



COMPUTER VISION

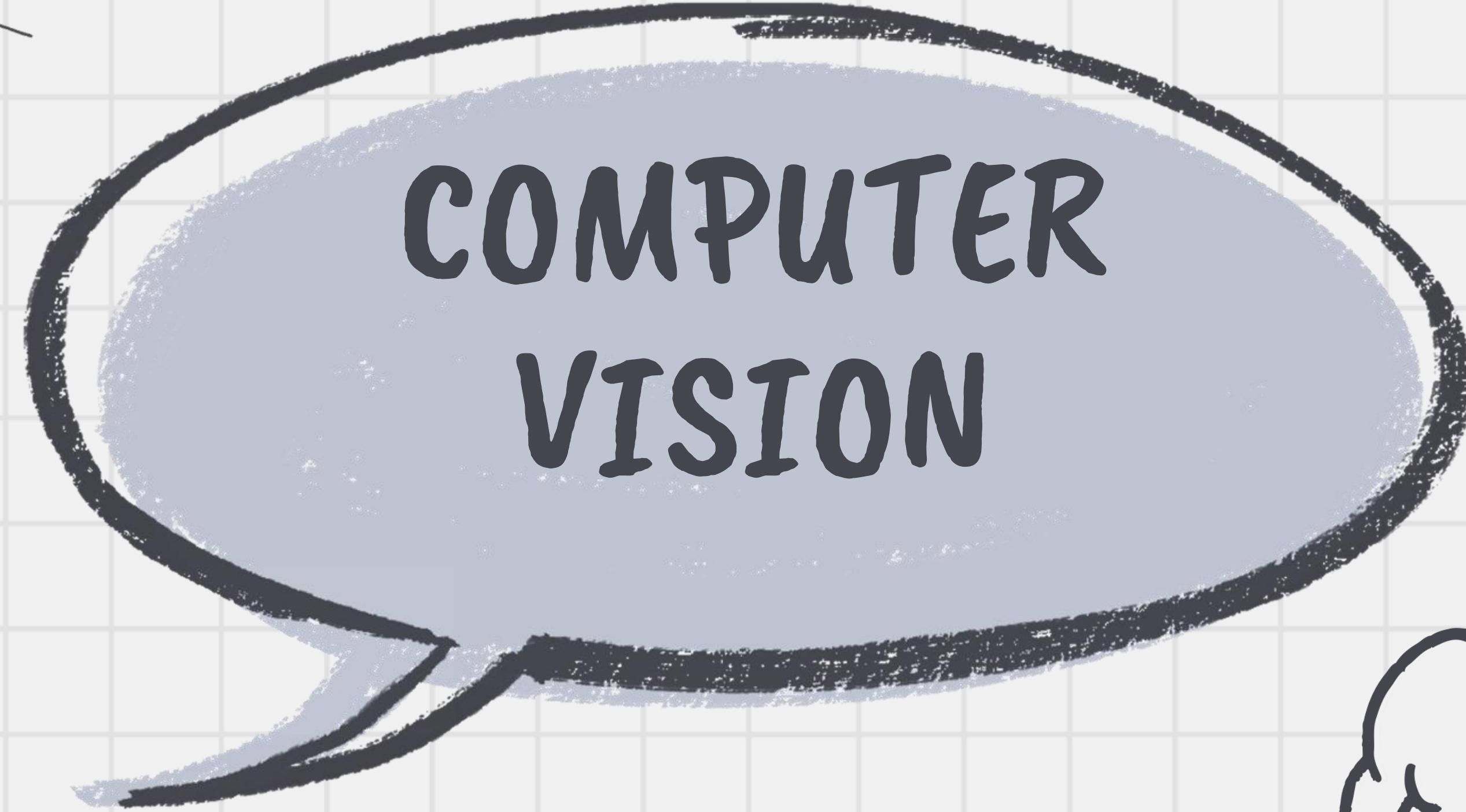
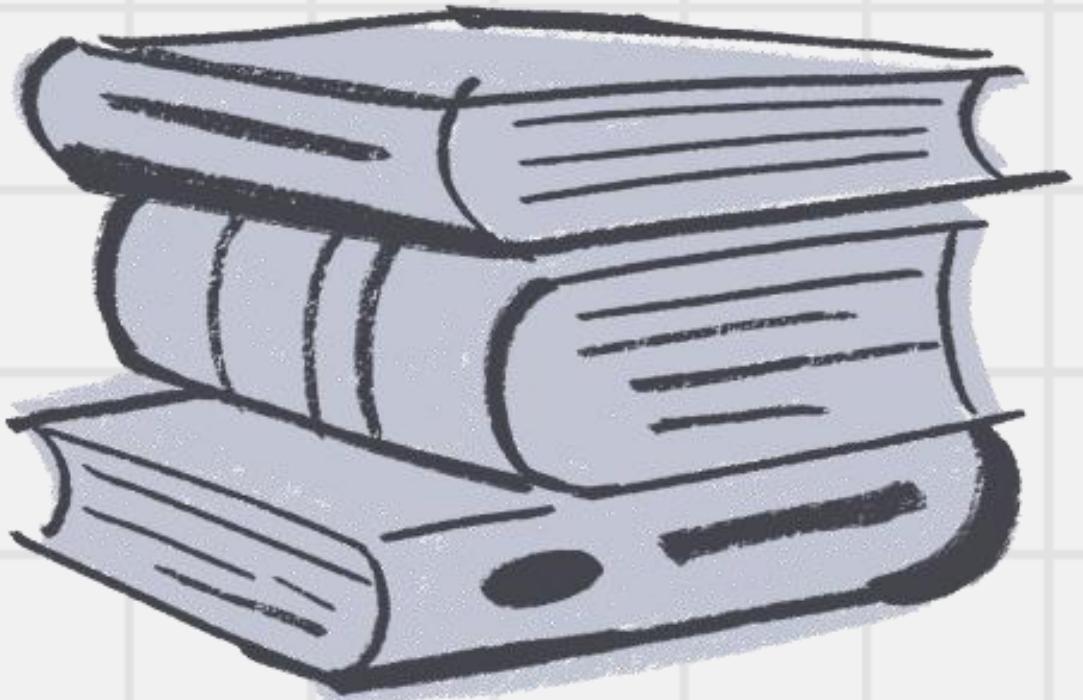


