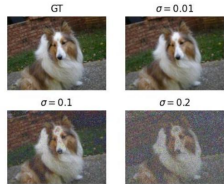


ADMM-Based Image Deconvolution with Conditioned Diffusion Prior

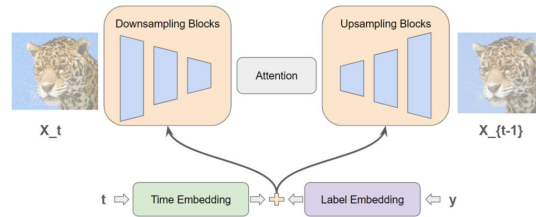
Jacob Deutsch
Stanford University

Motivation

- Diffusion Models have emerged as powerful tools for conditional image generation
- Diffusion Models are trained to denoise images
- Are Diffusion Models a good prior for ADMM?
- Does adding conditioning (class labels) improve results?



Method

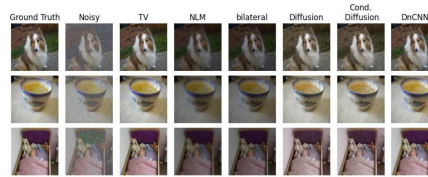


- Plug (un)conditioned diffusion models into ADMM and compare to other priors
- Diffusion models apply repeated denoising step to perform Z-update in ADMM
- Conditioned Diffusion using the ImageNet class label

Related Work

- [1] used unconditioned diffusion models with ADMM. Showed good performance and developed schedule for diffusion models. Only evaluated on two images.
- [2] employed diffusion models to outperform other methods in HQS framework

Experimental Results



- Diffusion performs on par or slightly worse than DnCNN, but better than traditional priors
- Class conditioning does not seem to offer much benefit. Perhaps need stronger form of conditioning like text?

References

- [1] Patel et. al., Deconvolution using ADMM with Diffusion Denoising Prior, Online, 2022
 [2] Zhu et. al., Denoising Diffusion Models for Plug-and-Play Image Restoration, IEEE/CVF, 2023

σ	TV		NLM		Bilateral		DnCNN		Diffusion		Diffusion Conditioned	
	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM
0.2	20.94	0.36	12.67	0.32	12.87	0.3	23.68	0.54	23.1	0.51	23.08	0.5
0.1	24.65	0.61	12.68	0.32	12.95	0.4	24.65	0.61	24.45	0.58	24.42	0.57
0.01	25.72	0.67	12.73	0.33	12.98	0.49	25.03	0.64	26.80	0.75	26.8	0.75

TABLE 1
PSNR and SSIM of all methods at each noise level