Kernel Method: Data Analysis with Positive Definite Kernels

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Outline I

Outline II

19 (Fri) Support vector machine and related topics

- Basics on convex analysis
- Optimization of SVM and its dual form
- Computational aspect and SMO

Support vector machine and related topics

- Extension of SVM
- Generalization ability of SVM: computational learning theory

Outline III

Outline IV

26 (Fri) Nonparametric inference with kernels (II)

- Homogeneity and independence test
- Conditional independence with kernels

Relation to other statistical methods

- Relation to functional data analysis, Gaussian process, and spline

Comments on Terminology

- "Kernel" is a general word for a function of the form

$$k : \mathcal{X} \times \mathcal{X} \to \mathbb{R}.$$

  But, "kernel" is often used to mean "positive definite kernel" for the methodology in this course in machine learning community.

- In statistics, the word "kernel" is often used for the method of kernel density estimation or Parzen window approach, *e.g.*,

$$\widehat{p}(x) = \frac{1}{N} \sum_{i=1}^{N} k(x, X_i).$$

- In this course, "kernel method" is used for "the method with positive definite kernels".

Tips

Web page:
`http://www.ism.ac.jp/~fukumizu/TITECH2010/`

The information and the slides for this course will be put on the web page.

Time Table

1st week	17 (Wed)	18 (Tue)	19 (Wed)
15:00-16:30	Intro	Methods (I)	SVM (I)
16:40-18:10	Basics on pos. def. kernels	Methods (II)	SVM (II)
2nd week	24 (Wed)	25 (Thu)	26 (Fri)
15:00-16:30	Theory on kernel and RKHS (I)	Structured data	Nonparametric inference (II)
16:40-18:10	Theory on kernel and RKHS (II)	Nonparametric inference (I)	Relation to other methods