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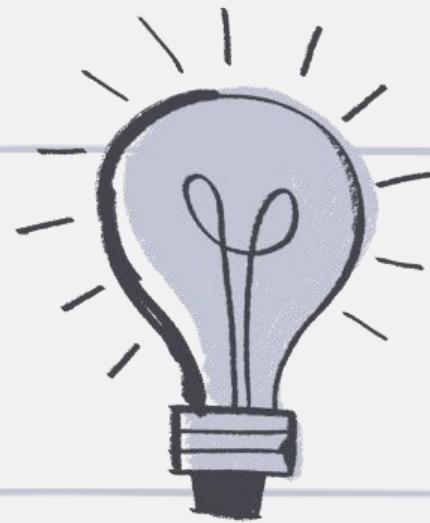
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01

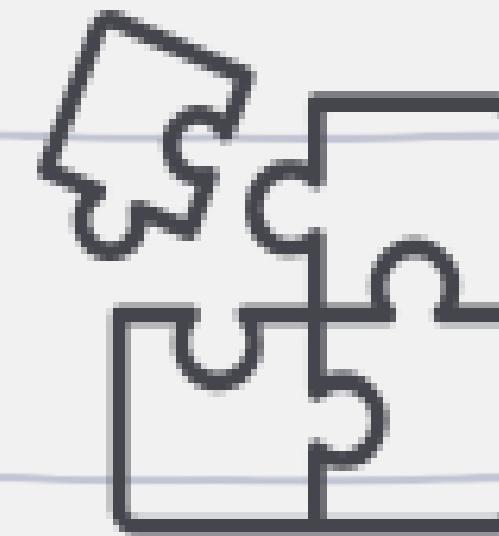
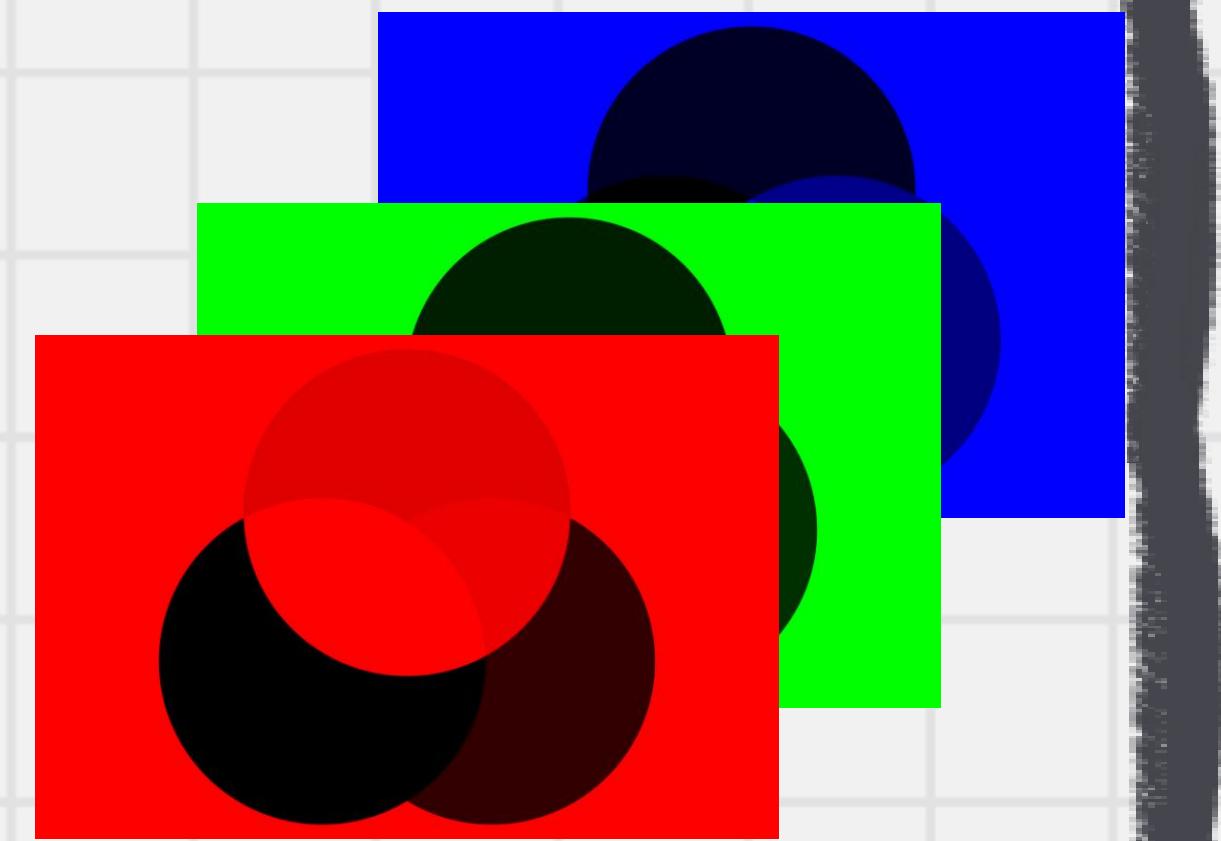
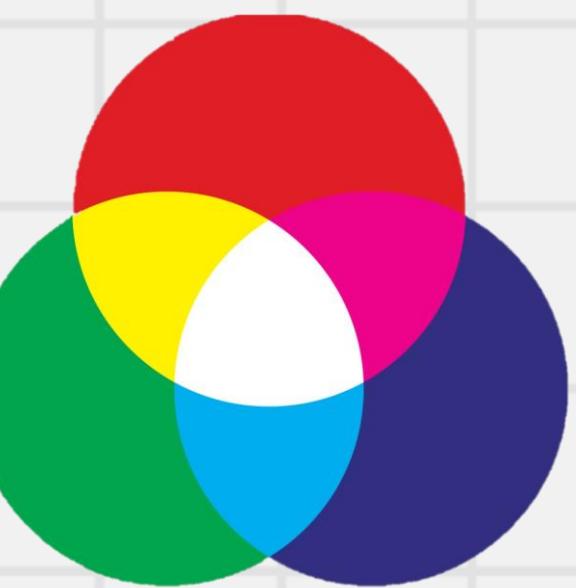


