Dept. of Artificial Intelligence and Software

The Department of AI & Software aims to cultivate creative talents who will lead the era of the Fourth Industrial Revolution by integrating Artificial Intelligence (AI) and Software (SW) technologies. The department offers a curriculum that enables students to simultaneously acquire cutting-edge AI core technologies—such as data science, machine learning, deep learning, big data, computer vision, and natural language processing—along with strong software development skills.

Based on this educational foundation, the department supports diverse career pathways and employment opportunities, fostering interdisciplinary and problem-solving professionals equipped with the practical competencies required in industrial fields. Graduates are prepared to actively contribute to a wide range of areas in the future digital society.

Through practice-oriented education, including project-based learning (PBL), field training, and industry-academia cooperation, students develop innovative thinking and hands-on skills demanded in real industrial and research environments. Furthermore, collaboration with various industries and opportunities for AI+X convergence research enhance students' integrated capabilities beyond the AI and software domains, meeting the complex demands of future society.

The Department of AI & Software transcends the boundaries of traditional computer engineering by applying AI and software technologies across diverse fields, providing a pathway for students to grow into globally competitive professionals.

□ Artificial Intelligence and Software Courses

· Advanced Analysis of Algorithms (3)

An introduction to the design of algorithms. The emphasis is on learning techniques for creating algorithms, analyzing them, and proving their correctness. Topics include models of computation, asymptotic notation for analysis of algorithms, sorting and searching algorithms, design techniques such as divide-and-conquer and dynamic programming, graph algorithms including spanning tree, shortest paths. Additional topics chosen from pattern matching, NP-hard, and NP-complete.

· Advanced Operating Systems (3)

Introduction to the design and analysis of operating systems. Topics include processes, mutual exclusion, synchronization, semaphores, monitors, deadlock prevention and detection, memory management, virtual memory, processor scheduling, disk management, file systems, security, protection, distributed systems. Students will present and discuss with hot issued topics.

· Advanced Artificial Intelligence (3)

An introduction to basic concepts in artificial intelligence from a computer science perspective. We learn how to find innovative solutions to difficult, independently motivated problems, such as search, logic, knowledge representation, rule-based programming, and reasoning with programming applications.

· **Advanced Computer Architecture (3)**

Advanced topics in the architecture and organization of computer systems. Topics include how information is represented in memory, machine-language instructions and how they can be implemented at the digital logic level and microcode level, assembly language programming, input/output operations, and performance issues.

· **Advanced Computer Network (3)**

In this course, special hot issues in the recent research and development of computer network area are studied extensively. The course contents consist of lectures, paper presentation, demo, and term project.

· **Modern Network Analysis (3)**

This course covers the architecture and principles of the modern network (Infrastructure networking, mobile communication, mobile network, social network, etc). It also covers the network structures of wireless lan, ad-hoc network, mesh network, and cellular networks. Furthermore many recent technologies such as medium access protocol, network resource management, mobility and location management, and routing protocols. The students will implement modern network simulation programs by using open source programming, then learn the performance comparison, evaluation, and analysis algorithms.

· **Machine Learning (3)**

Topics in machine learning, including artificial neural networks, genetic algorithms, support vector machines, Bayesian network, Markov chain are taught in this course.

· **Advanced Computer Graphics (3)**

This course provides an introduction of advanced topics in computer graphics. We cover the theoretical background and applications of a selected topic among advanced modeling, real-time rendering and animation, non-photorealistic rendering, and imaging.

· **Advanced Information Security (3)**

An introduction to the principles underlying advanced information security technology. Topics include classical encryption techniques, modern encryption techniques, conventional encryption algorithms, confidentiality using conventional encryption, public-key cryptography, message authentication and hash functions, hash and MAC algorithms, digital signatures and authentication protocols, network security and system security issues.

· **Advanced Topics in Computer Science (3)**

This course is designed to deal with state-of-the-art topics in computer science outside the regular course offerings. For a given semester the course content will be announced prior to registration for that semester.

· **Independent Study (3)**

To get a deep study, it is frequently necessary for a student to meet his adviser regularly so as to get the timely and proper guide in the personal meeting. This course exists to meet this kind of needs. It is like a personal tutoring course in the research and development.

