites:

None

Course Outline

1. Introduction to Machine Learning

2. Supervised Learning

- a. Linear regression, logistic regression, and generalized linear models
- b. Generative probabilistic models
- c. Convex optimization and quadratic programming
- d. Support vector machines
- e. Decision trees and ensemble models
- f. Non-parametric methods

3. Neural Networks

- a. Perceptrons and inspiration from neuroscience
- b. Multilayer neural networks and backpropagation
- c.Optimization techniques, best practices, loss curve analysis

4. Learning Theory

- Bias-variance tradeoff
- Regularization, model selection, and feature selection
- Generalization bounds and VC dimension

5. Unsupervised Learning

- a. Clustering: k-means, Gaussian mixture models
- b. Principal components analysis
- c. Independent components analysis
- d. Autoencoders

6. Reinforcement Learning

- a. Markov decision processes and the Bellman equations
- b. Value iteration, policy iteration
- c.Q-learning





AT85.05:BUSINESS INTELLIGENCE AND ANALYTICS FOR PROFESSIONALS

Objective:

Business intelligence (BI) is the process of analyzing business data to obtain business insights and actionable intelligence and knowledge, in order to support better business decision making and capture new business opportunities. This course will give professionals an understanding of the principles and practices of business intelligence and data analytics to support organizations in conducting their business in a competitive environment.

Learning Outcomes:

Students, on successful completion of the course, will be able to:

- Explain the concepts characteristics of BI and data analytics
- Describe multiple business problem/decision making domains requiring BI and data analytics
- Apply BI and data analytic tools and technologies to develop BI applications
- Integrate BI applications with other information systems as part of a business process
- Define a BI strategy for an organization
- Manage a BI project for an organization
- Describe big data analytics and applications

Prerequisites:

Data Modeling and Management

Course Outline

1. Introduction to Business Intelligence

- a.BI Definition
- b.Bl Concepts
- c. Business Intelligence, Analytics, and Data Science
- d. Business Intelligence to Support Decisions

2. Data Warehousing for BI

- a.DW design
- b.Multidimensional data modelling and analysis
- c.ETL process

3. Categories of Data analytics:

- a.Descriptive Analytics
- b.Predictive Analytics
- c.Prescriptive Analytics

4. Descriptive Analytics

- a. Descriptive Statistics
- b. Business Performance Management
- c. Data Visualization and Dashboard Design

5. Predictive Analytics

- a. Data Mining (Text Analytics and Text Mining, Web Analytics, Web Mining,
- b.and Social Analytics)
- c. Predictive Modeling

6. Overview of Prescriptive Analytics

- a. Optimization
- b. Multi-Criteria Systems

7. Technical Aspects

- a. BI Architecture
- b.BI Tools and Technologies

8. BI Applications

- a.BI Maturity
- b. BI Strategies
- c.BI Project (case study)

9. Overview of Big Data

- a. Big Data Analytics
- b. Example of Big Data Applications

Laborary Session(s):

None









AT85.06: DATA DRIVEN COMPUTER VISION

Objective:

The course provides professionals with research and development skills in the image processing, geometry, and statistical inference tools necessary for extracting useful information about the world from two-dimensional images, including applications to robot vision, intelligent video surveillance and monitoring, optical character recognition, and human-computer interfaces.

Learning Outcomes:

Students, on successful completion of the course, will be able to:

- Write computer programs to find point correspondences between different images of a 3D scene;
- Use noisy point correspondences between images to estimate projective transformations between planes, camera positions and orientations, and the 3D structure of a scene;
- Apply machine learning techniques for classification to problems involving segmentation, detection, and recognition of people and other objects in video sequences as well as optical character recognition;
- Apply sequential state estimation techniques to problems involving tracking of people and other objects in video sequences;
- Implement and evaluate state-of-the-art machine vision algorithms described in the primary academic literature;
- Integrate the necessary statistical estimation, image processing, and machine learning tools with a custom-designed algorithm to provide a complete solution to an image or video processing problem.

Prerequisites:

None

Course Outline

1. Introduction

2. Projective geometry

- a.2D projective geometry
- b.3D projective geometry
- c. Rigid transformations

3. Statistical estimation

- a. Linear methods
- b. Singular Value Decomposition (SVD)
- c. Nonlinear methods
- d. Robust methods

4. Cameras

- a. Finite cameras
- b. General cameras
- c. Camera parameter estimation (calibration)

5. Two-view stereo

- a. Epipolar geometry and the fundamental matrix
- b. Computing the fundamental matrix
- c.Interest points for sparse correspondence estimation
- d. Stereo rectification
- e.3D structure computation

6. N-view reconstruction

- a. Bundle adjustment
- b. Factorization
- c. Metric upgrade and autocalibration

6. N-view reconstruction

- a. Bundle adjustment
- b. Factorization
- c. Metric upgrade and autocalibration

7. Machine learning

- a.The Bayesian approach and empirical risk minimization
- b. Feature selection and classical computer vision methods
- c.CNNs and deep learning methods for computer vision

8. Sequential state estimation

- a. Kalman filters and extended Kalman filters
- b. Deep learning approaches to single and multiple object tracking







AT85.07: HUMAN-COMPUTER INTERACTION FOR PROFESSIONALS

Objective:

The objective of this course is to provide the concepts of HCI and user interfaces, focusing on user interface design and technologies. The students will learn principles and skills for designing interactive systems and Webbased applications.