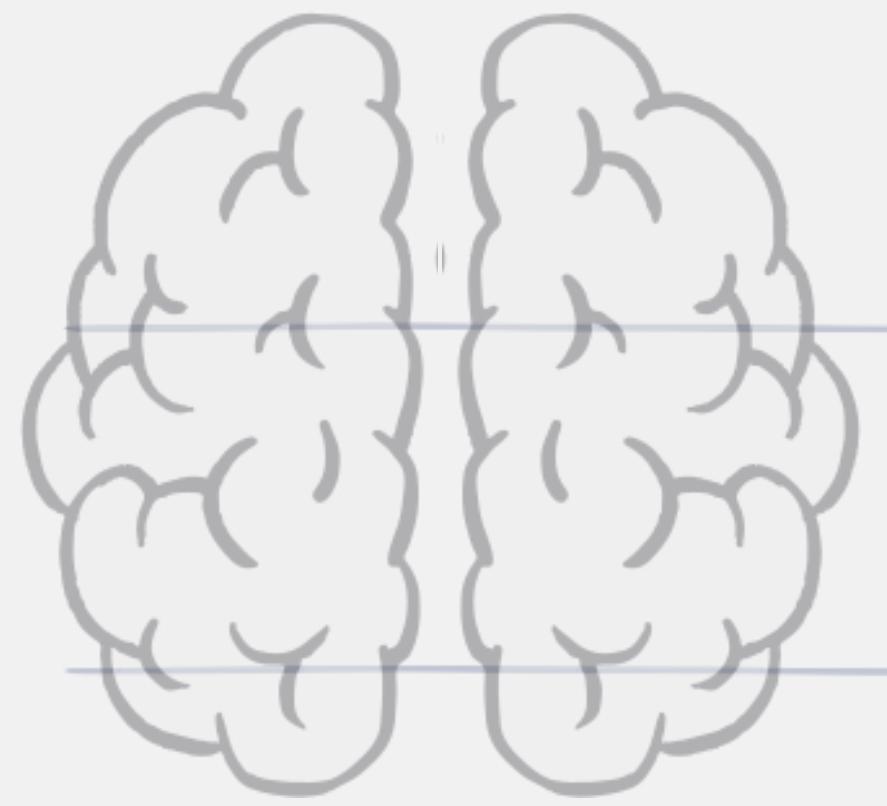
Image Formats

What is image format?

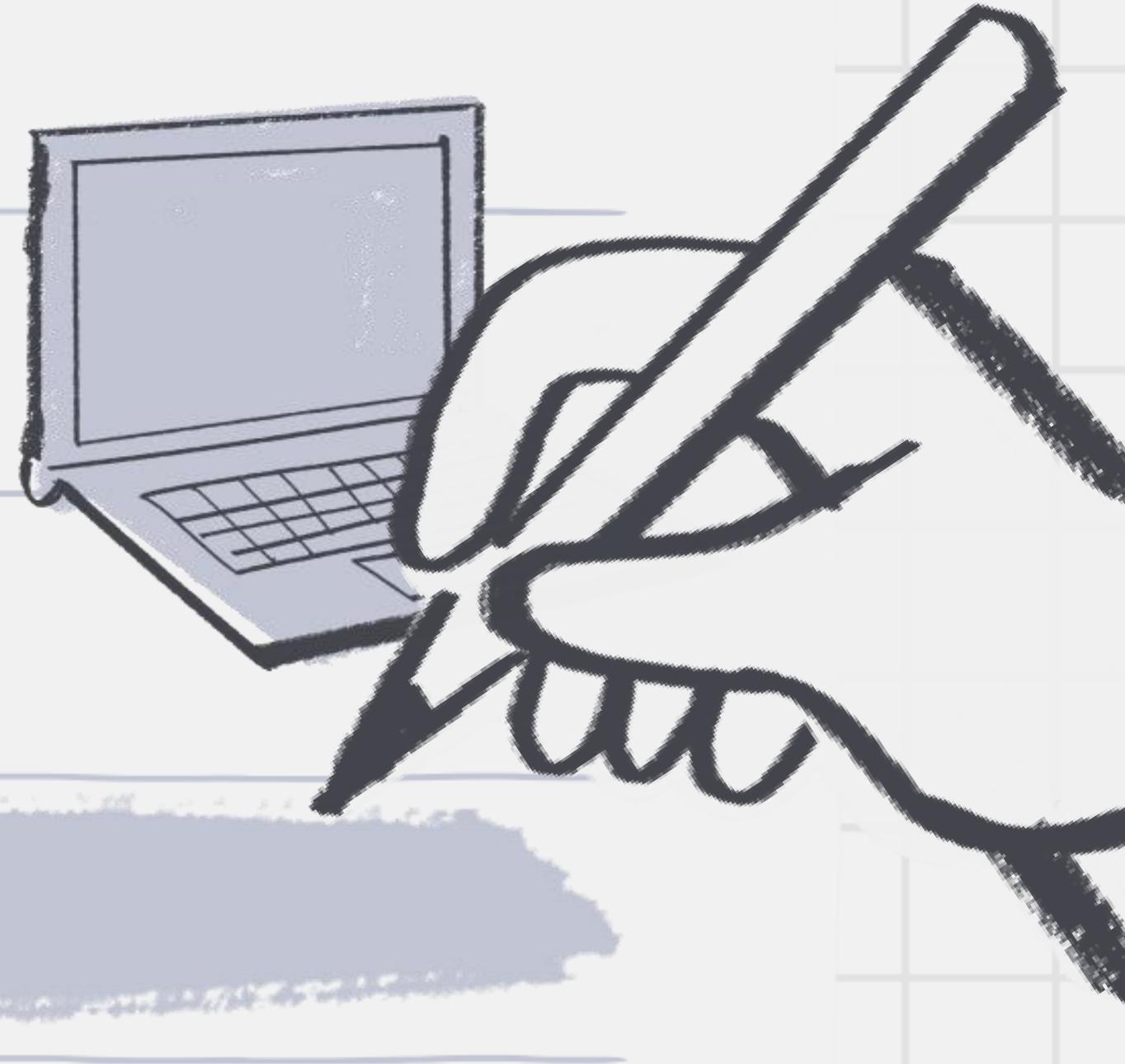


An image format refers to the way an image is represented and stored digitally, defining how pixel data is organized and encoded. It determines color representation (e.g., RGB, Grayscale) and file structure (e.g., JPEG, PNG, BMP).





A large, dark, circular brushstroke containing the white text "02".



The word "RGB Image" written in a large, dark, brushstroke font, centered at the bottom of the slide.

RGB Image

As we knew before that the image is a 2D array (matrix) of pixels. Now, we have to the in and ask ourselves: what does the pixel contain?

