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Reducing the Cost of Posterior Sampling in Linear Inverse Problems via Task-dependent Score Learning

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Score-based diffusion models (SDMs) enable efficient posterior sampling in Bayesian inverse problems. Traditional methods require multiple forward mapping evaluations, which are computationally costly. We focus on linear inverse problems, such as medical imaging, where these costs are significant. Our novel approach eliminates the need for forward mapping evaluations during sampling by shifting computation to an offline task. We train the score of a diffusion-like process based on the forward mapping, and then derive the posterior score using affine transformations without error. Our method, applicable to infinite-dimensional models, significantly reduces computational costs, making it ideal for frequent posterior sampling.

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