**Ders İçerikleri**

**AIE503-Introduction to AI Engineering**

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. Although AI has been studied for more than half a century, we still cannot make a computer that is as intelligent as a human in all aspects. However, we do have many successful applications. In some cases, the computer equipped with AI technology can be even more intelligent than us. The Deep Blue system which defeated the world chess champion is a well-know example.

In this course, we will study the most fundamental knowledge for understanding AI. We will introduce some basic search algorithms for problem solving; knowledge representation and reasoning; pattern recognition; fuzzy logic; and neural networks.

**AIE504- Machine Learning**

The course is a basic introduction to machine learning, including: Supervised learning (PAC learning, VC dimension, perceptron, SVM, stochastic gradient descent, deep learning, boosting, decision trees)

Unsupervised learning (principal component analysls, clustering, EM algorithm):The course will include both theory and applied machine learning, and a special emphasis will be put on machine learning algorithms.

**AIE505- Image Processing**

Image formation and reproduction, Image sampling and quantization, two-dimensional systems and transforms, Image enhancement, Image filtering and restoration, image reconstruction, image segmentation and analysis, random image models and power spectra, image coding, image compression standards.

**AIE506-Decision Making and Robotics**

The course provides an overview of mathematical models and algorithms behind state-of-the-art robotic systems, especially in service robotics. The course focus is in manipulation, optimal decision making and control, and learning, which are central components in more general purpose robotic systems. Manipulation is used as a scenario in which the mathematical models and algorithms are studied. In particular, methods and models that help cope with inherent uncertainty of the environment are considered.

**AIE507-Automata Theory**

This course aims to introduce students to the fundamentals of formal languages and the theory of computation. Topics to be covered include regular languages, regular expressions, finite state machines, non-deterministic machines, correspondence of finite automata and regular languages, pumping lemma for regular languages, grammars, context-free and context-sensitive grammars, pushdown automata, parsing and Turing machines.

**AIE508- Embedded Systems**

This course provides an introduction to Embedded Systems. Through the use of simulation software, real devices interfaced to a PC and with embedded devices, you will develop competence in microprocessor based digital system design and interfacing.

**AIE509-** **Data Mining and Big Data**

Data mining and big data involves storing, processing, analysing and making sense of huge volumes of data extracted in many formats and from many sources. Using information systems frameworks and knowledge discovery concepts, this project-based and research-oriented course uses latest published research and cutting-edge business intelligence tools for data analytics.

**AIE510- Deep Learning**

This course aims to not only cover the fundamentals of deep learning, but also give a grasp of contemporary research. The course will start with a brief overview of machine learning and numerical optimization. Then, the basic techniques and modern approaches in designing, training and visualizing feedforward neural network architectures and convolutional neural networks will be introduced. Convolutional neural network based methods for spatial localization of visual entities in images will be covered. Recurrent neural network architectures, and their applications in language and image understanding will be discussed.

**AIE511-** **Graphics and Visualization**

The objective of the course is to introduce fundamental methods for two-dimensional and tree-dimensional graphics. The course also comprise of a practical part which includes interactive graphics programming. The following topics will be discussed: Raster graphics, geometric transformations, viewing models, projections, parametric curves and surfaces, colour theory, hidden surface/line problems, illumination and shading.

**AIE512- Natural Language Processing**

History of natural language processing (NLP). The provenance of analysis and transformation of language by computational techniques. General linguistic preliminaries. Representations of text and speech that can aid prediction, extraction, and semantic reasoning over language. Automatic mining of knowledge from the web. The discipline of machine learning and its significance for NLP. Deep learning as a fundamental method for NLP. Recent technological developments in NLP, including automatic language translators such as Google Translate and personal assistants such as Siri.

**AIE513- Human Robot Interaction**

The purpose of this course the intersection of human-robot interactions to include human-computer interfaces as well as robotic emotions and facial expressions emulations. The result will provide a basis for students to assess the best approaches for interacting effectively with robots. Since the areas of expertise extend across several technical fields, one or two guest speakers will be brought in for some of the classes. Areas to be covered include biologically-inspired robotics, cognitive robotics, cultural and social aspects of robotics, data mining, examples of human systems interfaces, and machine learning with respect to A.I. principles and limitations. The student learning objectives are to integrate the interdisciplinary knowledge and to perform out-of-the-box thinking on current concepts.

**AIE514-Advanced Machine Learning**

This course is about learning to extract statistical structure from data, for making decisions and predictions, as well as for visualization. The course will cover many of the most important mathematical and computational tools for probabilistic modeling, as well as examine specific models from the literature and examine how they can be used for particular types of data.

**AIE515-** **Design of AI Sytems**

There are many cognitive tasks that people can do easily and almost unconsciously but that have proven extremely difficult to program on a computer. Artificial intelligence is the problem of developing computer systems that can carry out these tasks. This course will focus on three central areas in AI: representation and reasoning, learning, and natural language processing.