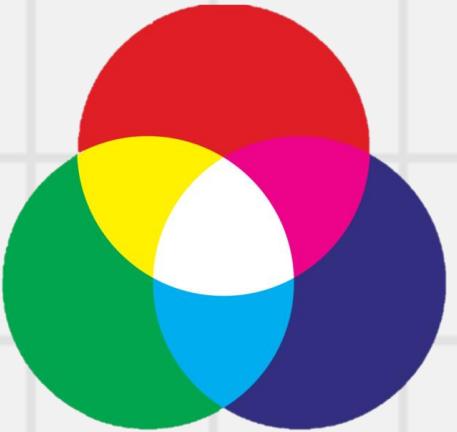
A 32-bit pixel stores color data, with 12 bits dedicated to RGB (4 bits per color). Each channel (Red, Green, Blue) has 16 intensity levels, allowing 4,096 possible colors. Colors mix using additive blending:

Red + Green = Yellow,

Red + Blue = Magenta,

Green + Blue = Cyan,

and all combined = White.



RGB Image

We can extract the colour plane of image by the following equation.

I is a 3D matrix representing an RGB image

$$I = [R \ G \ B]$$

And it can be represented $I = 0 \times RRGGGBB$

- RR: 8-bit Red
- GG: 8-bit Green
- BB: 8-bit Blue

🔴 Red Plane Extraction:

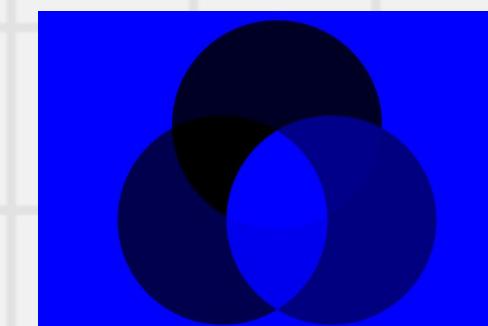
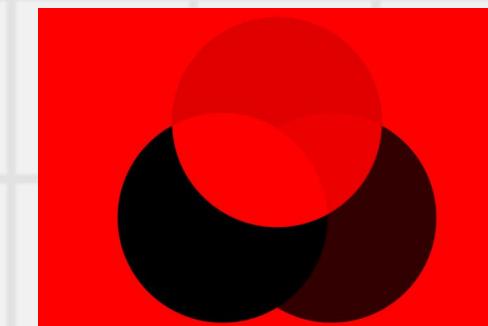
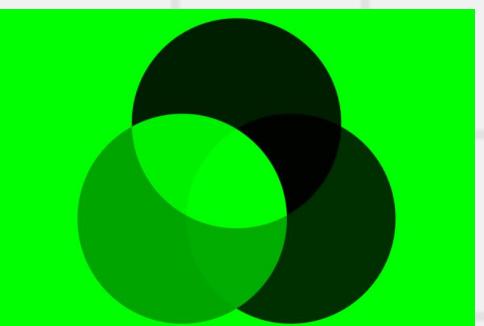
$$P_{red} = 0 \times RRGGGBB \wedge 0 \times FF0000$$

🟢 Green Plane Extraction:

$$P_{green} = 0 \times RRGGGBB \wedge 0 \times 00FF00$$

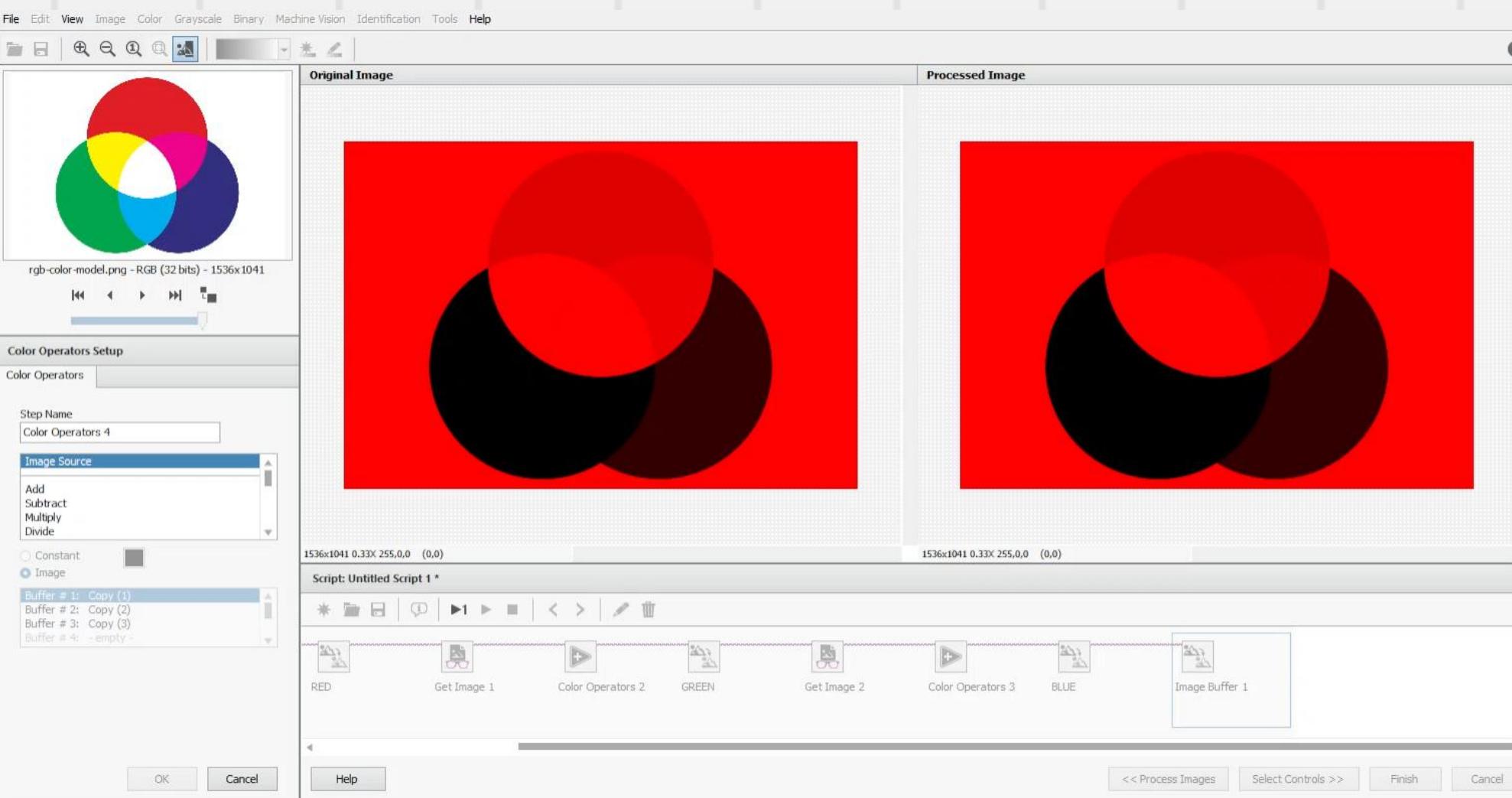
🔵 Blue Plane Extraction:

