



# Foundation of Intelligent Systems

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# Abstract

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- This course examines the foundations of Machine Learning.
- The **first** part explains Statistical Learning Theory, which is for learning from numerical and continuous data.  
  
The **second** part explains Computational Learning Theory, which is for learning from discrete data, such as formal languages, and formulae of first-order logic.
- Both parts consist of fundamental theories and methods of their applications.



# Contents (Part 1)

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- Lectured by Cuturi, April 19<sup>th</sup> – June 7<sup>th</sup>
- 1. Statistical Learning Theory
  - 1-1. Introduction to classification: historical perspective, separating hyperplanes, perceptron algorithm
  - 1-2. Probabilistic framework of classification and statistical learning theory : Vapnik-Chervonenkis theory, PAC learning, capacity measures,
  - 1-3 Review of major classification algorithms: LDA and logistic regression, ensemble methods, SVM, kernel methods.



# Contents (Part 2)

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- Lectured by Yamamoto, Jun 14<sup>th</sup> – July 26<sup>th</sup>
- 2. Computational Learning Theory
  - 2-1 Preliminaries on the Theory of Computation, Formalization of Learning, Formal Concept Analysis
  - 2-2 Learning in the limit from positive and negative data, query learning
  - 2-3 Difficulty of the learning from positive only data, Hierarchy of learnability, Mathematical axioms and learning, Computational algebra and learning



# Evaluation

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- Students are graded by the examinations provided both during the course and after the course. The examinations may be given in the form of report examinations.
- Students are expected to correctly understand concepts on statistical and computational machine learning.



# Course Materials

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- Course materials and texts will be provided via the KULASIS system after students' registration is completed (the second week of May).
- Before that please visit the following HP:  
<http://www.iip.ist.i.kyoto-u.ac.jp/member/cuturi/>  
or  
<http://www.iip.ist.i.kyoto-u.ac.jp/member/akihiro/>