Learning Outcomes:

Students, on successful completion of the course, will be able to:

- Explain the concepts of Human-Computer Interaction (HCI), user interface, user interface design,
- Explain the concepts of interface techniques and technologies; Graphical User Interface (GUI), direct manipulation, menu
- Analyze the evaluation of interface design

Prerequisites:

None

Course Outline

1. Introduction to Human-Computer Interaction (HCI)

- a. Human: Human Memory, Thinking, Individual

 Differences
- b. Computer: Entry Devices, Positioning and Pointing Devices, Output Devices
- c.Interaction: Models of Interaction, Ergonomics, Interaction Styles

2. Theories and Principles

- a. High-level Theories
- b. Object-Action Interface Model
- c. Golden Rules of Interface Design

3. User Interface

- a. Interface Widgets
- b.Interactive Devices
- c. Printed and Online Facilities

4. User Interface Design

- a. Design Development Process
- b. Software Tools
- c. User and Task Analysis
- d. Multimodal Interfaces
- e. Response Time and Display Rate
- f. Presentation Style

Laborary Session(s):

None

5. Interface Techniques and Technologies

- a. Graphical User Interface (GUI)
- b. Direct Manipulation
- c. Menu Selection
- d. Form Filling and Dialog Boxes
- e.Command and Natural Languages
- f. Multiple Windows
- g. Hypermedia and World Wide Web
- h. Virtual Environments

6. Evaluation of Interface Design

- a. Expert Review
- b. Usability Testing
- c. Acceptance Tests
- d. Experiments

7. Ubiquitous Computing Interaction

- a.Interface Design for Handheld Devices
- b. Handheld Usability







AT85.08: DEEP LEARNING FOR PROFESSIONALS

Objective:

The course builds on the content of Machine Learning, providing students with a deeper understanding of machine learning techniques and a wider variety of extant learning models. Students will be prepared to develop advanced machine learning applications and perform research at a state-of-the-art level.

Learning Outcomes:

Students, on successful completion of the course, will be able to:

- Design, train, test, and deploy modern convolutional neural networks (CNNs).
- Utilize the principles of adversarial learning to increase the robustness of a machine learning model.
- Design, train, test, and deploy generative adversarial networks (GANs).
- Utilize recurrent neural networks (RNNs) to model and predict time series.
- Utilize deep neural networks to solve difficult tabula rasa reinforcement learning problems.
- Apply state-of-the-art machine learning methods to solve problems in speech processing, speech synthesis, natural language understanding, natural language synthesis, computer vision, and intelligent agent design.

Prerequisites:

None

Course Outline

- 1. Overview of modern machine learning methods
- 2. Convolutional neural networks
 - a. Fundamentals
 - b.Inception modules
 - c. Residual layers
 - d. Squeeze and excitation
 - e. Detection models
 - f. Semantic segmentation models
 - g. Instance-aware segmentation models
- 3. Deep belief networks
- 4. Transfer learning
- 5. Automatic learning
- 6. Deep unsupervised learning
- a. Generative adversarial networks (GANs)
 - b. Variation auto encoders
- 7. Practical techniques for deep learning models
 - a. Weight initialization
 - b. Dropout
 - c. Adam optimization
 - d. Batch normalization
- 8. Time series processing
 - a. Hidden Markov models (HMMs)
 - b.Recurrent neural networks (RNNs) and backpropagation through time
 - c.Word embedding for natural language processing
 - d. Long short-term memory (LSTM) units
 - e. Gated recurrent units (GRUs)
 - f. Attention mechanisms for RNNs

9. Deep Reinforcement learning

- a. Policy gradients
- b. Actor/critic methods
- c.Imitation learning
- d. Exploration/exploitation
- e. Meta learning
- f. Monte Carlo methods

10. Applications

- a. Speech recognition
- b. Speech synthesis
- c. Conversational agents
- d. Recommendation systems
- e. Anomaly detection
- f. Computer vision systems



AT85.9001: SELECTED TOPIC: DATA GOVERNANCE: STRATEGIES, INFRASTRUCTURE AND FRAMEWORK

Objective:

This course will introduce the principles of data governance, the process of managing and controlling an organization's data assets. It encompasses the policies, procedures, standards, and guidelines for managing and ensuring the quality, accuracy, and security of data. Students will explore in details important data governance frameworks existing to date such as DAMA-DMBOK (Data Management Body of Knowledge) and COBIT (Control Objectives for Information and Related Technology). The course will discuss a structured approach to data governance by defining roles and responsibilities, establishing policies and procedures, and outlining best practices for managing data. Through a combination of lectures, case studies, and practical exercises, students will learn about data governance strategies, data infrastructure, and frameworks used to manage data in an organization.