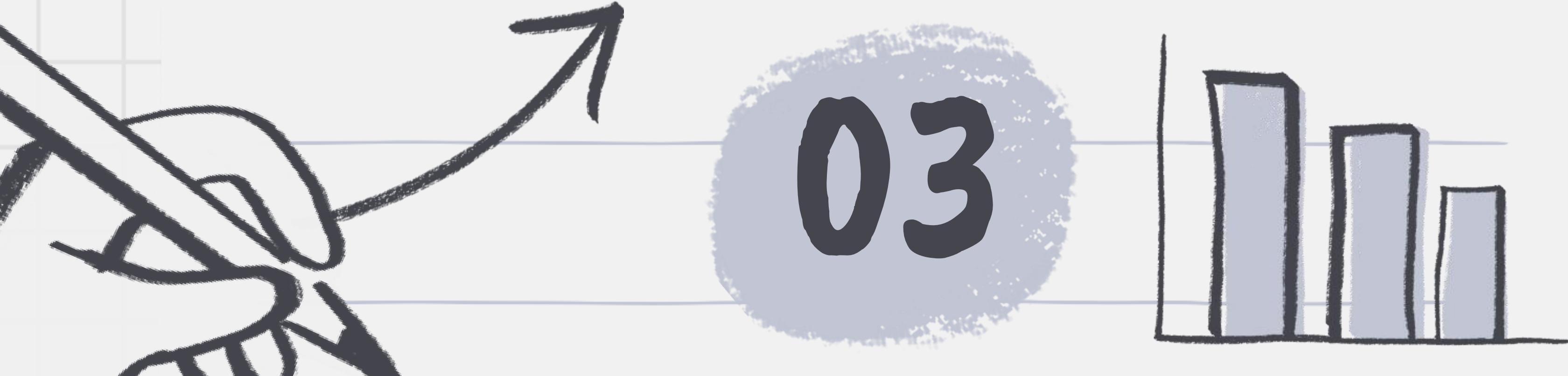
$$P_{blue} = 0 \times RRGGGBB \wedge 0 \times 0000FF$$



RGB Image

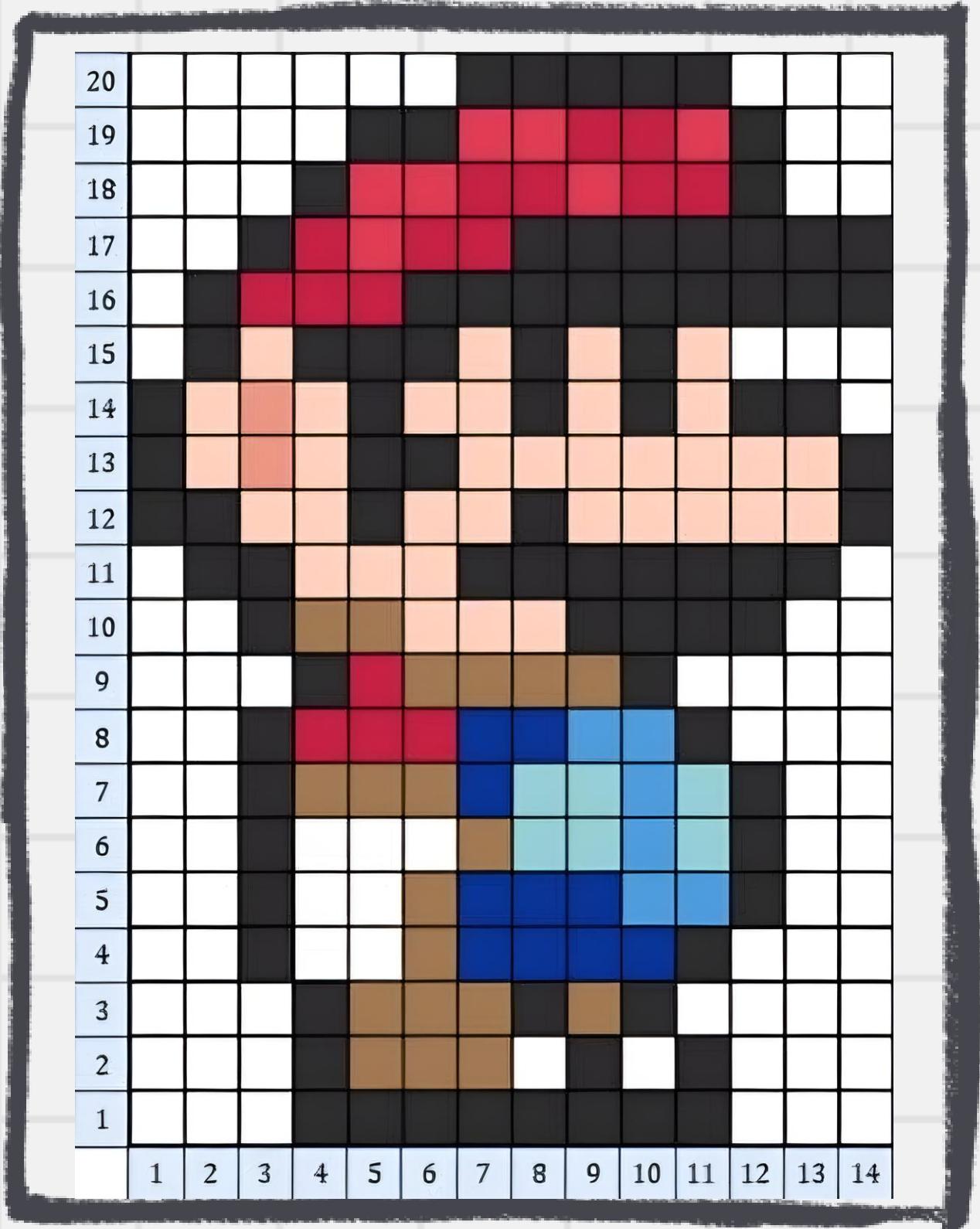
Now, watch the following video and think how can we restore the original image back. 🤔





Grayscale Image

Grayscale



- 📌 Grayscaleing is the process of converting a color image (RGB) into a black-and-white image where each pixel represents a shade of gray instead of color.
 - ◆ In a grayscale image, each pixel has only one intensity value instead of three (R, G, B).
 - ◆ The intensity ranges from 0 (black) to 255 (white) in an 8-bit image.
 - ◆ This reduces the image size and simplifies processing in computer vision tasks.

