

Kernel Methods and Pattern Analysis

- Construction of kernels: Properties of kernels, Basic kernels, Kernel types, Kernels for structured data, Kernels for sequential pattern analysis.
- Bayesian kernel methods: Bayesian inferencing, Gaussian processes for classification and regression, Relevance vector machines for classification and regression.
- Applications of kernel methods: Pattern analysis tasks in speech processing, image processing, text processing and bioinformatics.
- Pattern analysis using Eigen-decomposition: Generalized Eigen-analysis, Kernel principal component analysis, Kernel canonical correlation analysis, Kernel Fisher discriminant analysis.
- Pattern analysis using ranking, clustering and data visualization: Discovering rank relations using kernel methods, Discovering cluster structures using kernel methods, Data visualization using kernel methods.
- Pattern analysis using convex optimization: Convex optimization, sequential minimal optimization, Iterative methods, Pattern classification using support vector machines, Function approximation using support vector regression .
- Pattern analysis by learning from data: Risk minimization techniques for learning from data, Empirical risk minimization, Regularization, Elements of statistical learning theory, Structural risk minimization.

Text Books

1. J. Shawe-Taylor and N. Cristianini, Kernel Methods for Pattern Analysis, Cambridge University Press, 2004.
2. B. Scholkopf and A.J. Smola, Learning with Kernels – Support Vector Machines, Regularization, Optimization and Beyond, The MIT Press, 2002

References

1. V. Vapnik, Statistical Learning Theory, John Wiley & Sons, 1998
2. R. Herbrich, Learning Kernel Classifiers – Theory and Algorithms, The MIT Press, 2002
3. C.M. Bishop, Pattern Recognition and Machine Learning, Cambridge University Press, 2006
4. G. Camps-Valls, J.L. Rojo-Alvarez and M. Martinez-Ramon (Eds.), Kernel Methods in Bioengineering, Signal and Image Processing, Idea Group Publishing, 2007
5. B. Scholkopf, K. Tsuda and J-P. Vert (Eds.), Kernel Methods in Computational Biology, The MIT Press, 2004.

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