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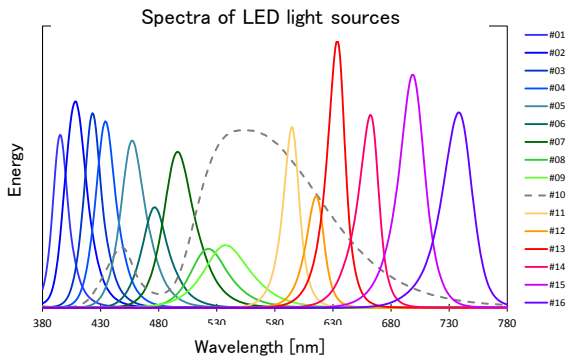
Illumination-based color enhancement

- Color enhancement by optimizing illumination spectrum -

Abstract

We propose a method to enhance color saturation while preserving the color appearance of white by controlling the spectral power distribution (SPD) of illumination. A color chart is used to design the SPD of illumination, which enables us to enhance several colors at the same time. In experiments, a sixteen-color LED lighting system was used as a light source. The intensity of each colored light can be modulated and is determined using the three color patches of the X-Rite ColorChecker. The color checker and multicolor wood-block prints were used to evaluate the color enhancement. The color distributions of these objects before and after changing the SPD of illumination were compared on a chromaticity diagram. Results show that the selected three colors are well enhanced with metameric white and the color balance under daylight preserved.

Determine weights (brightness) of each LED to maximize color saturation of red, green, and blue patches while preserving metameric white.



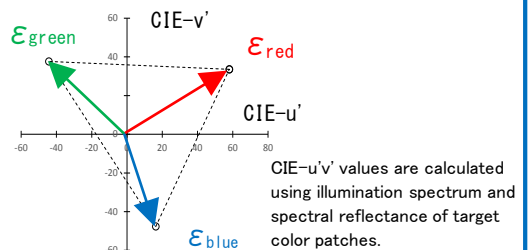
Proposed method

Determine weights of each LED to maximize ϵ :

$$\epsilon = (\epsilon_{red} + \epsilon_{green} + \epsilon_{blue})$$

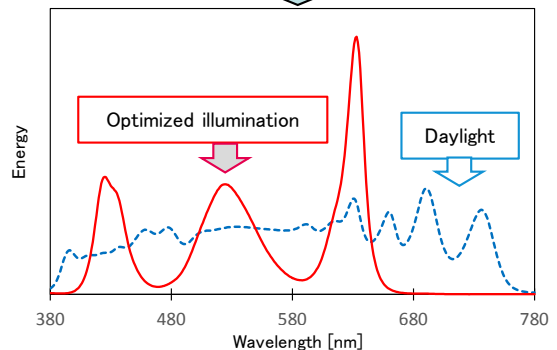
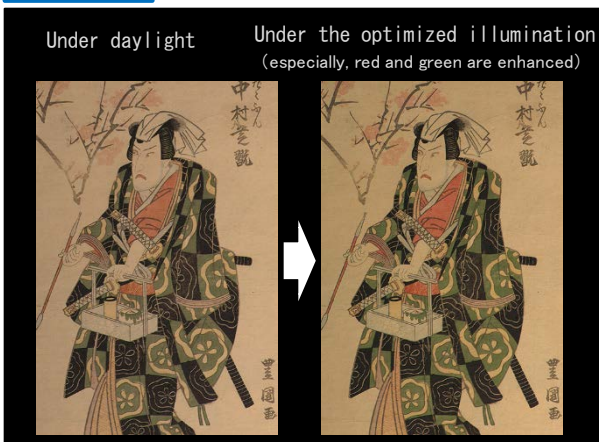
Condition of constraint

For white, $\Delta u'v' \leq 0.01$ and CIE-Y variation is less than 1%.



Experiments

Color degraded wood-block print (printed in the 1800s.)



Color saturation of red, green, and blue patches were enhanced 30%, 59%, and 13%, respectively, on CIE-a*b* color space

Reference

- [1] M. Tsuchida, K. Hiramatsu, K. Kashino, "Designing Spectral Power Distribution of Illumination with Color Chart to Enhance Color Saturation," in *Proc. IS&T 24th Color and Imaging conference (CIC24)*, pp. 278-282, 2016.

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