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Christoffel Adaptive Sampling for Sparse Random Feature Expansions

Random feature models are powerful tools for approximating high-dimensional functions and solving PDEs. Sparse random feature expansion (SRFE) enhances these methods by incorporating sparsity and compressive sensing, which is especially beneficial in data-scarce settings. We integrate active learning with SRFE by using the Christoffel function to guide an adaptive sampling process, dynamically selecting informative samples. Drawing random samples via the Christoffel function allows a weighted least-squares approximation with near-optimal sample complexity. Numerical experiments show that Christoffel adaptive sampling maintains high accuracy, demonstrating strong potential for scientific computing.