

VARIABLY SCALED (DISCONTINUOUS) KERNELS: FROM IMAGE RECONSTRUCTION TO SUPERVISED LEARNING

FRANCESCO MARCHETTI

Kernel methods are widely-employed and successfully applied in many fields. In this presentation, we discuss the employment of Variably Scaled Discontinuous Kernels (VSDKs) in the approximation of discontinuous functions and of Variably Scaled Kernels (VSKs) in the context of supervised learning. Variably scaled kernels have been introduced in the context of approximation theory in 2015. Here, we introduce VSDKs and we prove their efficacy in the reduction of the so-called Gibbs phenomenon, which affects the reconstruction of discontinuous functions causing non-physical oscillations and artifacts [3]. Moreover, we discuss the usage of VSDKs in medical imaging, more precisely in the context of magnetic particle imaging [2]. Then, we present an extension of the variably scaled setting to the support vector machines framework. In this case, we show how the resulting stacking technique is capable of improving the classification accuracy of standard methods [1]. The proposed technique is then applied in concrete medical classification tasks [4].

REFERENCES

- [1] C. CAMPI, F. MARCHETTI, E. PERRACCHIONE, *Learning via variably scaled kernels*, Adv. Comput. Math. **47** (2021), 51.
- [2] S. DE MARCHI, W. ERB, F. MARCHETTI, E. PERRACCHIONE, M. ROSSINI, *Shape-Driven Interpolation with Discontinuous Kernels: Error Analysis, Edge Extraction and Applications in MPI*, SIAM J. Sci. Comput. **42**(2) (2020), pp. B472–B491.
- [3] S. DE MARCHI, F. MARCHETTI, E. PERRACCHIONE, *Jumping with Variably Scaled Discontinuous Kernels (VSDKs)*, Bit Numer. Math. **60**(2) (2020), pp. 441–463.
- [4] F. MARCHETTI, F. DE MARTINO, M. SHAMSEDDIN, S. DE MARCHI, C. BRISKEN, *Variably Scaled Kernels Improve Classification of Hormonally-Treated Patient-Derived Xenografts*, 2020 IEEE Conference on Evolving and Adaptive Intelligent Systems (EAIS), Bari, Italy (2020), pp. 1–6.