Master thesis topic

Rate of convergence for machine learning procedures based on the empirical Christoffel function

This master thesis topic is at the interesction between asymptotic statistics and functional analysis. The Christoffel function $C_{\mu,d} : \mathbb{R}^p \to \mathbb{R}$ characterizes properties of a measure μ on $\mathbb{R}^p$, for a given bound on the degree of multivariate polynomials $d \in \mathbb{N}$. It is strongly connected to the theory of orthogonal polynomials [DX14]. Given an i.i.d. sample $X_1, \ldots, X_n$ following a probability distribution μ on $\mathbb{R}^p$, a plugin empirical couterpart $\hat{C}_{\mu,d}$ of $C_{\mu,d}$, called the empirical Christoffel function, is available. It has been shown recently [PL16, LP17] that the Christoffel function can be used to address several classical machine learning problems, such as density estimation, support estimation, anomality detection and affine matching.

The goal of this internship is to obtain quantitative statistical guarantees on machine learning procedures based on the empirical Christoffel function (convergence and rate of convergence). In this aim, we will use and improve preliminary results available in [LP17].

Key words : Orthogonal polynomials, density estimation, rate of convergence.

Contact : François Bachoc (`francois.bachoc@math.univ-toulouse.fr`) and Edouard Pauwels (`edouard.pauwels@irit.fr`), Institut de Recherche en Informatique de Toulouse.

Références

[DX14] Charles F Dunkl and Yuan Xu. *Orthogonal polynomials of several variables*. Number 155. Cambridge University Press, 2014.

[LP17] Jean-Bernard Lasserre and Edouard Pauwels. The empirical christoffel function with applications in machine learning. *arXiv preprint arXiv :1701.02886*, 2017.

[PL16] Edouard Pauwels and Jean B Lasserre. Sorting out typicality with the inverse moment matrix sos polynomial. In *Advances in Neural Information Processing Systems*, pages 190–198, 2016.