

Course Content

Course Title (English)	Kernel Methods and Machine Learning
Course Title (Chinese)	機器學習與核方法
Credit	3
Instructor	Prof. Pei-Yuan Wu 吳沛遠 教授
Outline	<p>Part I. Basic Concepts:</p> <ol style="list-style-type: none">1. Introduction of Kernel: Definition and basic properties.2. Theoretical foundation of kernels: Reproducing kernel Hilbert space3. Risk and Loss Functions4. Regularization, the representer theorem <p>Part II. Support Vector Machines:</p> <ol style="list-style-type: none">5. Convex Optimization6. Binary/Multi-class classification: SVM7. Quantile Estimation and Novelty Detection: one-class SVM8. Regression Estimation: Support Vector Regression9. Cost-effective Implementation: Subset Selection Methods, Nystrom Method, random Fourier features, Sequential Minimal Optimization. <p>Part III. Kernel Methods:</p> <ol style="list-style-type: none">10. Kernel Fisher Discriminant Analysis11. Nadaraya Watson kernel regression, kernel ridge regression12. Clustering: Kernel K-means, kernel-expectation maximization, kernel self-organizing map13. Kernel Feature Extraction: Kernel PCA, Manifold learning by graph Laplacian.

Goal	Kernel trick is a powerful tool to extend machine learning algorithms to deal with nonlinear models, as well as dealing with non-vectorial data. This course covers various kernel-based unsupervised and supervised learning models for pattern recognition problems, with an emphasis on an integrated understanding of the mathematical theory and their potential applications.
English Teaching	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Teaching Material	<input checked="" type="checkbox"/> English <input type="checkbox"/> Chinese