We have two ways of grayscaling:

1. Average Method
2. Weighted Method

Grayscaleing

1 Average Method (Simple Grayscale)

📌 This method takes the average of the three colour channels (R, G, B):

$$I = \frac{R + G + B}{3}$$

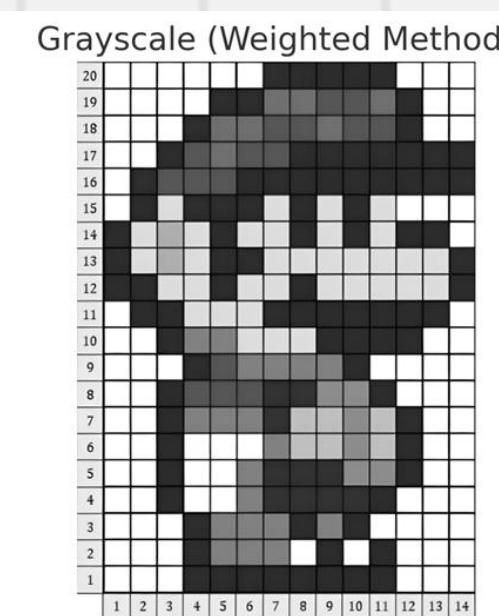
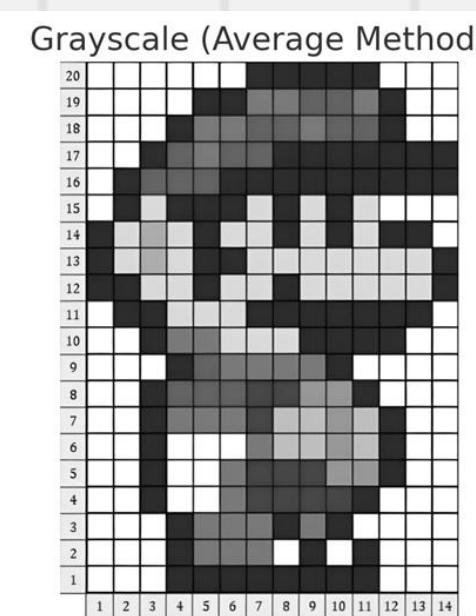
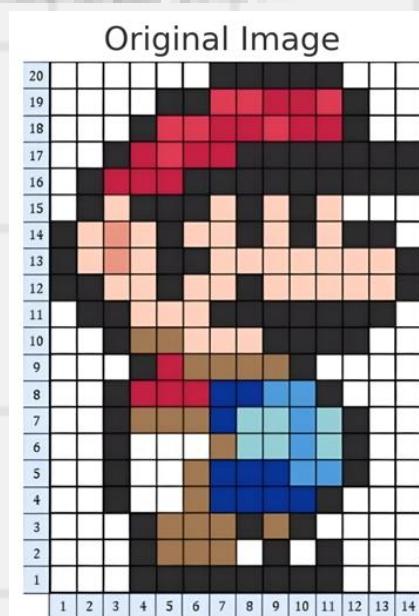
- ◆ Simple but less accurate
- ◆ Doesn't account for how the human eye perceives colors

2 Weighted Method (Perceived Grayscale)

📌 This method weights the RGB values based on human perception:

$$I_{gray} = 0.299R + 0.587G + 0.114B$$

- ✓ More accurate – gives more importance to Green, as the human eye is most sensitive to it.
- ✓ Used in computer vision & image processing



Grayscaleing

① Human Eye Sensitivity to Colors

The human eye is not equally sensitive to all colors: Green is perceived the brightest.

Red is less bright than green. Blue is the least bright. This is because the human retina has three types of cone cells (red, green, and blue), but the green cones are the most sensitive.

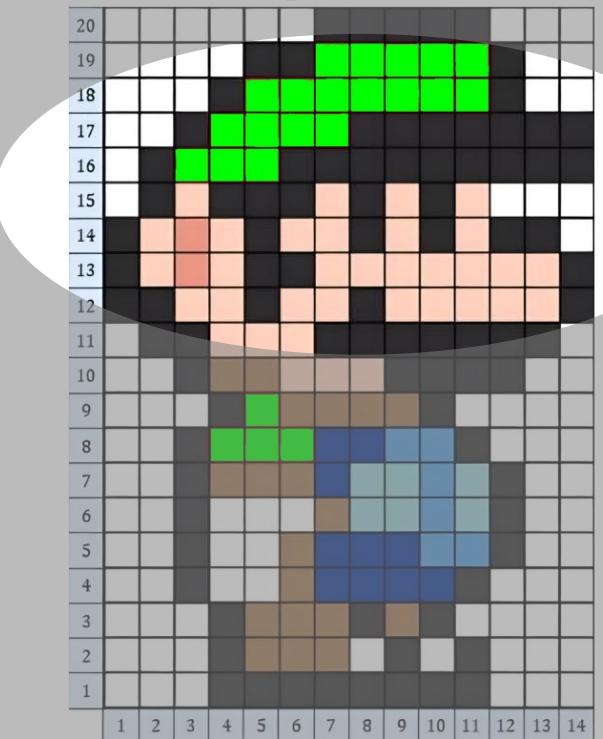
② Luminance and the NTSC Standard

The grayscale formula is derived from the luminance equation used in old television broadcasting standards (NTSC and PAL). These standards were designed to match human vision.

