Extended Syllabus

Course Title	Pattern Recognition	Semester	Spring 2024
Credit	3	Course Number	CSE5416/CSEG416/ AIE5102/AIEG102
Class Time	Tue, Thr, 13:30~14:45	Enrollment Eligibility	Undergraduate senior/ Graduate

Instructor's Photo	Name: Unsang Park (박운상)	Homepage: https://eclass.sogang.ac.kr
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	Office: R-911 Office Hours: Mon, Tue, Thr, 10 am – Noon (or, by appointment)	

Ⅰ. Course Overview

1. Description

Pattern recognition techniques are used to automatically classify physical objects (2D or 3D) or abstract multidimensional patterns (n points in d dimensions) into known or possibly unknown categories. A number of commercial pattern recognition systems exist for character recognition, handwriting recognition, document classification, fingerprint classification, face recognition, speech and speaker recognition, white blood cell (leukocyte) classification, military target recognition among others. Most machine vision systems employ pattern recognition techniques to identify objects for sorting, inspection, and assembly. The course will present competing approaches to exploratory data analysis and classifier design so students can make judicious choices when confronted with real pattern recognition problems. Students will implement some of the algorithms using Python or C/C++ programming languages.

2. Prerequisites

Some background in programming, multivariable calculus, matrix algebra and probability and statistics is essential.

3. Course Format (%)

Lecture	Discussion	Experiment /Practicum	Field study	Presentations	Other
80%	10%	10%	%	%	%

4. Evaluation (%)

Mid-term Exam	Final exam	Quizzes	Presentations	Projects	Assignments	Participation	Other
30%	30%	%	%	30%		5%	5%

Ⅱ. Course Objectives

This course will help students to understand and raise practical problem solving capabilities in the field of pattern recognition. Students will understand various pattern recognition related problems, how to solve those problems using traditional and deep learning methods, the limitations and possibilities of those techniques.

Ⅲ. Course Format

(* In detail)

- Course subjects will be taught by the main textbook and lecture material.
- Couple of projects will be assigned to help understand major concepts in pattern recognition.
- English is used for lecture materials and explanations.

Ⅳ. Course Requirements and Grading Criteria

Final grade is based on scores of midterm and final exam, projects, and attendance. All exams and project assignments should be solved by oneself and no cheating activity will be allowed.

Ⅴ. Course Policies

General rules for late or absence, assignments, projects, and exams will follow the University regulations.

VI. Materials and References

i). Main material

 1) Lecture notes

 2) Duda, Hart and Stork, Pattern Classification, Second Edition, Wiley, 2001

ii). Sub material

 1) Theodoridis and Koutroumbas, Pattern Recognition, 4th edition, Elsevier, 2009

 2) Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006

ii). TA

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VII. Course Schedule

(* Subject to change)

Week		
Week 1 (dd/ mm)	**Learning Objectives**	Introduction to Pattern Recognition (Ch 1)
	Topics	Learn basic concepts, history, major problems in pattern recognition
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 2 (dd/ mm)	**Learning Objectives**	Statistical Decision Theory (Ch 2)
	Topics	Learn principles of statistical decision theory.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 3 (dd/ mm)	**Learning Objectives**	Statistical Decision Theory (Ch 2)
	Topics	Learn principles of statistical decision theory.

	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	Project 1
Week 4 (dd/mm)	Learning Objectives	Parameter Estimation (Ch 3)
	Topics	Learn principles of parameter estimation.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 5 (dd/mm)	Learning Objectives	Parameter Estimation (Ch 3)
	Topics	Learn principles of parameter estimation.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	Project 2
Week 6 (dd/mm)	Learning Objectives	Component analysis and Discriminants (Ch 3)
	Topics	Learn principles of Component analysis and Discriminants.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 7 (dd/mm)	Learning Objectives	Non-parametric Techniques (Ch 4)
	Topics	Learn principles and applications of non-parametric techniques.

	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	Project 3
Week 8 (dd/ mm)	**Learning Objectives**	Midterm
	Topics	
	Class Work (Methods)	
	Materials (Required Readings)	
	Assignments	
Week 9 (dd/ mm)	**Learning Objectives**	Non-parametric Techniques (Ch 4)
	Topics	Learn principles and applications of non-parametric techniques.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 10 (dd/ mm)	**Learning Objectives**	Linear Discriminant Functions (Ch 5)
	Topics	Learn principles of Linear Discriminant Functions.
	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	Project 4
Week 11 (dd/ mm)	**Learning Objectives**	Neural Networks (Ch 6)
	Topics	Learn principles of Neural Networks.

	Class Work (Methods)	Lecture	
	Materials (Required Readings)	Lecture notes, main/sub textbook	
	Assignments		
Week 12 (dd/ mm)	**Learning Objectives**	Decision Trees (Ch 8)	
	Topics	Learn principles and applications of decision trees.	
	Class Work (Methods)	Lecture	
	Materials (Required Readings)	Lecture notes, main/sub textbook	
	Assignments		
Week 13 (dd/ mm)	**Learning Objectives**	Error Rate Estimation, Bagging, Boosting (Ch 9)	
	Topics	Learn principles and applications of error rate estimation, Bagging, Boosting.	
	Class Work (Methods)	Lecture	
	Materials (Required Readings)	Lecture notes, main/sub textbook	
	Assignments	Project 5	
Week 14 (dd/ mm)	**Learning Objectives**	Classifier Combination (Ch 9)	
	Topics	Learn principles and applications of classifier combination.	
	Class Work (Methods)	Lecture	
	Materials (Required Readings)	Lecture notes, main/sub textbook	
	Assignments		
Week 15 (dd/ mm)	**Learning Objectives**	Unsupervised Learning, Clustering, and Multidimensional Scaling (Ch 10)	
	Topics	Learn principles and applications of unsupervised Learning.	

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	Class Work (Methods)	Lecture
	Materials (Required Readings)	Lecture notes, main/sub textbook
	Assignments	
Week 16 (dd/ mm)	**Learning Objectives**	Final exam
	Topics	
	Class Work (Methods)	
	Materials (Required Readings)	
	Assignments	

Ⅷ. Special Accommodations

- Meetings will be available by appointments in addition to the office hour.
- Teaching assistant will be announced at the first class.
- Weekly lecture schedule can be changed during the Semester.

IX. Aid for the Challenged Students

- Students who need special care due to any handicap need to contact the instructor individually.