Q3 (iii) Why RGB not used in SOTA models ?

Though RGB is the simplest color model. But other color models often have significant advantage over it, eg:

① RGB space (encoded in 3 ~~bit~~ bytes) → only represents 40% of the colors perceivable to human eye. CIE XYZ model handles all the visible colors.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \frac{1}{0.17697} \begin{bmatrix} 0.49 & 0.31 & 0.2 \\ 0.17697 & 0.8124 & 0.01063 \\ 0 & 0.01 & 0.99 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

X, Y, Z → red stimulation, luminance, blue stimulation

② CIEL*a*b* model also takes into consideration of different responsiveness of diff con cells → better represents human perception

CIE L*u*v* handles images in natural scene better (due to having the notion of "lightness".)

Both of these outperform RGB in terms of accuracy (Wilson Castro ; MP. Rico Fernández a). All these CIE L models are also Device Independent, unlike RGB.

③ Phychological models : (HSL, HSV, HSI)

HSV works better than RGB for non-ideal lighting condition (ie. dim vs bright illumination)

④ $I_1I_2I_3$ model introduced by MICC is invariant to highlights, $C_1C_2C_3$ model invariant to shadowing effects

Also, if the colourization model is regression based, as discussed in Q2(iv) → it will output desaturated (dull, dim) images (gray-ish, not colorful)