Course number	U-LAS30 20036 LE10		
Course title (and course title in English)	Fundamentals of Artificial Intelligence-E2 Fundamentals of Artificial Intelligence-E2	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Program-Specific Associate Professor,CHU, Chenhui
Group	Informatics	Field(Classification)	(Issues)
Language of instruction	English	Old group	
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2025・First semester		
Days and periods	Mon.2	Target year	All students
Eligible students	For all majors		

[Overview and purpose of the course]

Recent development in artificial intelligence techniques (AI), in particular the set of techniques commonly referred to as “deep learning,” has significantly increased the number of tasks that computers can solve easily. This leads to a current explosion in the use of AI: chatbots helping users on commercial websites, self-driving cars, automatic translation, automatic photo tagging, etc. It is, of course, not possible to introduce all aspects of AI in one semester, but this course will attempt to give a sufficiently detailed explanation of at least a few of the most common AI techniques. We will focus on supervised machine learning in general and deep learning in particular. One goal will be to give practical and working knowledge to students so that they can apply what they learned to at least some simple tasks.

[Course objectives]

Students will have a good understanding of simple supervised machine learning techniques and be able to implement and use some for automatic classification tasks.

[Course schedule and contents)]

1. Overview of Artificial Intelligence and this Course (1 week)
This will give a “big picture” description of the field of AI. We would first discuss some common applications of AI: game AI, chatbots, machine translation, automation (self-driving vehicles, robots), etc. Then, we will discuss the paradigm of machine learning (supervised, semi-supervised, and unsupervised) and give an overview of this course.

2. Fundamental of Machine Learning (3 weeks)
Firstly, we will spend one lecture studying the basics of the Python programming language. Then, we will review some of the mathematics concepts that are the most necessary for the understanding of AI methods. In particular, we will review essential notions of calculus and optimization (derivative, numerical methods for finding a minimum), vector, and matrix. Finally, we will learn how to minimize a function with stochastic gradient descent and implement it in Python.

3. Basic Supervised Machine Learning (3 weeks)
Focusing on simple tasks of simple/multiple linear regression and classification, we introduce the terminology and basics of machine learning: defining a parameterized model, defining a loss, and training the model parameters by minimizing the loss. We will also introduce how to implement simple/multiple linear regression in Python.

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4. Deep Learning (3 weeks)
We will first introduce the basic ideas of deep learning neural networks. Then, we will study the architecture of neural networks and the back-propagation algorithm for optimizing neural networks. Finally, we will look at one of the most important types of neural network architectures, feed-forward with fully-connected layers, and study how to implement them using the deep learning framework Chainer.

5. Computer Vision and Natural Language Processing (4 weeks)
We will first give a brief introduction to computer vision: what is an image for a computer, and what are convolution layers? Then, we will study how to build an object recognition neural network with convolution layers, max-pooling layers, and fully-connected layers. Next, we will implement and train a real object recognition neural network in Chainer. Finally, we will have a quick look at recurrent architectures and how they are used to process text. As a final application, students will be asked to solve a real problem in their studies using the models (either basic supervised machine learning or deep learning) introduced in this course.

10. Feedback (1 week)

[Course requirements]

None

[Evaluation methods and policy]

Evaluation is based on class participation (15%), mini-reports and exercises (60%), and the final report of solving a real problem in students’ studies using the models learned in this course (25%).

[Textbooks]

Not used
Lecture handouts will be provided in the class.

[References, etc.]

（References, etc.）
Ian Goodfellow, Yoshua Bengio and Aaron Courville 『Deep Learning』 （The MIT Press） ISBN:978-0262035613

[Study outside of class (preparation and review)]

The instructor expects students to spend over 60 minutes after each class reviewing the content. Some practical exercises will also be given at the end of some lectures so as to let the students see how much of the content they do understand practically.

[Other information (office hours, etc.)]

No office hours are specified. However, questions and requests are welcome by email.