

Kernel Methods for Pattern Analysis

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Abstract

Kernel-based learning methods are a class of algorithms for pattern analysis, whose best known element is the Support Vector Machine, based on the idea of replacing inner products by Mercer Kernels. This substitution enables them to efficiently operate in very high-dimensional spaces, implementing the following simple idea: first embed the data into some vector space, and then detect linear relations in such a space. If the kernel is suitably chosen, points that are “similar” for the task at hand, will be mapped to nearby positions, and “different” points will be far apart.

The extraordinary impact that this approach is having in the field of machine learning is due to many reasons. Firstly because they often lead to convex optimization problems in cases where neural networks have been used in the past. Secondly because they establish a connection with the theory of Reproducing Kernel Hilbert Spaces, and finally because kernels have been recently developed to deal with data as diverse as sequences, graphs, images, text documents. And kernel-based algorithms have been developed to deal with problems as diverse as classification, novelty detection, ranking, regression, canonical correlation analysis, etc.

Results from Statistical Learning Theory are routinely used in the design of such algorithms, and applications are most commonly found in bioinformatics and text analysis. In this talk we will review the main ideas as well as the most recent research directions.