Shape-Constrained Kernel Machines and Their Applications*

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Abstract

Shape constraints (such as non-negativity, monotonicity, convexity, n-monotonicity or supermodularity) enable one to add prior knowledge to predictive models in a principled fashion with numerous successful applications in econometrics, finance, biology, reinforcement learning, and game theory. Incorporating this side information in a hard way (for instance, at every point of an interval) for rich function classes however is a rather challenging task. We will discuss a recent 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 will be demonstrated 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 (NeurIPS), vector-valued output (JMLR).

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