

Uniform Color Spaces Based on CIECAM02 and IPT Color Difference Equations

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Color difference equations based on the CIECAM02 color appearance model¹ and IPT color space² have been developed to fit experimental data from RIT.^{3,4} These color equations are not Euclidean, in similar fashion to CIE94 and CIEDE2000. In this research, we have derived Euclidean color spaces^{5,6,7} based on these CIECAM02 and IPT color difference equations so that color difference can be calculated as a simple color distance. First, the Euclidean line element^{8,9,10} was established, from which terms were derived for the new coordinates of lightness, chroma, and hue angle. Then, several common performance factors^{11,12,13} (e.g., CV and PF/3) and the statistical F test¹⁴ were used to test how well the new Euclidean color spaces fit the experimental data. The results show that CIECAM02 Euclidean color space has nearly the same performance factors as CIECAM02 color difference equation. Also, from the statistical point, CIECAM02 Euclidean color space was significantly better than the CIECAM02 color difference equation. Conversely, the IPT Euclidean color space performed poorer than the IPT color difference equation. The main reason is that the line element for the lightness dimension, I, could not be directly calculated and an approximation was used. To resolve this problem, a new IPT color difference equation should be designed such that line elements can be established directly.

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