Contribution ID: 132

Generative Modeling via Wasserstein Gradient flows of Maximum Mean Discrepancies

Monday, August 12, 2024 11:30 AM (1 hour)

This talk is concerned with inverse problems in imaging from

a Bayesian point of view, i.e. we want to sample from the posterior distribution given noisy measurement. We tackle the problem by studying gradient flows of particles in high dimensions. More precisely, we analyze Wasserstein gradient flows of maximum mean discrepancies defined with respect to different kernels,

including non-smooth ones. In high dimensions, we propose the efficient flow computation via Radon transform (slicing) and

subsequent sorting or random Fourier features. Special attention is paid to non-smooth Riesz kernels. We will see that Wasserstein gradient flows of corresponding maximum mean discrepancies have a rich structure. In particular, singular measures can become absolutely continuous ones and conversely.

Finally, we approximate our particle flows by conditional generative neural networks and apply them for conditional image generation and in inverse image restoration problems like computerized tomography and superresolution.

This is joint work with J. Hertrich (UCL) and P. Hagemann, F. Altekrüger, R. Beinert, J. Chemseddine, M. Gräf, Ch. Wald (TU Berlin).

References:

P. Hagemann, J. Hertrich, F. Altekrüger, R. Beinert, J. Chemseddine and G. Steidl. Posterior sampling based on gradient flows of the MMD with negative distance kernel. ICLR 2024.

J. Hertrich, M. Gräf, R. Beinert and G. Steidl. Wasserstein steepest descent flows of discrepancies with Riesz kernels. Journal of Mathematical Analysis and Applications 2024.

F Altekrüger, P. Hagemann and G. Steidl. Conditional generative models are provably robust: Pointwise guarantees for Bayesian inverse problems. Transactions on Machine Learning Research 2024

F. Altekrüger, J. Hertrich and G. Steidl. Neural Wasserstein Gradient Flows for Maximum Mean Discrepancies with Riesz Kernels. ICML 2023

Presenter: Prof. STEIDL, Gabriele (TU Berlin)

Session Classification: Plenary Talk

Track Classification: Plenary Talks