

Supplemental Material: Joint Optimization of Camera Model and Deep Neural Network for Image Recognition

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1. Optimized parameters of camera models with other classification networks

The optimized parameters of the camera model when the classification networks are ViT/S-16 or SE-ResNet50 are presented in Eqs. (1)–(8). Fig. 1 and Fig. 2 support the results of Section 5.2. “Leaf-R, G, B” and “Flower-R, G, B” denote the optimized camera models for the leaf and flower datasets, respectively. “Canon 500D-R, G, B” denotes the baseline, Canon 500D. γ and M denote the parameters of the power function and CCM described in Section 3.2, respectively.

The gamma parameter γ and CCM M optimized with ViT/S-16 for the flower dataset,

$$\gamma = 0.5082, \quad (1)$$

$$M = \begin{pmatrix} 6.6363 & -3.1685 & 1.7187 \\ -0.2704 & 1.8864 & -1.2406 \\ -0.0951 & -0.5354 & 1.8670 \end{pmatrix}. \quad (2)$$

The gamma parameter γ and CCM M optimized with ViT/S-16 for the leaf dataset,

$$\gamma = 0.5766, \quad (3)$$

$$M = \begin{pmatrix} 6.6355 & -3.1765 & 1.7174 \\ -0.2537 & 1.8942 & -1.2238 \\ -0.0812 & -0.5211 & 1.8810 \end{pmatrix}. \quad (4)$$

The gamma parameter γ and CCM M optimized with SE-ResNet50 for the flower dataset,

$$\gamma = 0.4807, \quad (5)$$

$$M = \begin{pmatrix} 6.6523 & -3.1228 & 1.7537 \\ -0.2983 & 1.9169 & -1.2115 \\ -0.0895 & -0.5216 & 1.8795 \end{pmatrix}. \quad (6)$$

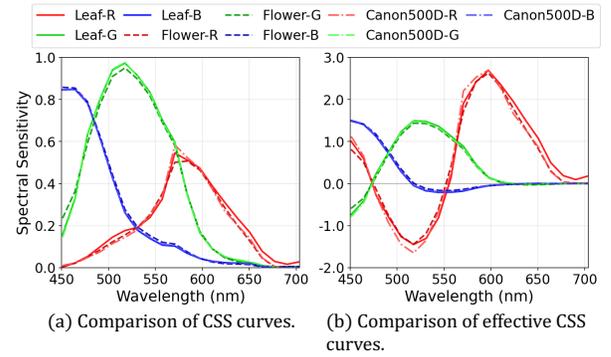


Figure 1. CSS optimized with ViT/S-16. Comparison of CSS curves (a) and their corresponding effective CSS considering a CCM (b). The effective CSS is a linear combination of the CSS and CCM.

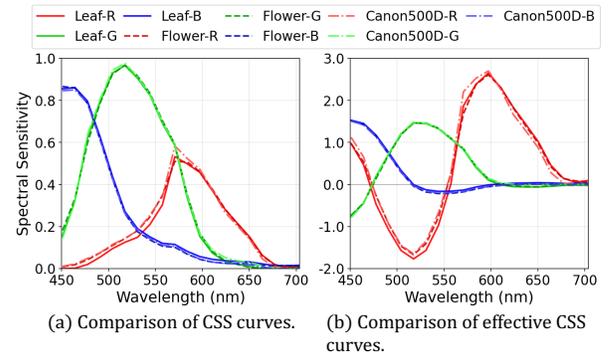


Figure 2. CSS optimized with SE-ResNet50. Comparison of CSS curves (a) and their corresponding effective CSS considering a CCM (b). The effective CSS is a linear combination of the CSS and CCM.

The gamma parameter γ and CCM M optimized with SE-ResNet50 for the leaf dataset,

$$\gamma = 0.5029, \quad (7)$$



(a) Optimized with ViT-S/16 for the flower dataset. (b) Optimized with ViT-S/16 for the leaf dataset. (c) Optimized with SE-ResNet50 for the flower dataset. (d) Optimized with SE-ResNet50 for the leaf dataset.

Figure 3. Visual comparison of images generated by different camera models optimized under different setups.

$$M = \begin{pmatrix} 6.6320 & -3.1617 & 1.7494 \\ -0.2331 & 1.9069 & -1.2231 \\ -0.0940 & -0.5336 & 1.8681 \end{pmatrix}. \quad (8)$$

2. Image examples generated by camera models with other classification networks

Figure 3 presents simulated images captured using these optimized camera models. Figure 3a and Fig. 3b show example images generated by camera models optimized with ViT-S/16 for the flower and leaf datasets, respectively. Similarly, Fig. 3c and Fig. 3d are example images generated by camera models optimized with SE-ResNet50.