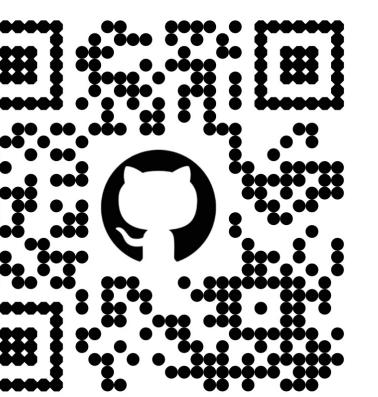


# SA-LUT: Spatial Adaptive 4D Look-Up Table for Photorealistic Style Transfer

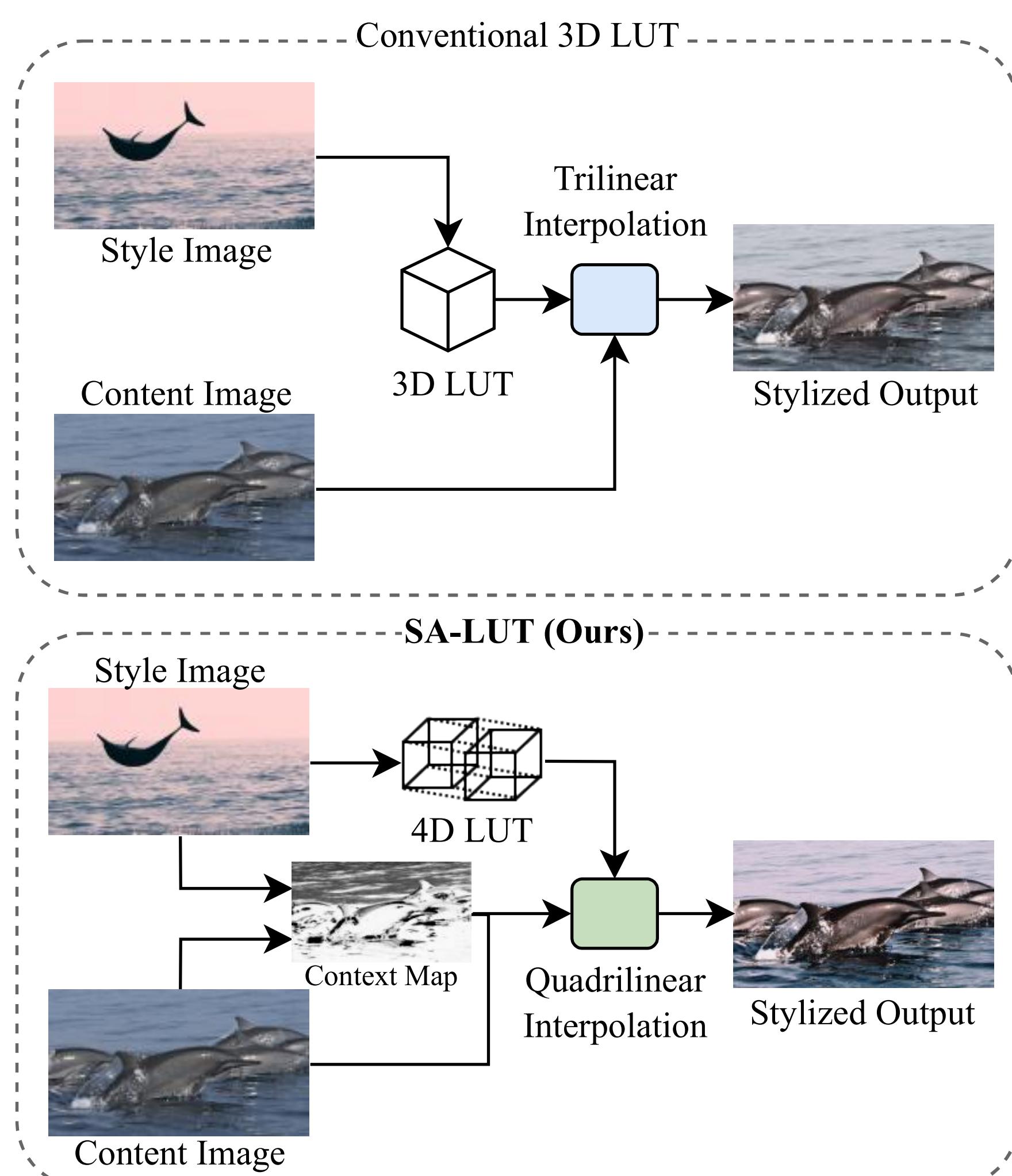
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## Highlight

