Color Coordinate Transformation Tutorial Exercise

Exercise

The coordinate transformation between RGB and YCbCr color spaces is ruled by the following equations:

$$\begin{bmatrix} Y \\ Cr \\ Cb \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ 0.500 & -.0418 & -0.081 \\ -0.169 & -0.331 & 0.500 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix},$$

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1.000 & 1.403 & 0.000 \\ 1.000 & -0.715 & -0.344 \\ 1.000 & -1.000 & 1.772 \end{bmatrix} \begin{bmatrix} Y \\ Cr \\ Cb \end{bmatrix}.$$

1. With a dynamic range of 10-bit, RGB values are in the range $[0, 1023]$. What is the range of the corresponding YCrCb values?

2. Are all the values of the above estimated range valid RGB values in the range $[0, 1023]$?