

Expanding the gamut of color images with daylight fluo inks

**Daylight fluorescent colorants**

Daylight fluorescent colorants are widely used for special inks, highlighting markers, warning devices, toys and optical brighteners.

**Spectral reflectance of daylight fluorescent colorants**

![Spectral reflectance of the daylight fluorescent yellow](image1)

Figure 1. Spectral reflectance of the daylight fluorescent yellow \( y_f \), magenta \( m_f \), red \( r_f \) and green \( g_f \) colors under the D65 illuminant together with the corresponding classical colorants.

**Goals**

- Combine classical cmyk inks with the daylight fluorescent \( m \), magenta and yellow \( y \) inks
- Get new strongly saturated and bright colors
- Enhance image parts by increasing both chroma and brightness
- Provide tools for designers, such as chroma expansion factors and a preview of the printable gamut expanded image

**Fluorescent and classical ink gamuts**

The fluorescent ink gamut \( G_f \) is larger than the classical cmyk gamut \( G_{cmyk} \) by 56%.

It also shows colors located beyond the display sRGB \( G_{sRGB} \) gamut boundary.

![Comparison between the classical cmyk gamut](image2)

Figure 2. Comparison between the classical cmyk gamut \( G_{cmyk} \) and the fluorescent ink gamut \( G_f \) and between the \( G_f \) gamut and the display sRGB gamut \( G_{sRGB} \).

**Gamut expansion**

Map input sRGB colors to colors beyond the sRGB gamut by increasing linearly and possibly non-linearly their chroma

![Gamut expansion scheme mapping the input display sRGB gamut to the fluorescent ink gamut](image3)

Figure 3. Gamut expansion scheme mapping the input display sRGB \( G_{sRGB} \) gamut to the fluorescent ink gamut \( G_f \).

\[
C_{\text{destExp}} = \alpha \cdot C_{\text{sRGB}} + \left( C_{\text{source}} - \alpha \cdot C_{\text{sRGB}} \right) \left( C_{\text{destNonExp}} - \alpha \cdot C_{\text{sRGB}} \right) (1)
\]

**Color continuity between expanded and non-expanded image parts**

Continuity of colors is ensured by a spatial interpolation map with values varying between 1 and 0, see Fig. 4. The final colors are obtained by interpolation between the gamut mapped colors \( C_{\text{destExp}} \) with user-defined gamut expansion parameters and the non-expanded destination colors \( C_{\text{destNonExp}} \) located outside the selected image parts (Eq. 2).

\[
C_{\text{dest}} = C_{\text{destExp}} \cdot M(x,y) + C_{\text{destNonExp}} (1-M(x,y)) (2)
\]

**Results**

- Produce artistic images with bright and saturated colors, e.g. lizard in Fig. 5.
- Reinforce human attention on a product, e.g. the watch of Fig. 6

![Photograph of a lizard image printed with cmyk inks only (left image) and gamut expanded with the \( G_f \) fluorescent ink gamut (right image)](image4)

Figure 4. Spatial interpolation map of an arbitrary selection (red line)

![Photograph of an advertising image printed with classical cmyk inks only (left image) and of the same printed image where the watch has been gamut expanded with the \( G_f \) gamut.](image5)

Figure 6. Photograph of a lizard image printed with cmyk inks only (left image) and gamut expanded with the \( G_f \) fluorescent ink gamut (right image), see http://bsp.epfl.ch/files/content/sites/bsp/files/shared/gallery/PosterLSPPRResDay2012.pdf.

![Photograph of an advertising image printed with classical cmyk inks only (left image) and of the same printed image where the watch has been gamut expanded with the \( G_f \) gamut.](image6)

Figure 7. From left to the right image, the yellow, daylight fluorescent yellow, magenta and daylight fluorescent magenta ink layers of the gamut expanded watch of image shown in Fig. 5.

**Further publications**


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