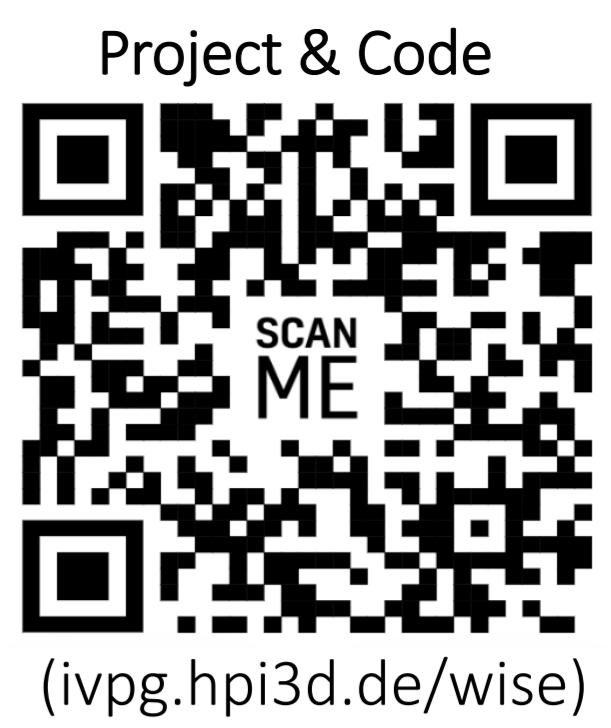


WISE: Whitebox Image Stylization by Example-based Learning

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Problem

How can we achieve fine-grained control over style transfer?
How can we disentangle the stylization process and represent it as a whitebox of interpretable operations?