Learning Outcomes:

Students, on successful completion of the course, will be able to

- Explain principles, concepts and importance of data governance in an organization.
- Identify key stakeholders and explain their roles and responsibilities in organizational data governance.
- Define strategies, policies and procedures that define how data should be used, accessed, stored, and protected, including data security policies, data retention policies, data privacy policies, and other policies and standards.

Prerequisites:

None

Course Outline:

I. Introduction to Data Governance and its importance

- 1. Definition of Data Governance
- 2. Key concepts of Data Governance
- 3. Benefits of Data Governance
- 4. Frameworks of Data Governance

II. Data Governance Frameworks

- 1. Overview of Data Governance Frameworks (DAMA-DMBOK, COBIT, etc.)
- 2. The importance of selecting the right Data Governance Framework
- 3. Comparison of various Data Governance Frameworks

III. Practical techniques for deep learning models

- 1. The importance of Data Governance in a company's hierarchy
- 2. Key roles and responsibilities of Data Governance teams
- 3. Stakeholder engagement strategies

IV. Data Quality Management

- 1. Understanding data quality dimensions
- 2. Data quality assessment methodologies
- 3. Data quality management techniques

V. Data Privacy and Security

- 1. Overview of data privacy laws and regulations
- 2. Best practices for data security and privacy
- 3. Strategies for managing data breaches

VI. Data Architecture and Infrastructure

- 1. Overview of Data Architecture
- 2. Different types of Data Architecture
- 3. Strategies for designing and implementing a data architecture

VII. Data Governance Maturity Models

- 1. Overview of Data Governance maturity models
- 2. Strategies for measuring Data Governance maturity
- 3. The importance of Data Governance maturity for organizations



INTRODUCING SOME OF THE FACULTY MEMBERS



DR. CHUTIPORN ANUTARIYA

- BSc (1st Class Honors, Statistics), Chulalongkorn University, Thailand
- MSc (Computer Science), Asian Institute of Technology, Thailand
- DTechSc (Computer Science), Asian Institute of Technology, Thailand
- Research Interests: Learning Technologies and Massive Open Online Course (MOOCs), Database and Information Systems, Knowledge Representation and Knowledge Management, Open Data and Open Government Data, Semantic and Linked Data Technologies, Ontologies, Web and Mobile Technologies.

DR. VATCHARAPORN ESICHAIKUL

- Ph.D in Management Information System, Kent State University, USA Major: Management Information Systems.
 - Minor: Operation Research.
- M.B.A., in Computer Systems and Management Science, Oklahoma State University, USA
 - Major: Computer Systems and Management Science.
- B.Acc. (Honors), Chulalongkorn University, Thailand
- Research Interests: Decision Support Technologies, Business Intelligence, Data Analytics, E-Commerce, and E-Government





DR. CHAKLAM SILPASUWANCHAI

- D. Eng in Computer Science, Kochi University of Technology, Japan
- M. Eng in Computer Science, Asian Institute of Technology, Thailand
- BSc in Computer Science, Sirindhorn International Institute of Technology, Thammasat University, Thailand (First-Class Honours)
- Research Interests: Neural Engineering: Acquisition, extraction, and classification of brain signals, namely EEG signals (P300, SSVEP,IM) for I/O and development; Natural Language Processing: Text summarization, intent detection, social media analysis, stock prediction with news

INTRODUCING SOME OF THE FACULTY MEMBERS



DR. CHANTRI POLPRASERT

- Ph.D., Electrical Engineering, University of Washington, Seattle, WA
- M.Eng., Telecommunications, Asian Institute of Technology, Pathumthani, Thailand
- B.Eng., Electrical Engineering, Chulalongkorn University, Bangkok, Thailand
- Research Interests: Data Science and Machine Learning, Anomaly Detection, Predictive Maintenance, Artificial Intelligence, Acoustic Signal Processing, Digital Signal Processing in Wireless Communications, Internet of Things, Cybersecurity

DR. CHERDSAK KINGKAN

- Ph.D in Information Sciences, Tohoku University, Sendai, Japan
- M.Eng in Computer Engineering, Stevens Institute of Technology, Hoboken, NJ, USA
- B.Eng in Information Science and Engineering, M.S. Ramaiah Institute of Technology, Bangalore, India
- Data Analyst at the SEC in Thailand
- Researcher at the National Electronics and Computer Technology Center (NECTEC) in Thailand
- Guest Lecturer at the Graduate School of Information Sciences at Tohoku University
- Research Interests: Computer Vision, Deep Learning, Data Science and Machine Learning







ADMISSION REQUIREMENTS:

- 1. Bachelor's degree & transcripts (English version)
- 2. Résumé (English version)
- 3. Application form
- 4. English requirements: IELTS 5.0 (minimum score of writing skill: 5.0) or take English Test at AITCV Office (writing skill: 5.0)
- 5. Picture (3*4)
- 6. Passport

TUITION FEE:

Tution fee and registration fee: 14,975 USD.

The fee is payable into 3 installments.

The above tuition fee does include two field trips at AIT Main Campus, Thailand.

CONTACT US

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