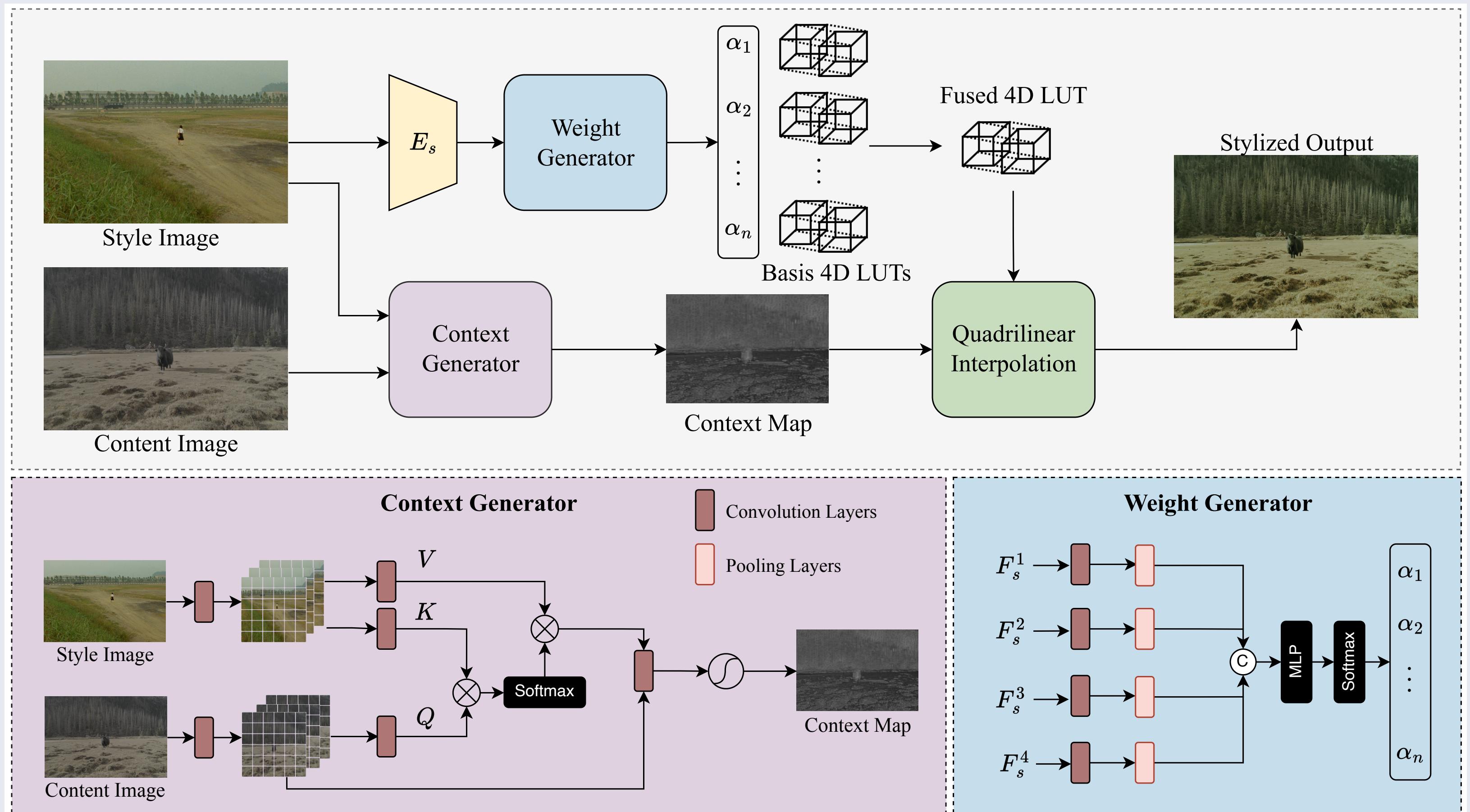
- **Style-guided color transformation with a context dimension**
- **Enabling region-aware grading.** **PST50 Benchmark:** the first PST benchmark with paired ground truth.
- **Efficient and Practical:** Strong quality (lower LPIPS, higher SSIM/PSNR while maintaining real time applicability).



