Diffusion-Enhanced PatchMatch: A Framework for Arbitrary Style Transfer with Diffusion Models

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JUNE 18-22, 2023
CVPR
VANCOUVER, CANADA

Abstract

*In this work, we present a novel method, **Diffusion-Enhanced PatchMatch (DEPM)**, that leverages Stable Diffusion for style transfer without any finetuning or pretraining. DEPM captures high-level style features while preserving the fine-grained texture details of the original image. By enabling the transfer of arbitrary styles during inference, our approach makes the process more flexible and efficient. Moreover, its optimization- free nature makes it accessible to a wide range of users.*

Main Contributions

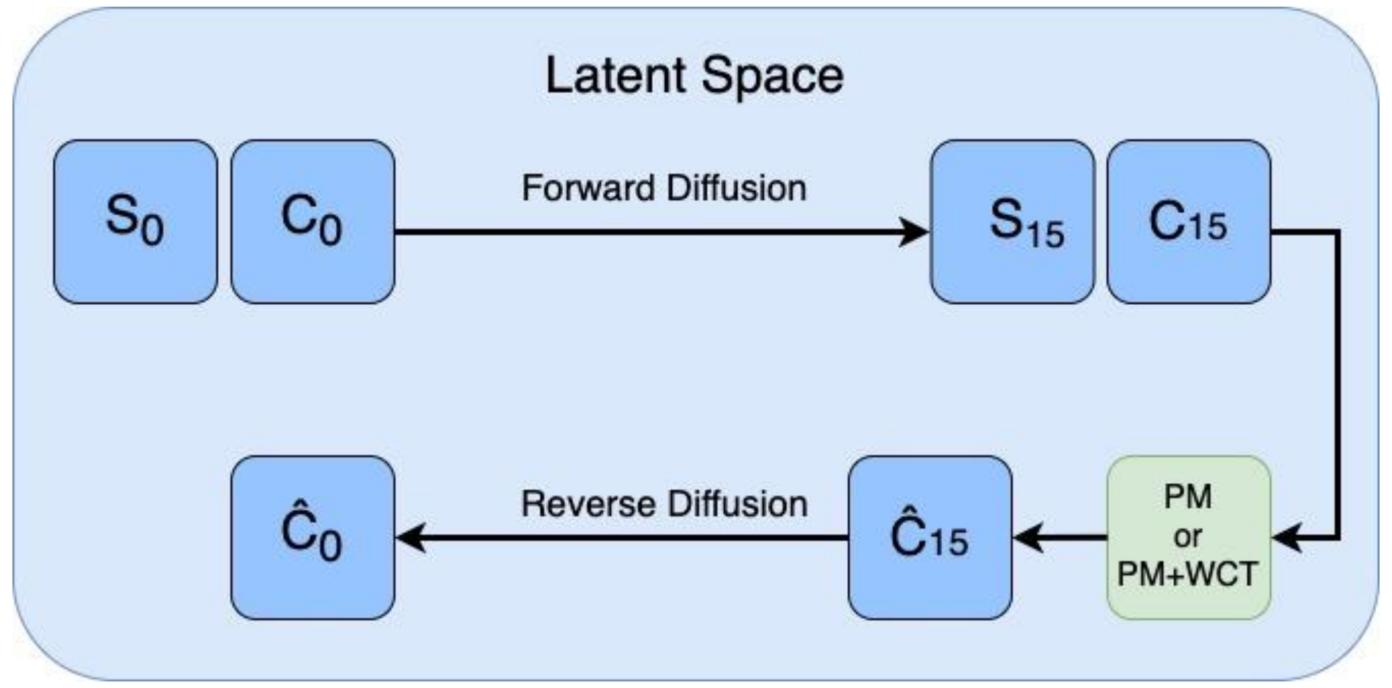
- We utilize patch-based techniques with whitening and coloring transformations in the latent space of Stable Diffusion for high-quality arbitrary style transfer.
- Our approach demonstrates superior performance in terms of color transformation while preserving the content details of the input image.
- Our method enables arbitrary style transfer without the need for any training, making it a highly flexible and efficient solution for a wide range of applications.

Main Components

- Stable Diffusion: Stability AI
- Patch Match (PM): Chen et al., Fast patch-based style transfer of arbitrary style, 2016
- Whitening and Coloring Transform (WCT): Li et al., Universal style transfer via feature transforms, 2017

Method

- C_0 and S_0 are the latent representations of content and style images at timestamp t = 0.
- We perform t = 15 steps of deterministic forward pass with LMSDiscreteScheduler to get C_{15} and S_{15} (total number of steps is T = 100), then we start the reverse diffusion process.
- At t = 15 we perform PM or PM followed by WCT to get the latent representation $\hat{C}_{15}$. We finish the process by performing t = 15 reverse diffusion steps on $\hat{C}_{15}$ resulting in $\hat{C}_0$, the latent representation of the stylized image.