· **Case Study in Computer System (3)**

In this course, students survey and study the recent technical trend of computer system architecture ranging from mobile phones and mobile PCs to large computer systems. Selected technical papers are read and presented during the course and each student writes a survey paper for a selected topic on novel computer system architecture.

· **Intelligent Robot (3)**

This course covers intelligent robot research topics related to building and programming mobile and articulated robots to perform simple tasks. It also covers major paradigms of robot programming and architectures for building perception, control, and learning systems for intelligent robots. These topics will be pursued through independent reading, class discussion, and project implementations. Papers covered will be drawn from robotics, computer vision, animation, machine learning, and neuroscience. Special emphasis will be given to developing autonomous control from human performance.

· **Data Mining (3)**

An introduction to the design of data mining programs. The emphasis is on learning techniques for searching for hidden relationships and patterns in the data, which has been accumulating in many forms, including database systems, spreadsheets, text files, and recently web pages. Topics include machine learning and classification, knowledge representation, decision tree, clustering, visualization, and customer modeling and targeted marketing.

· **Advanced Information Computing (3)**

This course will cover traditional material as well as recent advances in information retrieval (IR), the study of the indexing, processing, and querying of textual data. The focus will be on Korean language processing techniques and the newer techniques that try to move beyond keyword search and bring some intelligence to

the task of processing and retrieving textual information, including hypertext documents available on the world-wide-web.

· **Smart Internet of Things (3)**

Through this lesson, we will be able to apply IoT / IoS, that is, the distributed environment elements of human, things, and services, to the object space network that forms intelligent relationships such as sensing, networking, and information processing cooperatively without human intervention.

· **Practices in Advanced Big Data (3)**

Students will learn the advanced theory and practices in big data. Students will have industry expert-level skills to program real-world big data software based on open platforms. This course includes a development project and in-depth discussions.

· **Cloud Architect by AWS Academy (3)**

This course covers the fundamentals of building IT infrastructure on cloud. It covers how to optimize the use of the cloud services by understanding AWS services and how they fit into cloud-based solutions with few hands-on exercises.

· **Selected Topics in Security (3)**

Topics include advanced theory and practice for information security. Special topics on big data and security are covered.

· **Artificial Intelligence and Security (3)**

Topics include theory and practice for information security and artificial intelligence. Special topics on artificial intelligence for security and security for artificial intelligence are covered.

· **Advanced Vehicle Intelligence (3)**

Students are expected to learn the core aspects of intelligent vehicles including:
1) localization and mapping, 2) object recognition and tracking, 3) path planning and following. They implement all or part of the learned techniques in software, which is validated on a simulator driven by data sets obtained from real vehicles running on actual streets.

· **Intelligent Mobility Service (3)**

Emerging services such as car sharing, personal vehicles, unmanned delivery, and adaptive traffic control offer new opportunities for mobility technologies based on artificial intelligence. Students are requested to formulate techniques targeted towards resolving real-world problems, and provide solutions to them exploiting data

obtained from practical systems.

· **Autonomous Driving System (3)**

Students are expected to learn techniques involved in perception, planning, and control for autonomous vehicles. They also execute their own projects that run on either a simulator or a self-driven model car.

· **Introduction to Quantum Computing (3)**

Fundamental concepts in quamtum computing are taught in terms of Dirac notation. Quantum operations such as Quantum Fourier Tranform, Quantum Phase Estimation are introduced. Quantum circuits which implements quantum algorithms such as Shor's factoring algorithm, Grover's search algorithm will be built and simulated in python + IBM qiskit library.

· **Advanced System Performance Analysis (3)**

The course focuses on measuring and optimizing system performance, covering various performance analsys tools and techniques in diverse computing environments.

· **Projects in Artificial Intelligence 3 (3)**

The course emphasizes the practical application and utilization of AI technology in real-world settings. It aims to improve the students' practical experience and deepen their understanding of AI through self-driven project planning, implementation, evaluation, and collaboration.

· **Projects in Artificial Intelligence 2 (3)**

The goal is to understant the practical applications of AI technology across various fields through hands-on excercises and applications based on a complehensive understanding of AI. Experimentation is used to gain insights into how AI technology can be applied in diverse domains using various datasets.

