Supplementary Materials for "DDColor: Towards Photo-Realistic Image Colorization via Dual Decoders"

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In this supplementary document, we provide the following materials to complement the main manuscript:

- Detailed network architecture of DDColor;
- Additional qualitative results;
- Additional ablation study and visual results;
- Runtime analysis;
- More results on legacy black and white photos.

1. Detailed Network Architecture

We list the detailed architecture of DDColor with a ConvNeXt-T[5] backbone in Table 1. The resolution of the input image is 256×256.

2. Additional Qualitative Results

Here, we show more qualitative comparisons with previous methods on ImageNet[6] validation in Figure 3. As in the main paper, we compare our method with DeOldify [1], Wu *et al*. [8], ColTran [4], CT2 [7], BigColor [3] and ColorFormer [9]. The visual comparisons on COCO-Stuff[2] and ADE20K[10] are also presented in Figure 4 and 5, respectively. It can be seen that our method achieves more natural and vivid results in diverse scenarios, and produces more semantically consistent colors for a variety of objects.

3. Additional Ablation Study and Visual Results

We build four variants of our model with different ConvNeXt[5] backbones, as detailed in Table 2. As can be seen, the backbone plays a key role in image colorization. We choice ConvNeXt-L due to its superior performance.

More visual results on ablations of color decoder, colorfulness loss, and different visual feature scales are shown in Figure 1 and Figure 2.

4. Runtime Analysis

Our method colorizes grayscale images of resolution 256×256 at 25 FPS / 21 FPS using ConvNeXt-T / ConvNeXt-L as the backbone. The inference speed of our end-to-end method is ×96 faster than the previous transformer-based method [4]. All tests are performed on a machine with an NVIDIA Tesla V100 GPU.

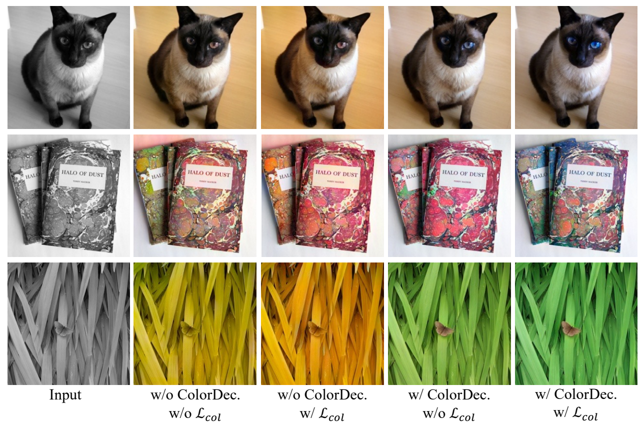


Figure 1. **More visual results of ablation on color decoder and colorfulness loss.**

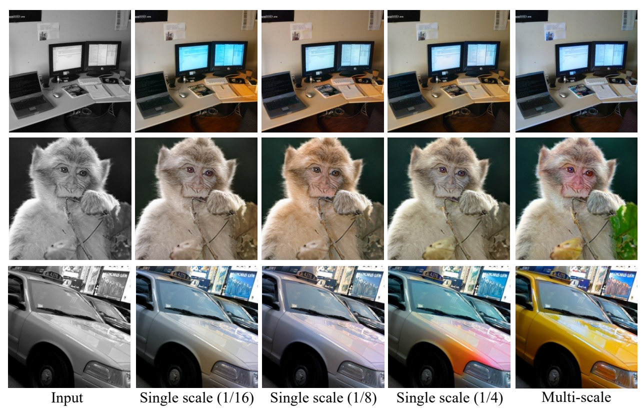


Figure 2. **More visual results of ablation on different feature scales.**

5. More Results on Legacy Black and White Photos

More colorization results on legacy black and white photos are shown in Figure 6, demonstrating the generalization capability of our method.

	Output size	DDColor
Stage 1	64×64×96	Conv. 4×4, 96, stide 4 [Depthwise Conv. 7×7, 96 Conv. 1×1, 384 Conv. 1×1, 96] × 3
Stage 2	32×32×192	[Depthwise Conv. 7×7, 192 Conv. 1×1, 768 Conv. 1×1, 192] × 3
Stage 3	16×16×384	[Depthwise Conv. 7×7, 384 Conv. 1×1, 1536 Conv. 1×1, 384] × 9
Stage 4	8×8×768	[Depthwise Conv. 7×7, 768 Conv. 1×1, 3072 Conv. 1×1, 768] × 3
Stage 5	16×16×512	PixelShuffle, scale 2 Concat feat. from Stage 3 Conv. 3×3, 512
Stage 6	32×32×512	PixelShuffle, scale 2 Concat feat. from Stage 2 Conv. 3×3, 512
Stage 7	64×64×256	PixelShuffle, scale 2 Concat feat. from Stage 1 Conv. 3×3, 256
Stage 8	256×256×256	PixelShuffle, scale 4
Color Dec.	256×100	Conv. 1×1, 256 feat. from Stage 5 Conv. 1×1, 256 feat. from Stage 6 Conv. 1×1, 256 feat. from Stage 7 [Conv. 1×1, 256×3 Cross-attn. Self-attn. Conv. 1×1, 2048 Conv. 1×1, 256] × 9
Stage 9	256×256×100	Dot Product feat. from Stage 8 & feat. from Color Dec.
Stage 10	256×256×2	Concat input Conv. 1×1, 2

