

# Recognition Informatics

Special Subjects  
Elective 2 credit

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## 1. Course Description

The course consists of following subjects: structure of pattern recognition systems, Bayes' theorem; statistical feature extraction; linear discriminant function; and neural networks. We will review actual applications in this area, such as character, voice and image recognition. This course is related to DP1.

## 2. Course Objectives

The aim of the course is to comprehend the basic structure of pattern recognition systems and pattern recognizers based on Bayes' theorem. We shall learn the following: complexity, discrimination ability and robustness of discrimination functions; structure of parametric recognizer and non-parametric recognizer; and the difference between the two recognizers. Students in this course will obtain skills in applying these methods and techniques to actual problems.

## 3. Grading Policy

Assessed by the reports. The learners can get feedback from the reports commented by the professor.

## 4. Textbook and Reference

Textbook

Jyunichiro Toriwaki, "Fundamentals on pattern information processing," Asakura Pub., 2000, ISBN978-4-254-12709-6.

Kenichiro Ishi, Naonori Ueda, Eisaku Maeda and Hiroshi Murase, "Pattern Recognition," Ohmsha, 1998, ISBN978-4-274-13149-3.

## 5. Requirements(Assignments)

This course is the most basic among pattern recognition related subjects in a graduate school. The participants had better learn the image processing and the voice processing at the next stage of this course. The learners should review information algebra, coding theory, probability theory, information theory and mathematical programming.

The learners must read the part of the textbook carefully, then confirm concept of each class's keywords before the class (1.5 hours), and take exercises written in the end of the section after the class (1.5 hours).

## 6. Note

The classes will proceeded according the text books.

If there are few students, they will take turns reading and explaining the books.

## 7. Schedule

- [1] fundamentals of pattern recognition (1)  
procedure, characteristics of pattern sets, fundamentals of discrimination
- [2] fundamentals of pattern recognition (2)  
feature extraction, pre-processing, voice recognition
- [3] fundamentals of pattern recognition (3)  
character recognition
- [4] image processing (1)  
functions for image processing, image recognition
- [5] image processing (2)  
summary of image processing methods
- [6] image processing (3)  
advanced pattern recognition and comprehension
- [7] Structure of pattern recognition system and feature vectors  
Structure of pattern recognition, feature vectors and feature space, nearest neighbor algorithm and prototype
- [8] machine learning and discrimination functions (1)  
necessity of machine learning, nearest neighbor algorithm and linear discriminant functions, learning scheme of perception
- [9] machine learning and discrimination functions (2)  
piecewise linear discriminant functions
- [10] machine learning based on error evaluation  
Widrow-Hoff learning rule, error evaluation and perception, backpropagation
- [11] design for recognizers (1)  
parametric and non-parametric learning, parameter estimation, design for discrimination function
- [12] design for recognizers (2)  
number of dimensions for feature space and leaning samples, recognizer optimization
- [13] feature assessing and probability of error on Bayes' theorem (1)  
Feature assessing, deviation of within or without class, probability of error on Bayes' theorem
- [14] feature assessing and probability of error on Bayes' theorem (2)  
nearest neighbor and probability of error on Bayes' theorem, estimation for probability of error on Bayes' theorem
- [15] report writing