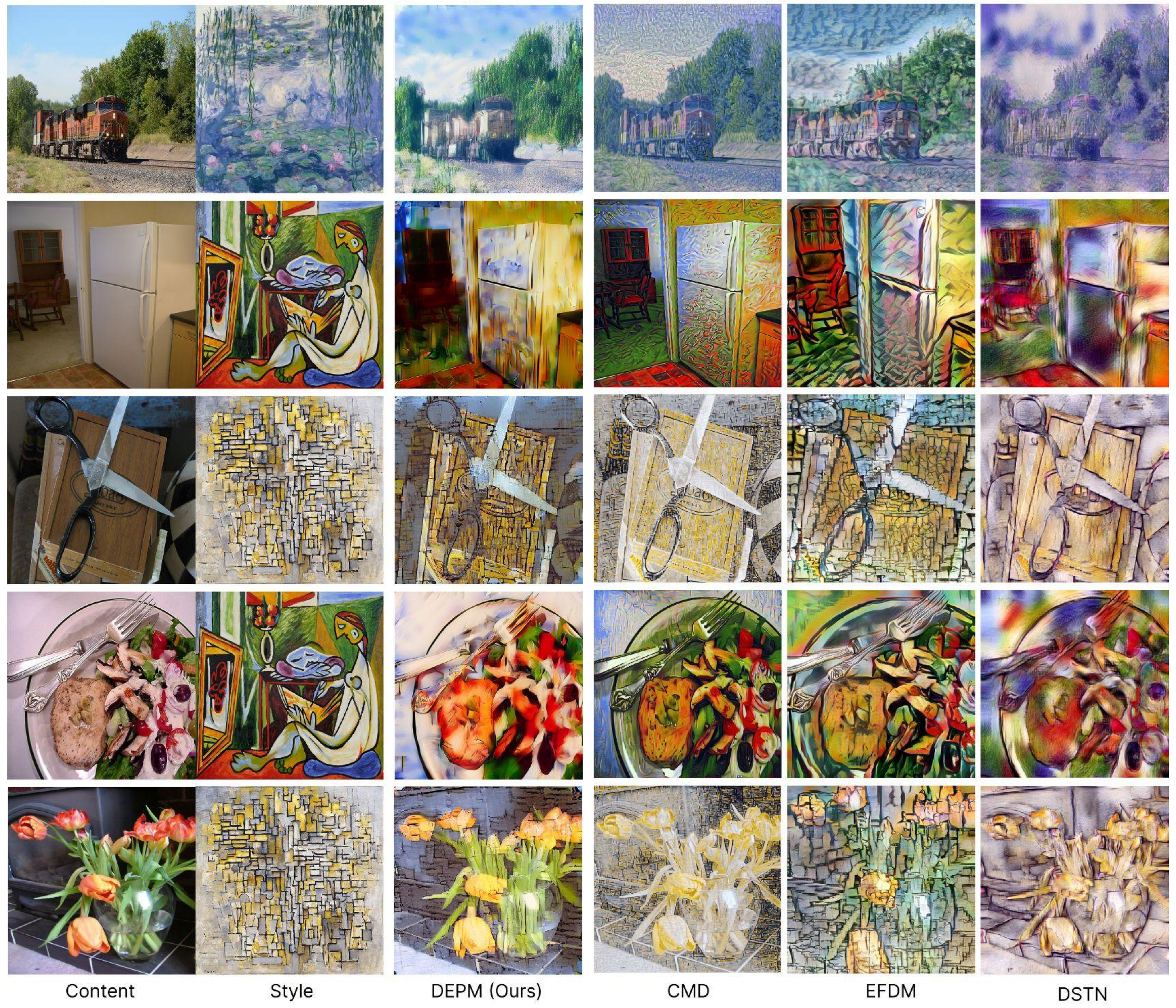


Quantitative comparison

- Perceptual Similarity (LPIPS) Loss across 100 images with 3 different style transfer methods.

	DEPM (ours)	CMD	EFDM	DSTN
LPIPS	**0.596**	0.719	0.606	0.615

Experiments and Comparison



Summary

- We have presented a novel approach to style transfer that synergistically combines diffusion models with style transfer techniques, enabling the transfer of arbitrary styles during the inference step without any finetuning or pretraining.

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