Table 1. **Detailed architecture of DDColor**.

Model Name	Backbone	FID↓	CF↑	ΔCF↓	Params
DDColor-T	ConvNeXt-T	4.38	37.66	0.55	55.0M
DDColor-S	ConvNeXt-S	4.25	38.10	0.11	76.6M
DDColor-B	ConvNeXt-B	4.06	38.15	0.06	116.2M
DDColor-L	ConvNeXt-L	**3.92**	**38.26**	**0.05**	227.9M

Table 2. **Backbone variants.** We build four variants of our DDColor based on backbones of different sizes. The overall performance improves with the increase of the scale of the backbone network.

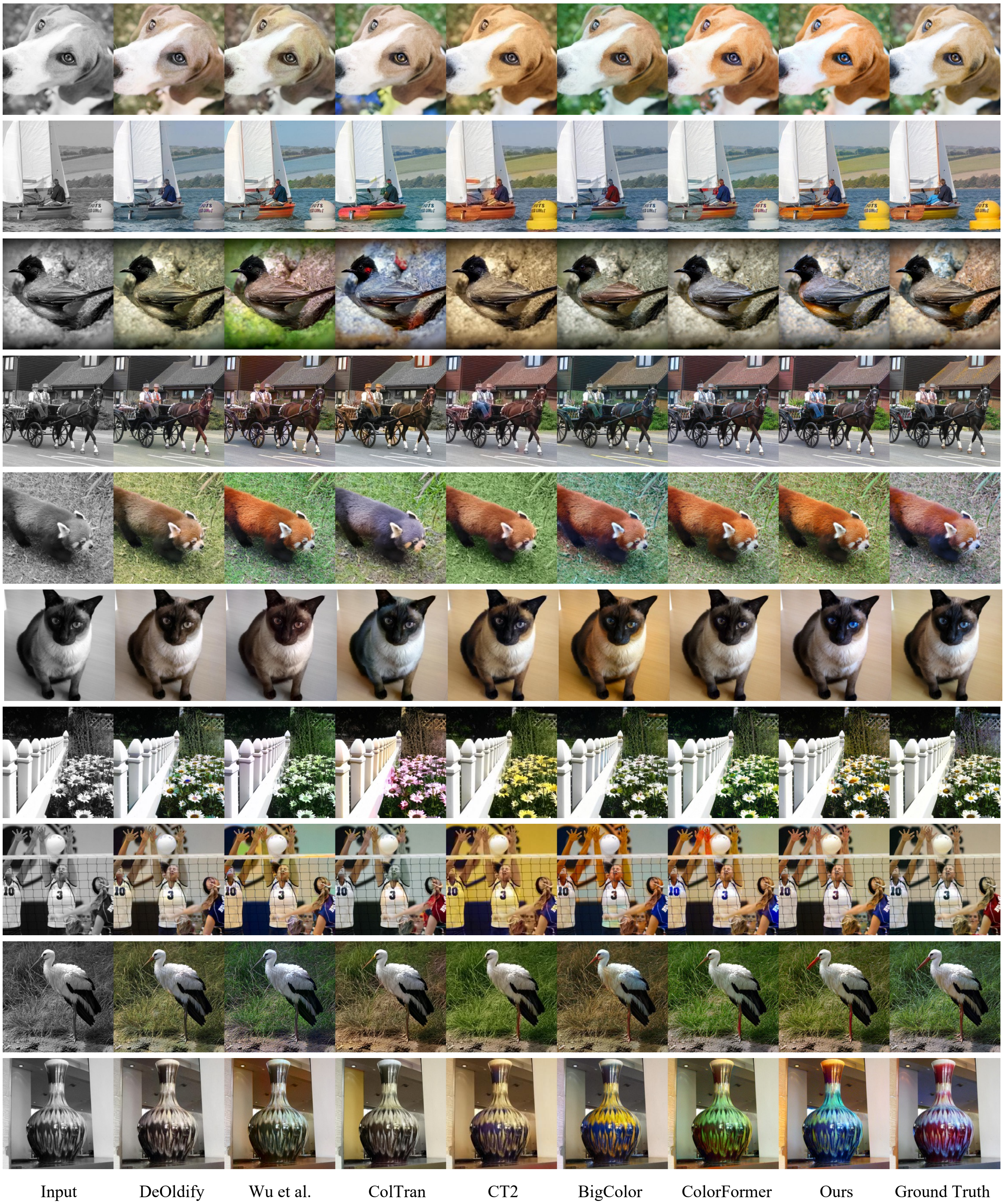
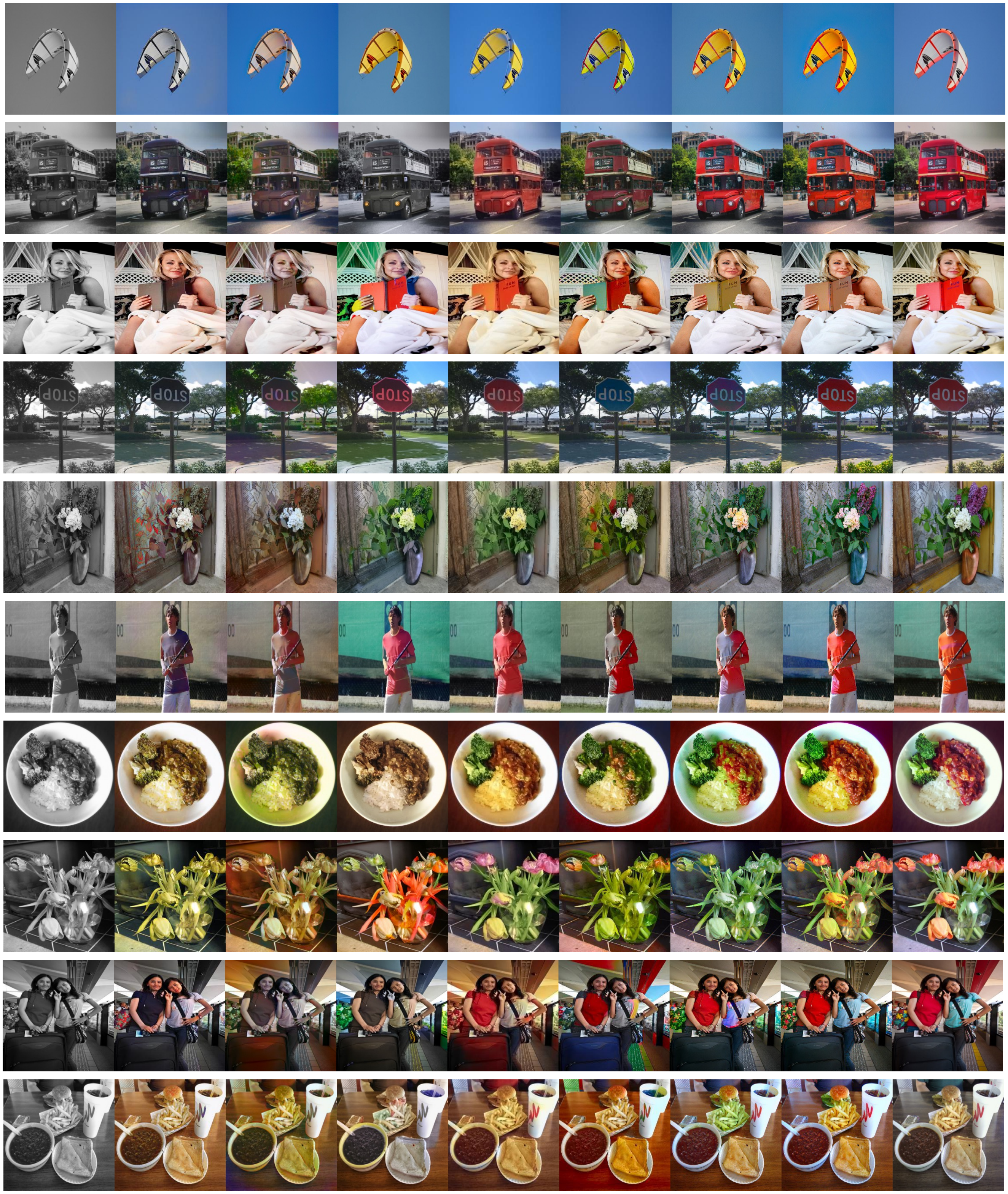