Main Idea – Whitebox Style Transfer

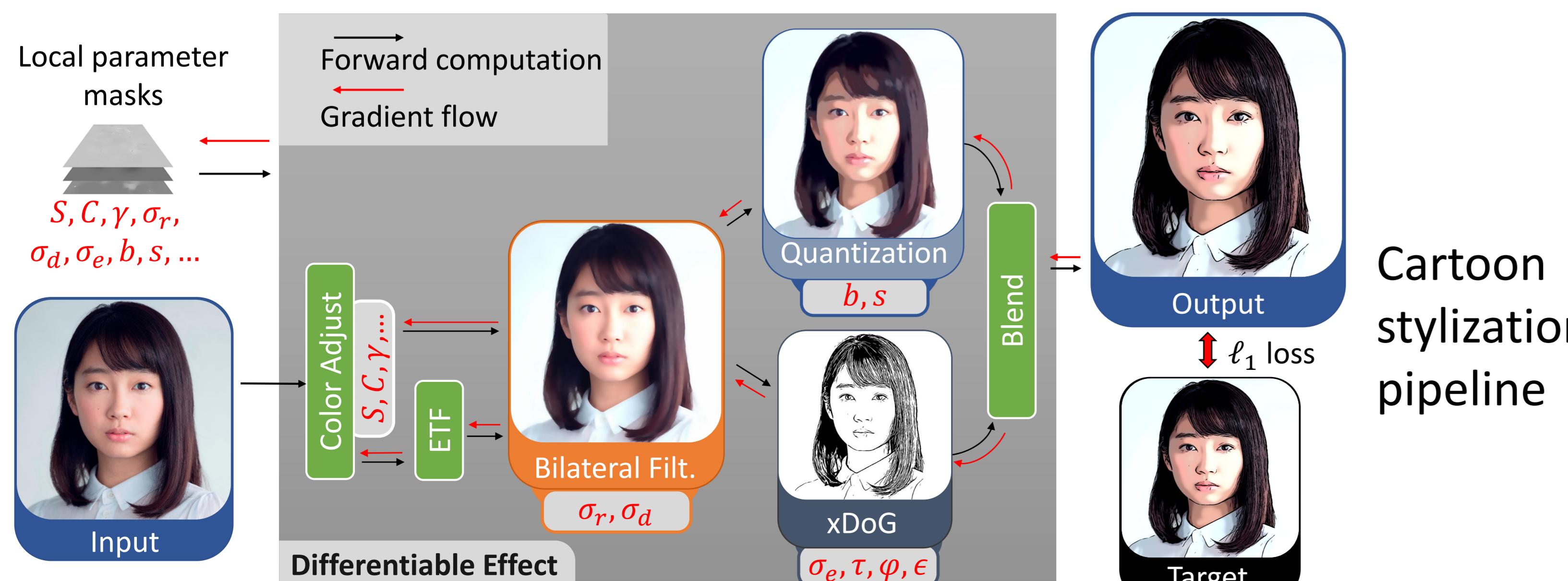


We implement *algorithmic image filtering techniques* such as an oilpainting effect or xDoG [1] as differentiable operations and optimize/learn their parameters to resemble reference styles.

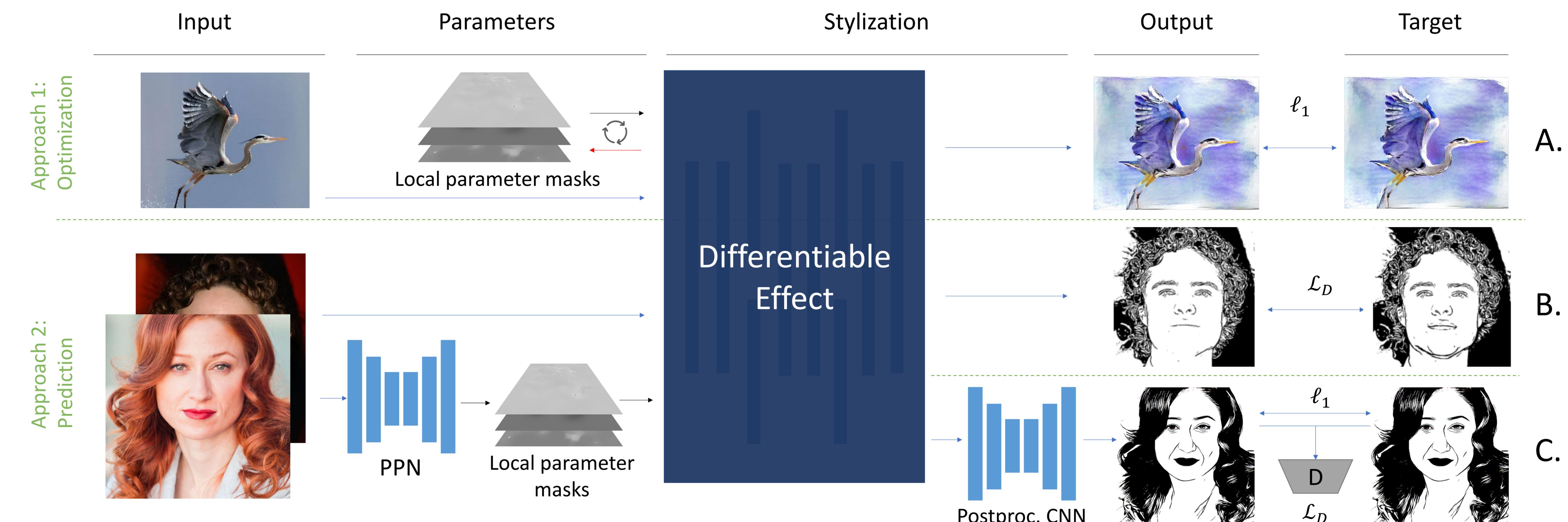
Benefits of *WISE* vs. CNN-based methods:

- Style parameters (e.g., contour-amount, bump-mapping, etc.) are disentangled and remain globally and locally *editable*
- We achieve higher runtime performance and resolution-independence during inference

Exemplary differentiable algorithmic image-filtering technique:



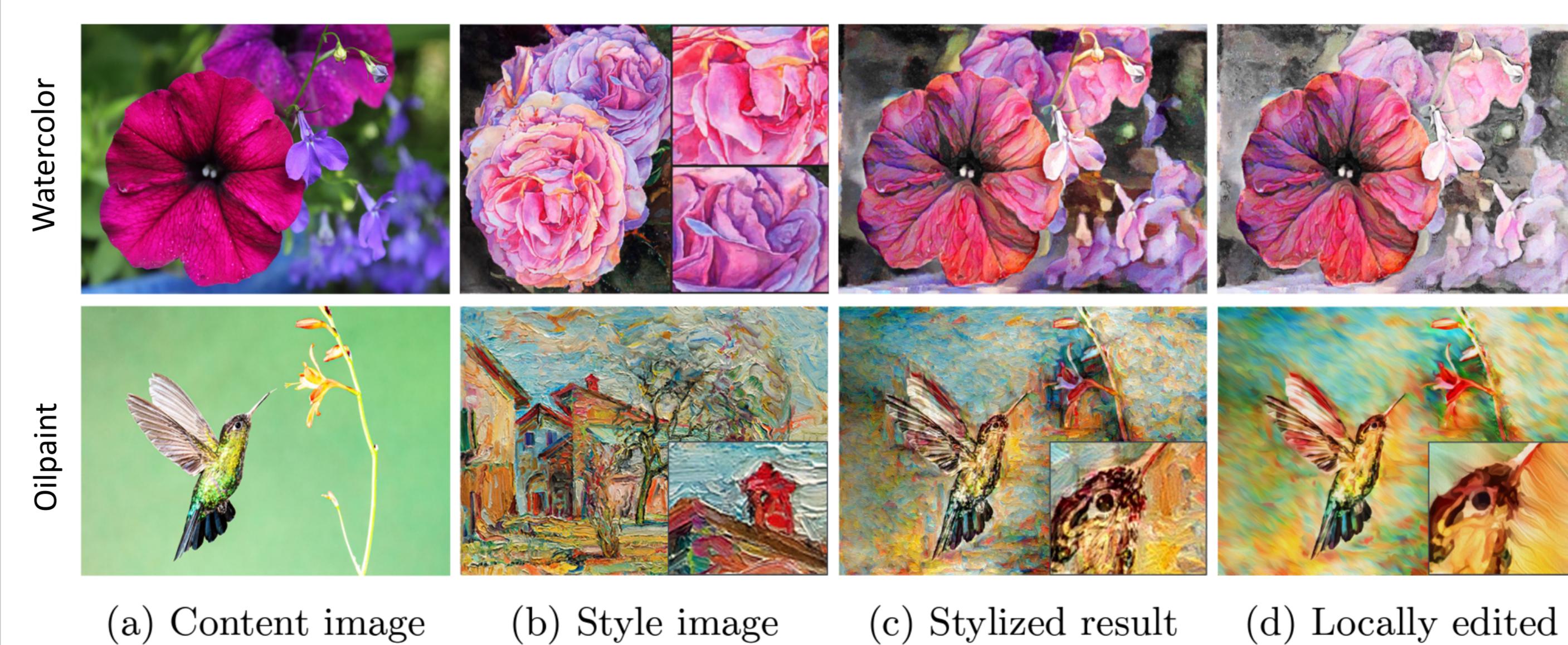
WISE Framework



We propose *WISE*, a framework for interpretable example-based image processing and demonstrate:

- A. Parametric style transfer can optimize parameter masks to match a stylization target
- B. Parameter Prediction Networks (PPNs) can adapt effects to the image content by predicting parameter masks
 - They can be used to improve the effect locally (e.g., for facial structure enhancement as shown in B.)
 - They can be jointly learned with a postprocessing CNN (C.) to enhance the expressivity of simple effects such as xDoG [1] and learn image-to-image translation tasks, e.g., hand-drawn sketch-stylization.