· **Projects in Artificial Intelligence 1 (3)**

Based on a technical understanding of AI technology, the objective is to plan proejcts using diverse datasets, enhance collaborative skills through utilization, and gain practical experience. The goal is to develop an understanding of the societal applicability of AI.

· **Advanced Topics in Artificial Intelligence (3)**

Conducting research on highlighted challenges that emerge as major targets in the field of AI.

· **3D Vision (3)**

Based on the latest technology and theories in the field of 3D Vision, the course deepens understanding through advanced algorithms and applications. It aims to enhance practical skills, specifically improving the ability to solve real-time 3D vision problems, fostering expertise for contributions to next-generation vision systems.

· **Advanced Robotics (3)**

Focusing on advanced robitics, students learn robot system design, control algorithms, and sensor applications. The course enhances their ability to address challenges in the industry. By gaining understadning and practical experience in cutting-edge robotic technology, it aims to strengthen the capability to develop creative and innovative robotic solutions.

· **Artificial Intelligence Platform (3)**

Providing platform technology essential for developing AI applications, the course enhances practical skills and problem-solving abilities through diverse AI platform applications. It aims to cultivate students' capability to effectively develop and merge AI systems.

· **Artificial Intelligence Ethics (3)**

A course addressing the ethical aspects of AI from a technical perspective. It explores the ethical considerations of AI, including morality safety, transparency, and fairness, while learning about ethical development and utilization of AI. The course aims to foster students into ethically responsible AI technolgoy experts, capable of leading sustainable AI innovations considering societal impact.

· **Advanced Recommendation System (3)**

Focusing on in-depth recommendation system theory and exercise, the corse covers various recommendation algorithms and data modeling techniques. It aims to enhacne practical skills for applications in real industrial and service sectors, cultvating professionals with expertise needed to design and implement effective and innovative recommendation systems.

· **Reinforcement Learning (3)**

Covering various reinforcement learning algorithms and applications based on agents interacting with the environment, the course teaches algorithms to solve complex

decision-making problems. Students learn specialized knowledge for applying reinforcement learning in real systems and improving performance, fostering the ability to develop innovative reinforcement learning solutions.

· **Probabilistic Graphical Moodels and Machine Learning (3)**

A course integrating graph models and machine learning, it covers probabilistic graph theory and machine learning techniques to model patterns and relationships in complex systems, Students learn theories related to data analysis, prediction, and the fusion of probabilistic graph theory with machine learning.

· **Machine Learning with Graphs (3)**

A course teaches techniques for analyzing and modeling network and complex interaction structures in graph-based data. It cultivates the ability to develop effective learning models for real-world problems.

· **Advanced Topics in Natural Language Processing (3)**

Focusing on advanced natural language processing theory and applications, the course emphasizes learning the latest technologies in language modeling, machine translation, etc. Students learn the ability to address problems using real natural language data.

· **Deep Learning Ⅱ (3)**

The goal is to enhance understanding of deep neural network through in-depth research and practical exercies based on real-world data, building on a foundation of knowledge about neural networks and deep learning.

· **Deep Learning Ⅰ(3)**

Building on an understanding of neural networks and deep learning, the course focuses on learning various deep learning algorithms and studying methods for extracting and representing the meangful information from complex data.

· **Agentic Artificial Intelligence and Creative Programming (3)**

This course explores the concepts and technologies of Agentic AI—artificial intelligence capable of autonomous reasoning, planning, and acting—and how they can be integrated across various application domains. Students will examine recent research and real-world cases of Agentic AI applied in fields such as robotics, recommender systems, model compression, computer vision, intelligent network control, and cybersecurity, thereby developing a solid understanding of the underlying

theories and techniques.

· **Agentic Artificial Intelligence Capstone Project (3)**

This course focuses on project-based design and implementation of intelligent agents with autonomous learning and decision-making mechanisms, aiming to develop practical problem-solving and application skills in complex environments.

· **Research Ethics & Master Thesis (3)**

This course will provide the graduate students with the writing skill for the master's thesis as well as the research ethics. It will cover the identification of the research problem, problem solving approaches and results, literature survey, and thesis formats. This course will also provide opportunity to become involved in graduate research, under guidance of a supervisor, on a problem of mutual interest to student and supervisor. Regarding the research ethics, the course emphasizes on plagiarism so that the students can follow the research standards.

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