NamedCurves: Learned Image Enhancement via Color Naming

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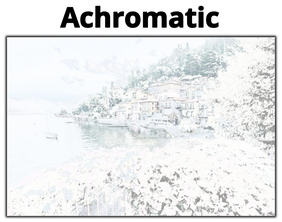
Project Page

Retouch images by color names, allowing easy adjustments of human concepts like the 'blue' of the sky.

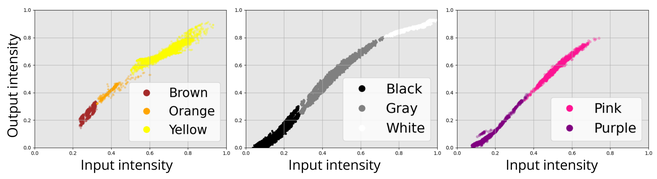
Background: Color Naming

Color Naming decomposes an image into 11-dimensional probability maps. Each value corresponds to the probability of belonging to a specific color name:



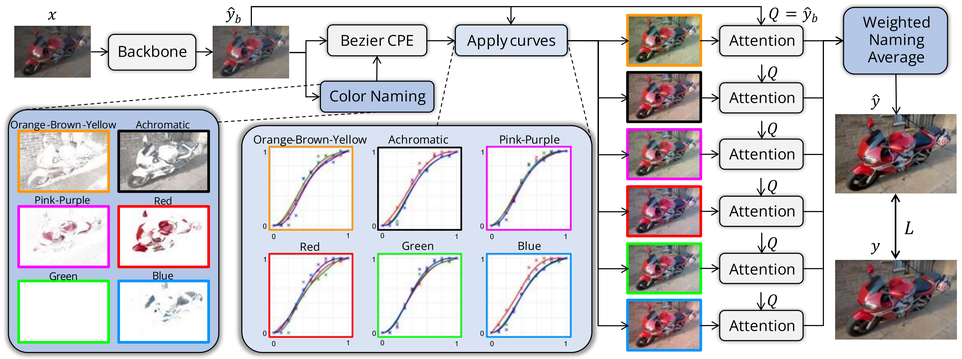
For the sake of visualization, we use different color maps for each color name, proportional to their probability.

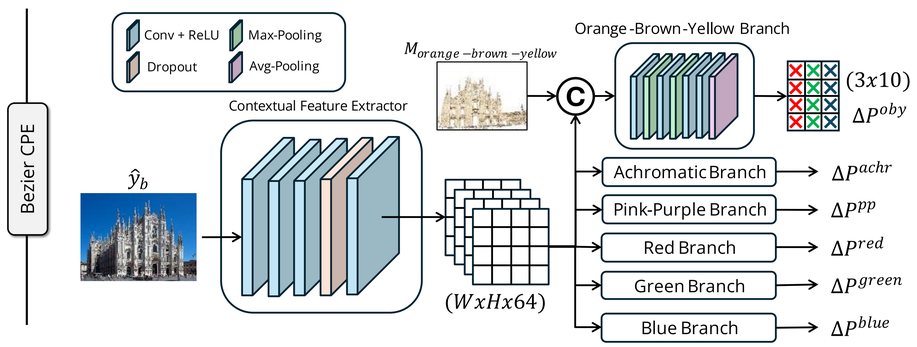
We blend the color names with similar hues, as our method aims to learn a curve that can be applied at all intensity levels:



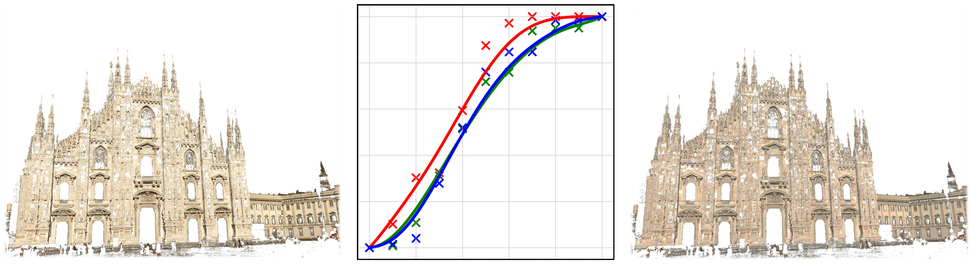
NamedCurves: our method

Our method globally adjusts the image by estimating a set of control points (×/×/×) that define RGB tone curves for each color name. The globally adjusted images are then fused using an attention-based mechanism and color naming probabilities.





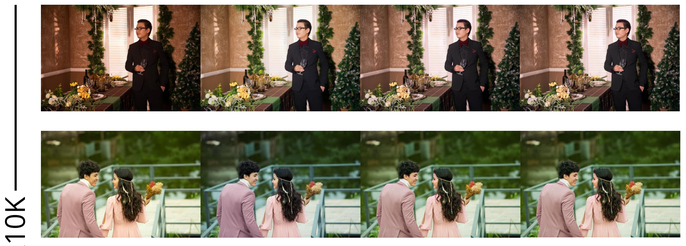
Orange-Brown-Yellow



**Showing the pixels with a probability >0.5 for the color name Orange-Brown-Yellow. We also display the RGB tone curves for this category and the retouched pixels.*

Experiments & Results

Method	PSNR ↑	SSIM ↑	LPIPS ↓	ΔE_{00} ↓	ΔE_{ab} ↓	Time (ms)
3DLUT	25.29	0.923	0.043	6.76	7.55	13
SepLUT	25.47	0.921	0.042	6.71	7.49	10
AdaInt	25.49	0.926	0.041	6.69	7.47	13
NamedCurves	**25.59**	**0.936**	**0.038**	**6.07**	**7.40**	26



Method	Expert A PSNR ↑	Expert A ΔE_{ab} ↓	Expert B PSNR ↑	Expert B ΔE_{ab} ↓	Expert C PSNR ↑	Expert C ΔE_{ab} ↓
HDRNet	23.93	8.70	23.96	8.84	24.08	8.87
3DLUT	25.64	6.97	24.70	7.71	25.18	7.58
SepLUT	26.28	6.59	25.23	7.49	25.59	7.51
AdaInt	26.33	6.56	25.40	7.33	25.68	7.31
NamedCurves	**26.81**	**6.48**	**25.91**	**7.18**	**25.69**	**7.27**

Adding Color Naming (*CN & WN-Avg*) into the architecure produces the largest boosts in performance.

Backbone	Curves	CN	Att.	WN-Avg	PSNR ↑	SSIM ↑	ΔE_{00} ↓	
	6	✓	✓	✓	23.40	0.912	8.87	
✓					23.74	0.916	8.68	
✓	1				24.09	0.921	7.53	
✓	6				24.24	0.922	7.50	+0.32 PSNR
✓	6	✓			24.56	0.926	7.07	+0.12 PSNR
✓	6	✓		✓	24.68	0.926	6.88	
✓	6	✓	✓		24.60	0.926	6.92	+0.31 PSNR
✓	6	✓	✓	✓	**24.91**	**0.927**	**6.60**	

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