On the use of Support Vector Machines for Antenna Array Processing

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Abstract

Support Vector Machines (SVM) are Machine Learning techniques which have been showing superior generalization performance and robustness against noise in a large variety of regression and classification problems, compared to classical linear methods and neural networks. Also, the SVM formulation guarantees the existence and uniqueness of solutions, thus avoiding the problems of convergence and local minima of most classical nonlinear approaches. For that reason, SVMs have been gaining popularity among the scientific community.

In this course we adapt the SVM formulation to the communications environments, where signals are complex and training data sets are usually much smaller than in other applications.

We develop SVM methods for regression, with emphasis in nonlinear array processing with spatial and temporal reference. Practical implementations are provided with detailed explanations of the algorithm implementations. That way, attendants will be able to immediately experiment and apply the SVM approaches to array processing.

We show the improved performance of SVM methods over classical linear techniques and, interestingly, we prove that our approaches contain, as particular cases, nonlinear and linear versions of the classical Wiener Filter and the Minimum Variance Distortionless Method (MVDM).

Practical demonstrations of our approaches will be provided if computers are available for the attendants to develop guided experiments in Matlab.