1. Course Code

2210

2. Course Title

G72e:Artificial Intelligence Exercises

3. Teacher

IWAMOTO, Hisashi

4. Term

Spring 2

5. Course Requirements (Courses / Knowledge for this course) and Important Information

Taking a "F30e: Fundamentals of Computer Programming Python" course

6. Course Overview and Objectives

n this course, students learn the foundamation of Artificial Intelligence(AI) and aim to get the ability to use AI in practice.
The area of study include image classification, image recognition, data analysis, and anormaly detection.

7. Course Outline

1. Overview of Artificial Intelligence
2. Densely Connected Neural Network(DNN)
3. Data Augmentation
4. Convolutional Neural Network(CNN)
5. Sequence Processing
6. Regression
7. Feature Extraction/Fine Tuning
8. Heat Map / Class activation map(CAM)
9. Prediction
10. Image denoising
11. Anomaly Detection
12. Yolo (End to End Learning)
13. Annotation / Yolo
14. Vision Transformer / Natural Language Model
15. Course Summary
16.

8. Textbooks (Required Books for this course)

None

9. Reference Books (optional books for further study)

https://www.manning.com/books/deep-learning-with-python-second-edition

https://www.oreilly.com/library/view/hands-on-unsupervised-learning/9781492035633/

10. Course Goals (Attainment Targets)

(1) To understand the foundamental operation of AI
(2) To become proficient through AI practical exercises
(3) To be able to use AI
(4) To be able to make AI-based systems
(5)
(6)
(7)
(8)

11. Correspondence relationship between Educational goals and Course goals

Educational goals of the school			Course Goals
High level ICT skills	Basic academic skills		(1)
	Specialized knowledge and literacy		(2)
Human skill (Tankyu skill)	Ability to continually improve own strengths		
	Ability to discover and resolve the problem in society	Problem setting	
		Hypothesis planning	
		Hypothesis testing	
		Practice	
	Fundamental Competencies for Working Persons	Ability to step forward	
		Ability to think through	(3)(4)
		Ability to work in a team	
Professional ethics			

12. Evaluation

Goals	Evaluation method & point allocation					
	Examination	Quiz	Reports	Presentation	Deliverables	Other
(1)			○		○	
(2)			○			
(3)			○			○
(4)			○			○
(5)						
(6)						
(7)						
(8)						
Allocation			60		30	10

13. Evaluation Criteria

Examination	
Quiz	
Reports	Reports in every two weeks evaluates students understand the key contents of the lectures and materials.
Presentation	
Deliverables	Evaluates the participation and understanding of the excersize in the class.
Other	Asking questions and making comments.

14. Active Learning

Hourly percentage of active learning within the whole class time	50%

1	Active learning such as problem solving assignment using the knowledge and skills acquired in class.	All the time
2	Active learning such as group works and discussions.	Sometimes
3	Outcome presentations and feedbacks.	Sometimes
4	Students actively make decisions on how the class should be conducted.	Sometimes

15. Notes

Class materials are offered as pdf files. Your PC (Windows, Mac or Linux) and the Internet connection are required for the class and homeworks.

16. Course plan

(Notice) This plan is tentative and might be changed at the time of delivery

Lessen 1: Overview of Artificial Intelligence (Lecture 90 min.)

The overview of this course will be explained. Students understand the goal and scope of this course through AI exercise.

1. What is Artificial Intelligence?
2. Course Orientation (learning objectives, performance evaluation, etc.)
3. How to use Google Colaboratory
4. Explanation of AI Platforms

Lessen 2: Densely Connected Neural Network(DNN) (Lecture 45 min., Exercise 45 min.)

Denesely Connected Neural Network will be explained.

1. What is Denesely Connected Neural Network?
2. Recognizing Handwritten Characters

Lessen 3: Data Augmentation (Lecture 45 min., Exercise 45 min.)

Explanation of Data Augumentation when there is little training data

Data augmentation is a technique used to expand the size of a training dataset by applying varius transformations to the existing data.

Lessen 4: Convolutional Neural Network(CNN) (Lecture 45 min., Exercise 45 min.)

Explanation of Convolutional Neural Network(CNN)

A CNN is a type of deep learning model that is particularly well-suited for processing grid-like data.

Lessen 5: Sequence Processing (Lecture 45 min., Exercise 45 min.)

Explanation of Sequence Processing

Neural networks can be used to classify such data by processing the sequence values
1-D Convolutional Nueral Network(CNN) is stuidied for sequential patterns.

Lessen 6: Regression (Lecture 45 min., Exercise 45 min.)

Explanation of Regression

Students will conduct an exercise to predict housing proces using the California Housing dataset、and study how to perform regression using AI by doing this exercise.

Lessen 7: Feature Extraction/Fine Tuning	(Lecture 45 min., Exercise 45 min.)

Explanation og the transfer training

Students will study transfer learning and the fine tuning to efficiently perform machine learning with a small amount of training data

Lessen 8: Heat Map / Class activation map(CAM)	(Lecture 45 min., Exercise 45 min.)

Explanation Grad-CAM, which is explanatory AI technique.

Grad-CAM can visualize important regions in the input data

Lessen 9: Prediction	(Lecture 45 min., Exercise 45 min.)

Students study how to make predictions using the periodicity of data. In this execise, web site access trafic and stock price prediction are explained.

Lessen 10: Image denoising	(Lecture 45 min., Exercise 45 min.)

Explanation of Image denoising (noise reduction)

Using anormaly detection, students perform noise reduction in this exercise.

Lessen 11: Anomaly Detection	(Lecture 45 min., Exercise 45 min.)

Studets study to classify ECG data , which is inbalance data. Semi-supervised learning is also introduced.

Lessen 12: Yolo (End to End Learning)	(Lecture 45 min., Exercise 45 min.)

Students conduct an exercise on "End to End learning", which not only classifies the type of images but also identifies the locations and size.

Lessen 13: Annotation / Yolo	(Lecture 45 min., Exercise 45 min.)

Students conduct an exercise on anotating training data for "Yolo" which is "End to End AI. and actually run "Yolo".

Lessen 14: Vision Transformer / Natural Language Model	(Lecture 45 min., Exercise 45 min.)

Students conduct an exercise on image classification using visual transformer. Transfor is employed in large language model(LLM).
Natural Language Models (NLMs), often referred to as Large Language Models (LLMs) in their more advanced forms, are a type of artificial intelligence program designed to understand, generate, and manipulate human language.
Students study the natural language model.

Lessen 15: Course Summary	(Lecture 90 min.)

Couse Summary