Zhaiming Shen - Graph-based Semi-supervised Local Clustering with Few Labeled Nodes

Local clustering aims at extracting a local structure inside a graph without the necessity of knowing the entire graph structure. As the local structure is usually small in size compared to the entire graph, one can think of it as a compressive sensing problem where the indices of target cluster can be thought as a sparse solution to a linear system. In this talk, based on two pioneering works under the same framework, I will introduce a new semi-supervised local clustering approach using only very few labeled nodes. Our approach improves the existing works by making the initial cut to be the entire graph and hence overcomes a major limitation of the existing works, which is the low quality of initial cut. Extensive experimental results on various datasets demonstrate the effectiveness of our approach.

Ye He - Zeroth-Order Sampling Methods for Non-Log-Concave Distributions: Alleviating Metastability by Denoising Diffusion

We consider the problem of sampling from non-logconcave distribution, based on queries of its unnormalized density. We first propose an oracle-based meta-algorithm, Diffusion Monte Carlo (DMC), based on the simulation of a denoising diffusion process with its score function approximated by a generic Monte Carlo estimator. Then we provide an implementation of DMC, based on rejection sampling, and this turns DMC into a true algorithm, termed Zeroth-Order Diffusion Monte Carlo (ZOD-MC). For low dimensional distributions, ZOD-MC is a very efficient sampler, with performance exceeding latest samplers, including also-denoising-diffusion-based RDMC and RS-DMC.

Sima Moshafi - Effects of Cake Formation on Flow and Transport in a Pleated Membrane Filter

Our study presents a mathematical model for understanding fouling mechanisms in pleated membrane filters, which have a higher surface area-to-volume ratio than flat filters, focusing particularly on cake formation and feed flow dynamics. The model divides the filter into six sub-regions and employs Darcy's law, Stokes equations, and the advection-diffusion equation for simulation. Asymptotic analysis is applied to simplify the model, considering the small aspect ratios of the filter cartridge and pleats. The findings aim to improve filter efficiency by optimizing filtrate volume and maintaining particle concentration, highlighting the influence of cartridge geometry.