## Challenge

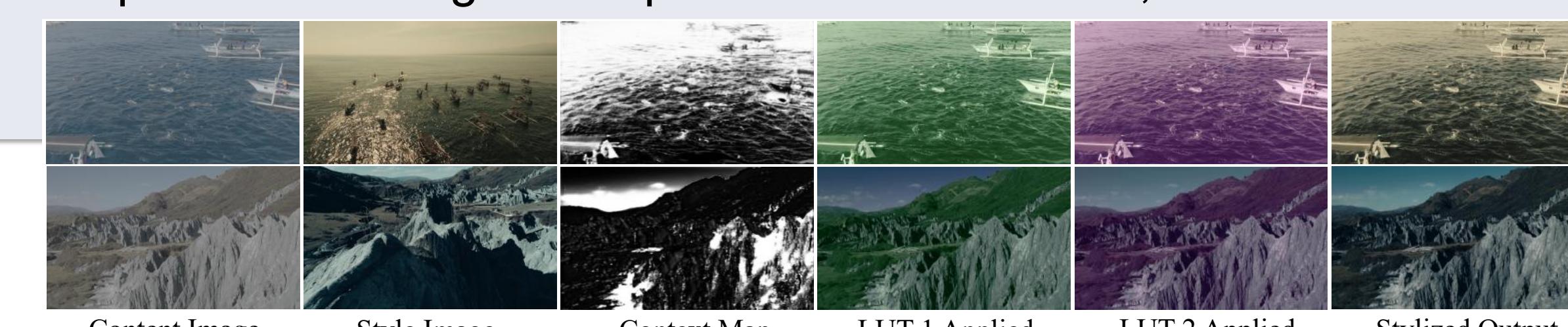
- Knowing *what* is the style to be transferred and *where* to apply it.
- Tradition 3D LUTs are content agnostic, learning based methods capture style but can be inefficient or introduce artifacts.
- Existing benchmark and datasets lack sufficient diversity and reliable ground truth for objective evaluation

## Method



**SA-LUT** fuses style-guided 4D LUT generation with a spatial context map via cross-attention.

- Multi-scale style features create a custom 4D LUT; context map enables region-specific color grading.
- Efficiency: Quadrilinear interpolation and log color space ensure real-time, artifact-free transformations.



## PST50

- 100 content-style image pairs from professional sources (50 for each partition)
- Featuring diverse content images in four categories: natural landscapes, human/cultural, architectural, and wildlife.
- Wide range of stylistic color variations.

Dataset	L* Dist	a* Dist	b* Dist
PST50 Paired	1.759	2.676	2.892
PST50 Unpaired	1.491	2.499	2.811
DPST [22]	1.491	2.477	2.558

## Results

Method	LPIPS ↓	PSNR ↑	SSIM ↑	H-Corr ↑	Inference Time (s)
AdaIN [10]	0.53	18.21	0.62	0.39	0.0499
NLUT [3]	0.36	20.59	0.80	0.33	16.1112 + 0.0003
Deep Preset [9]	0.32	23.42	0.84	0.41	<b>0.0002</b>
ModFlow [14]	0.28	20.13	0.85	0.33	0.0800
WCT <sup>2</sup> [26]	0.27	19.86	0.81	0.31	0.6600
Neural Preset [13]	0.19	23.03	0.89	0.44	N/A
<b>SA-LUT (Ours)</b>	<b>0.12</b>	<b>25.29</b>	<b>0.92</b>	<b>0.51</b>	0.2128 + 0.0100