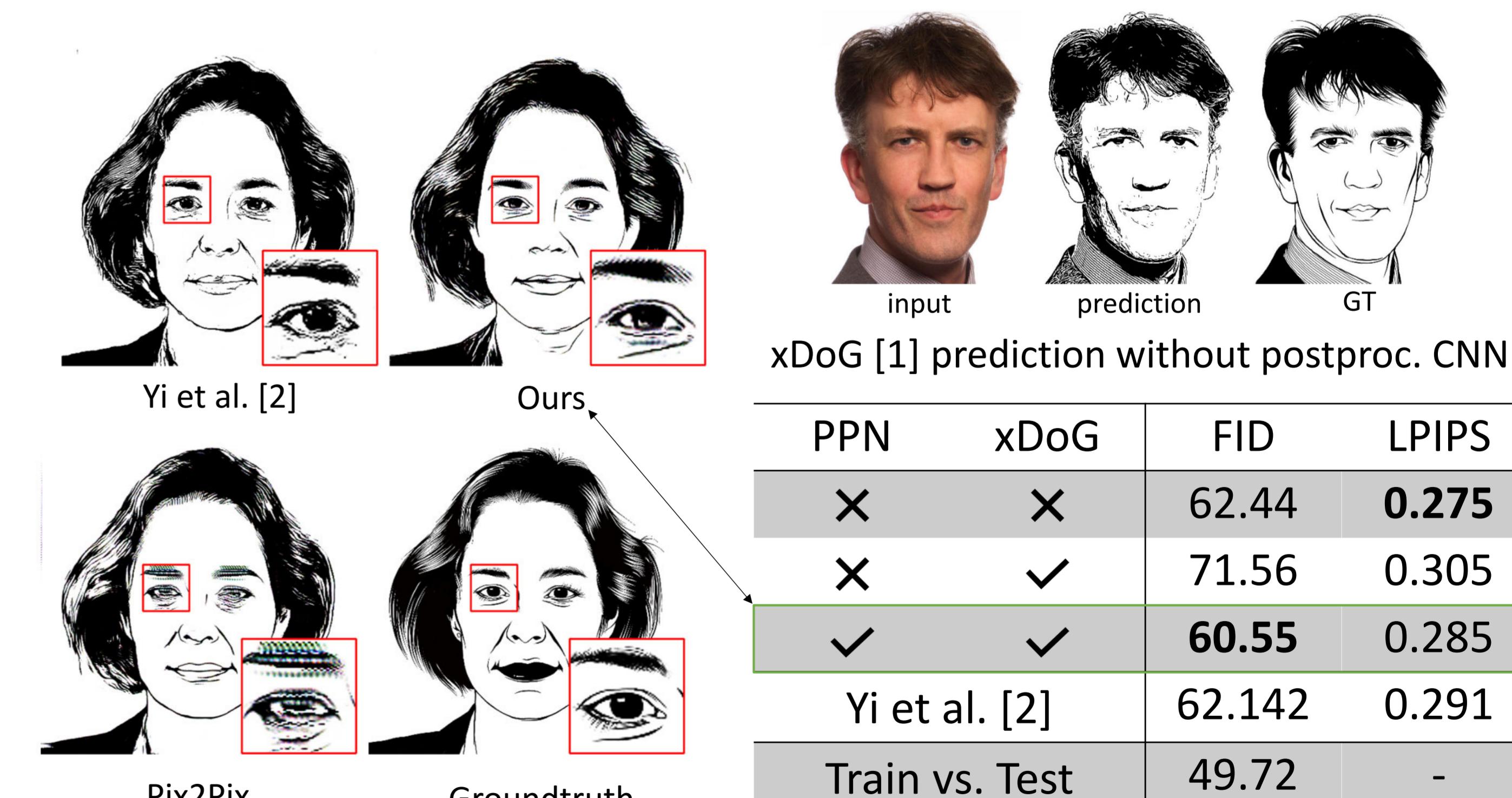
Parametric Style Transfer



style domain:	XDoG bw-drawing	Cartoon cartoon	Watercolor watercolor common	Oilpaint common
\mathcal{L}_S STROTSS	0.340	0.289	0.351	0.39
Our results	0.246	0.406	0.359	0.42
\mathcal{L}_C STROTSS	0.099	0.094	0.081	0.036
Our results	0.172	0.148	0.092	0.034
ℓ_1 Difference	0.188	0.136	0.007	0.021
			0.036	0.039

Ability of our implemented effect pipelines to match in-domain and arbitrary-domain (common) stylization results by a SOTA NST (STROTTS[3]).

Img2Img Translation on APDrawing



References:

- [1] Winnemöller et al., Advanced Image Stylization with eXtended Difference-of-Gaussians, NPAR 2011
- [2] Yi et al., APDrawingGAN: Generating Artistic Portrait Drawings from Face Photos with Hierarchical GANs, CVPR 2019
- [3] Kolkov et al., Style Transfer by Relaxed Optimal Transport and Self-Similarity, CVPR 2019