



復旦大學

数据科学与深度学习  
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# Learning Multi-Index Models with Hyper-Kernel Ridge Regression



黄硕

Italian Institute of Technology  
(IIT)-MIT

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**Abstract:** Deep neural networks excel in high-dimensional problems, outperforming models such as kernel methods, which suffer from the curse of dimensionality. However, the theoretical foundations of this success remain poorly understood. We follow the idea that the compositional structure of the learning task is the key factor determining when deep networks outperform other approaches. Taking a step towards formalizing this idea, we consider a simple compositional model, namely the multi-index model (MIM). In this context, I will introduce hyper-kernel ridge regression (HKRR), an approach blending neural networks and kernel methods. Our main contribution is a sample complexity result demonstrating that HKRR can efficiently learn MIM, overcoming the curse of dimensionality. Further, we exploit the kernel nature of the estimator to develop ad hoc optimization approaches. Indeed, we contrast alternating minimization and alternating gradient methods both theoretically and numerically. These numerical results complement and reinforce our theoretical findings. This talk is based on the joint work with Ernesto De Vito (UniGe), Lorenzo Rosasco (MIT, IIT, UniGe), Tomaso Poggio (MIT).

**个人简介:**黄硕, Italian Institute of Technology (IIT)-MIT及热那亚机器学习中心 (MaLGa) 博士后研究员, 合作导师为Lorenzo Rosasco 以及Tomaso Poggio (MIT 脑与认知科学系讲席教授)。她于2023年在香港城市大学获得数学博士学位, 研究方向主要聚焦于深度神经网络的统计学习理论、核方法与函数逼近论。