When Kernel Machines Meet Shape Constraints*

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Abstract

Shape constraints (such as non-negativity, monotonicity, convexity, n-monotonicity or supermodularity) enable one to incorporate prior knowledge into predictive models in a principled way with numerous successful applications in econometrics, finance, biology, reinforcement learning, and game theory. Including this side information in a hard fashion (for instance at every point of an interval) for rich function classes however is a quite challenging task. In this talk I am going to present a convex optimization framework to encode hard affine constraints on function values and derivatives in the flexible family of kernel machines. The efficiency of the approach is illustrated in joint quantile regression (analysis of aircraft departures), convoy localization and safety-critical control (piloting an underwater vehicle while avoiding obstacles).

Papers: real-valued output, vector-valued output.

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