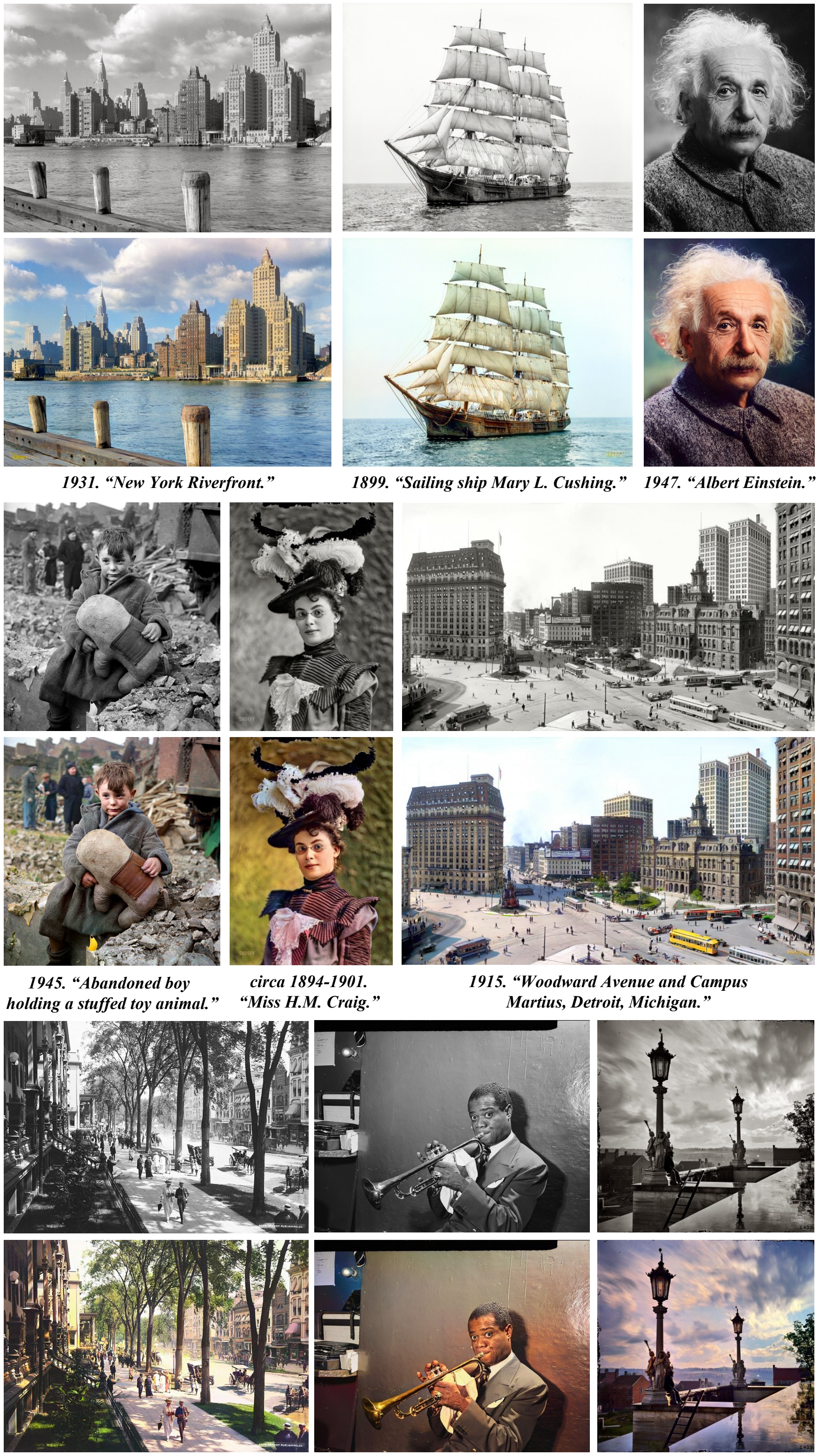
Figure 3. **More qualitative comparisons with previous colorization methods on ImageNet.**



Input DeOldify Wu et al. ColTran CT2 BigColor ColorFormer Ours Ground Truth

Figure 4. **Qualitative comparisons with previous colorization methods on COCO-Stuff.**

Figure 5. **Qualitative comparisons with previous colorization methods on ADE20K.**



1931. "New York Riverfront." *1899. "Sailing ship Mary L. Cushing."* *1947. "Albert Einstein."*

1945. "Abandoned boy holding a stuffed toy animal." *circa 1894-1901. "Miss H.M. Craig."* *1915. "Woodward Avenue and Campus Martius, Detroit, Michigan."*

circa 1900-1915. "Broadway at the United States Hotel Saratoga Springs." *1946. "Louis Armstrong practicing in his dressing room."* *1864. "View from the Capitol at Nashville, Tennessee."*

Figure 6. **More results on legacy black and white photos.**

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