XUEMENG WANG, Simon Fraser University

Christoffel Adaptive Sampling in Sparse Random Feature Models for Function Approximation

Random feature models have become a powerful tool for approximating high-dimensional functions and solving partial differential equations (PDEs) efficiently. The sparse random feature expansion (SRFE) enhances traditional random feature methods by incorporating sparsity and compressive sensing principles, making it particularly effective in data-scarce settings. In this work, we integrate active learning with sparse random feature approximations to improve sampling efficiency. Specifically, we incorporate the Christoffel function to guide an adaptive sampling process, dynamically selecting informative sample points based on their contribution to the function space. This approach optimizes the distribution of sample points by leveraging the Christoffel function associated with a chosen function basis. We conduct numerical experiments on comparing adaptive and non-adaptive sampling strategies within the sparse random feature framework and examine their implications for function approximation. Furthermore, we implement different sparse recovery solvers, including Orthogonal Matching Pursuit (OMP) and Hard Thresholding Pursuit (HTP) to reconstruct target function. Our results demonstrate the advantages of adaptive sampling in maintaining high accuracy while reducing sample complexity, highlighting its potential for scientific computing.

This is joint work with Ben Adcock and Khiem Can.