Preliminary Research Idea (3): Reducing Steps in Diffusion Models

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In standard diffusion models, we typically need to execute T steps of the forward noise addition process to ensure that the original data $\mathbf{x}_0$ is completely masked. The goal is to make the distribution at step T converge to a standard Gaussian distribution, where its mean and covariance are independent of the original input $\mathbf{x}_0$. In this way, the reverse process can start directly from $\mathcal{N}(\mathbf{0}, \mathbf{I})$ sampling and perform denoising through T iterative steps.

However, since T is usually very large, this iterative process is computationally expensive and slow. I have been thinking about how to significantly reduce it to $T' \ll T$ steps, thereby accelerating both the forward and reverse processes simultaneously. One possible approach is to introduce some kind of 'jump' mechanism in the final stage, so that the intermediate state $\mathbf{x}_{T'}$ can be directly converted to $\mathbf{x}_T$ faster than the standard diffusion process.