

# Optical Implementation of Denoising Diffusion Models for Efficient Image Generation

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Diffusion models require a large number of denoising steps for sample generation, resulting in substantial latency and energy consumption on digital electronic hardware. This study proposes harnessing light propagation through transparent media to execute denoising diffusion models. Our methodology utilizes passive diffractive optical layers to transmit predicted noise terms within image samples. We employ distinct sets of denoising layers for different time periods of the diffusion process, enabling the optical implementation. This framework allows for rapid image generation with minimal power consumption, leveraging the inherent efficiency of optical information processing.