Course number	G-LAS12 80010 LE10		
Course title (and course title in English)	Statistical Learning Theory Statistical Learning Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KASHIMA HISASHI Graduate School of Informatics Senior Lecturer,TAKEUCHI KOH

Group	Interdisciplinary Graduate Courses	Field(Classification)	Statistics, Informatics and Data Science

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.1	Target year	Graduate students	Eligible students	For science students

(Students of Graduate School of Informatics cannot take this course as liberal arts and general education course. Please register the course with your department.)

[Overview and purpose of the course]

This course will provide a in-depth exploration of the foundational theory and practical applications of statistical machine learning, which plays a significant role in statistical data analysis and data mining. We will primarily focus on supervised and unsupervised learning, with an emphasis on supervised learning. The course will cover essential theoretical concepts such as maximum likelihood estimation and Bayesian inference, as well as introduce the concept of Probably Approximately Correct (PAC) learning.

Throughout the course, you will gain familiarity with various probabilistic models and predictive algorithms, including logistic regression, perceptrons, and neural networks. Additionally, we will touch upon advanced topics like semi-supervised learning, transfer learning, and sparse modeling, providing you with insights into the latest developments in the field of machine learning. In addition, opportunities for hands-on data analysis exercises will also be provided.

[Course objectives]

Understanding basic concepts, problems, and techniques of statistical learning and some of the recent topics.

[Course schedule and contents)]

1. Statistical Machine Learning
- Introduction to machine learning: historical perspective, basic concepts, and applications
- Regression and classification: linear regression, logistic regression, and neural networks.
- Inference framework and statistical learning theory: maximum likelihood estimation, regularization, Bayesian inference, Vapnik-Chervonenkis theory
- Model selection: performance measures, cross-validation, hyper-parameter selection

2. Advanced topics
- Semi-supervised learning
- Transfer learning
- Sparse modeling
- Deep neural networks
- Graph learning

Continue to Statistical Learning Theory(2)↓↓↓

Statistical Learning Theory(2)

[Course requirements]

None

[Evaluation methods and policy]

Reports and/or final exam.

[Textbooks]

Instructed during class

[References, etc.]

（References, etc.）

Hastie, Friedman, Tibshirani 『The Elements of Statistical Learning』 （Springer）
Shai Shalev-Shwartz and Shai Ben-David 『Understanding Machine Learning: From Theory to Algorithms』（Cambridge University Press）

[Study outside of class (preparation and review)]

Basic knowledge about probability and statistics

[Other information (office hours, etc.)]