

Assignment 1 - Computer Vision

Original Image:



Answer 1) a) Gray Nearest Neighbor Resampling output size = 1000*1500:



For size = 500*800:



b) Bonus Question: Tried the bilinear interpolation need to improvise on it.

Answer 2)

a) Gray Dithering Output with threshold 1:



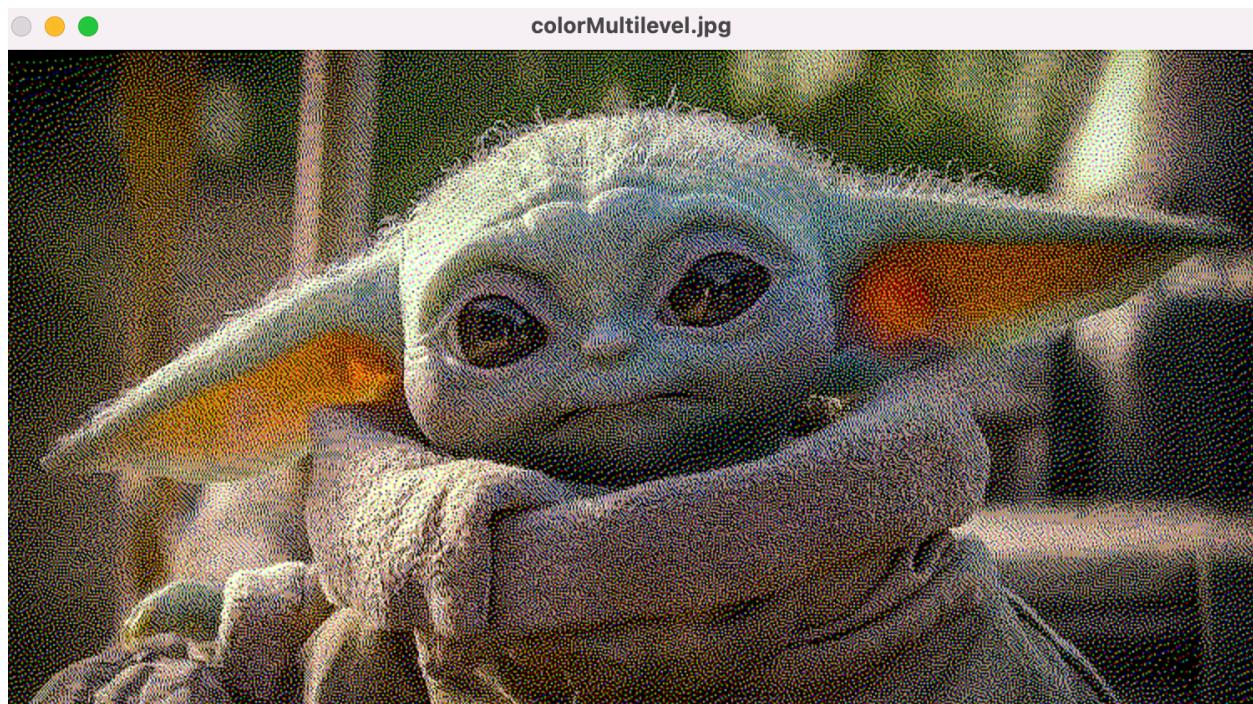
b) Gray Multilevel Dithering Output with levels [0, 85, 170, 255]:



With less levels and shorter range of levels, the image gets unclear and stippling is more obvious: (levels - [50, 85, 155])



c) (Bonus Question) Color Multilevel Dithering Output:



Answer 3)

Assignment - 1 Question 3 - Color Space Conversion

a) Given a range of RGB components 0 to 255

$$R = 200$$

$G = 25 \rightarrow$ some shade of purple

$$B = 180$$

To find \rightarrow HSI equivalent

Step 1 \rightarrow Normalize $R = \frac{200}{255}, G = \frac{25}{255}, B = \frac{180}{255}$

$$\text{Step 2} \rightarrow \text{Intensity} = \frac{R+G+B}{3} = \frac{200+25+180}{3} = \frac{405}{3} = 135$$

$$\Rightarrow \text{Intensity} = 0.5294$$

$$\text{Step 3} \rightarrow \text{Compute } \cos H = \frac{2R-G-B}{\sqrt{(R-G)^2 + (R-B)(G-B)}} \text{ for Hue.}$$

$$\Rightarrow \cos H = \frac{2 \times 200 - 25 - 180}{255} = \frac{400 - 25 - 180}{255} = \frac{400 - 25 - 180}{255} = \frac{2 \sqrt{(200-25)^2 + (200-180)(25-180)}}{255}$$

$$\Rightarrow \cos H = \frac{195}{2 \sqrt{27525}} = 0.5876 \Rightarrow H = 54.013^\circ$$

But here, $B > G \rightarrow H$ must be greater than 180°

$$\therefore H = 360 - 54.013 = 305.987^\circ \leftarrow \text{Hue}$$

$$\text{Step 4} \rightarrow \text{Compute for Saturation} \rightarrow S = 1 - \frac{3}{R+G+B} \cdot \min(R, G, B)$$

$$\Rightarrow S = 1 - \frac{3}{200+25+180} \times \frac{25}{255} = 1 - \frac{3 \times 25}{405} = 1 - \frac{15}{81} = 0.7058$$

$$\Rightarrow \text{Saturation} = 0.7058$$

b) Given: Hue = 240°

Saturation = 1

Intensity = 0.2

To find \rightarrow RGB equivalent

1) By the RGB cube, we see that a color with hue $\rightarrow 240^\circ \Rightarrow$ it is in the blue sub-triangle

2) Since saturation = 1 \Rightarrow the R, G, B point lies on the edge of triangle
 \therefore The color is fully saturated blue
 $\Rightarrow G=0 \& R=0$

3) We also know that

$$\text{Intensity} = \frac{R+G+B}{3} = 0.2$$

$$\Rightarrow \frac{0+0+0}{3} = \frac{0+0+B}{255} = 0.2$$

$$\Rightarrow B = 0.2 \times 3 \times 255 = 153$$

$$\therefore R=0, G=0, B=153$$

$$\text{OR } R, G, B = (0, 0, 153) //$$