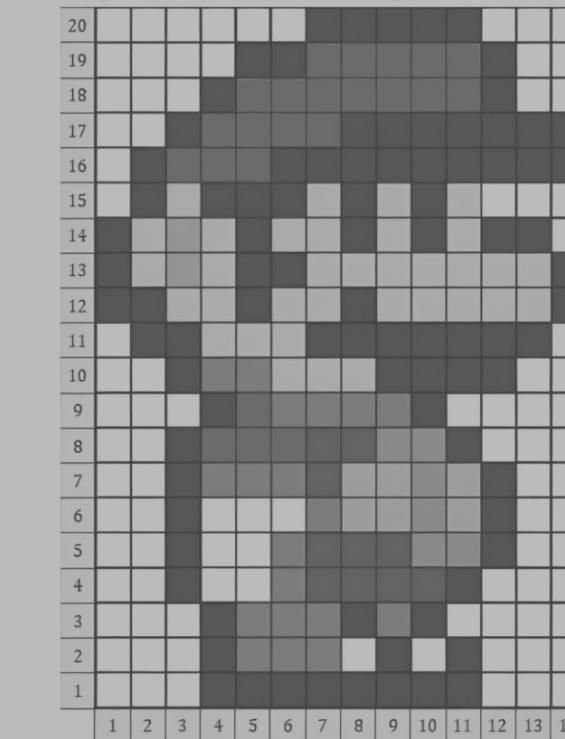
The formula for luminance (Y') is:

$$Y' = 0.2989R + 0.5870G + 0.1140B$$

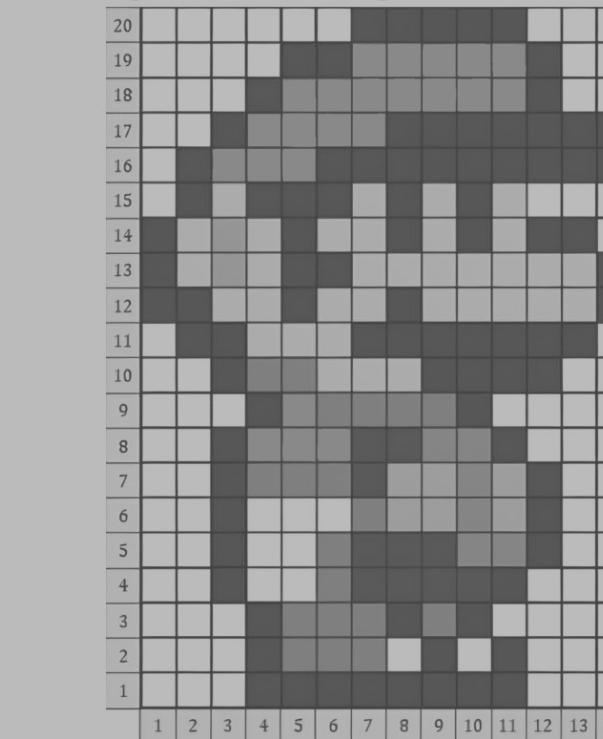
Modified Image (Green Added)



Grayscale (Average Method)



Grayscale (Weighted Method)



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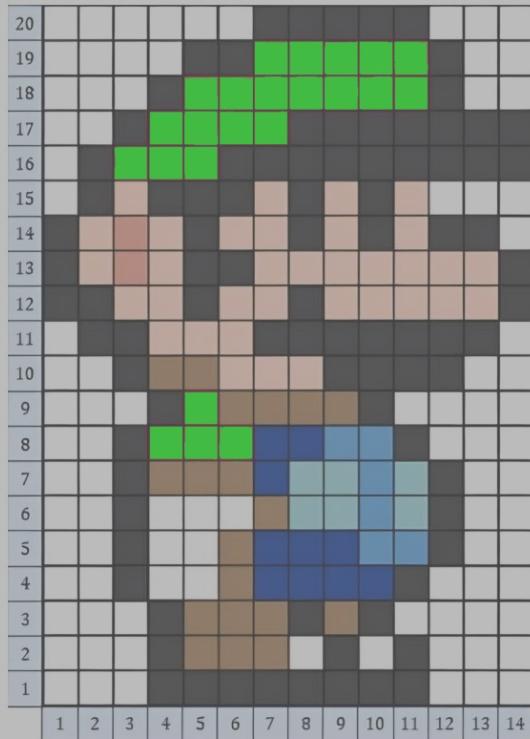
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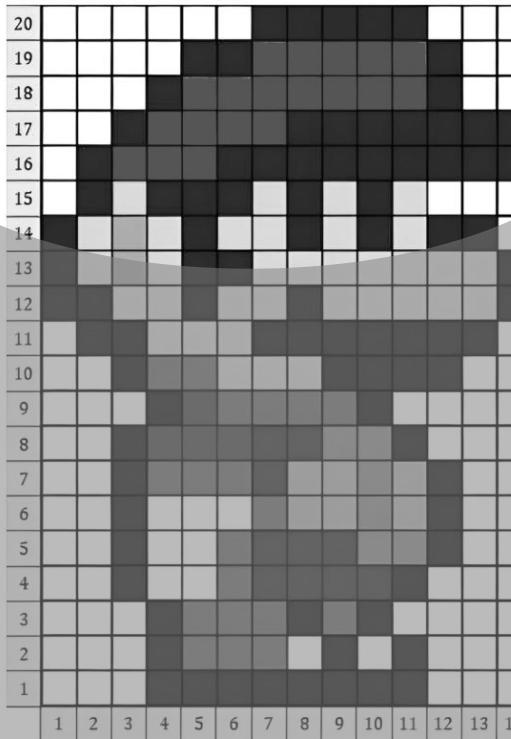
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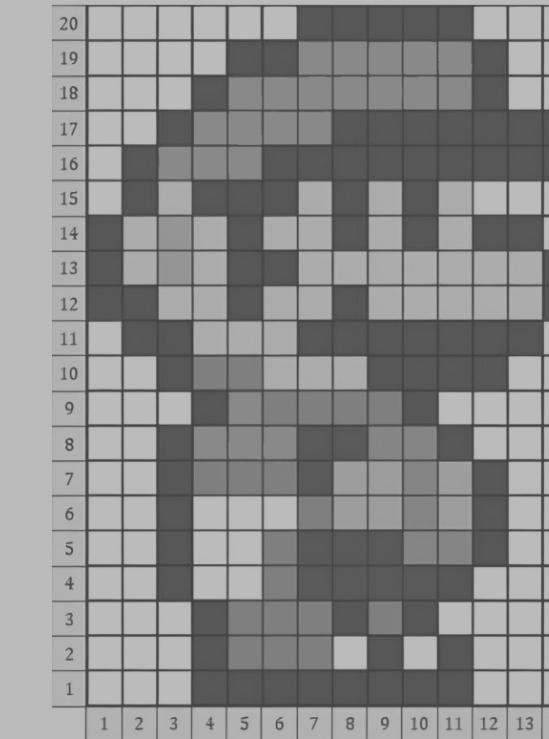
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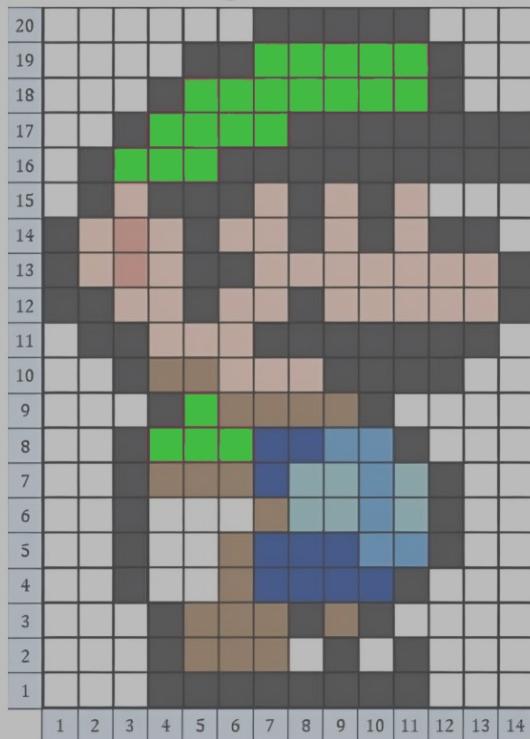
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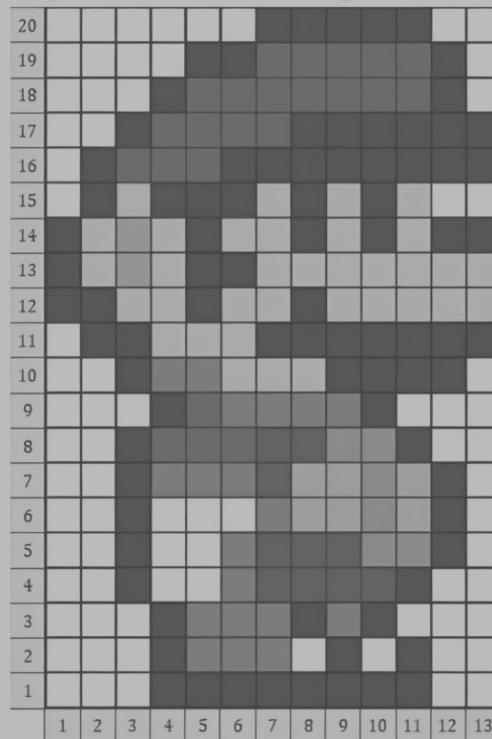
The formula for luminance (Y') is:

$$Y' = 0.2989R + 0.5870G + 0.1140B$$

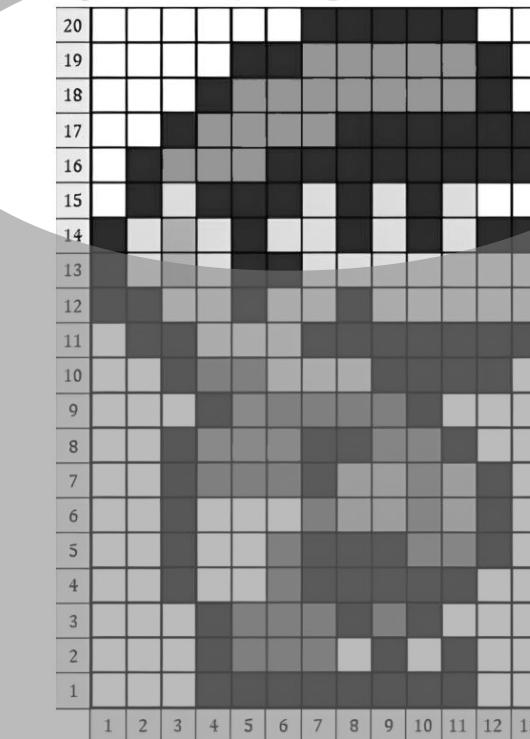
Modified Image (Green Added)

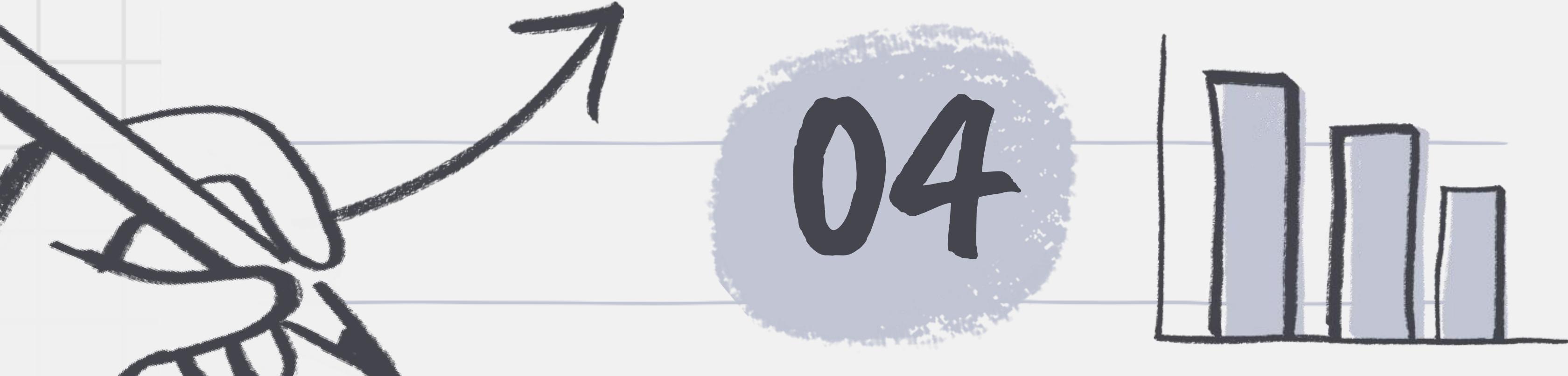


Grayscale (Average Method)



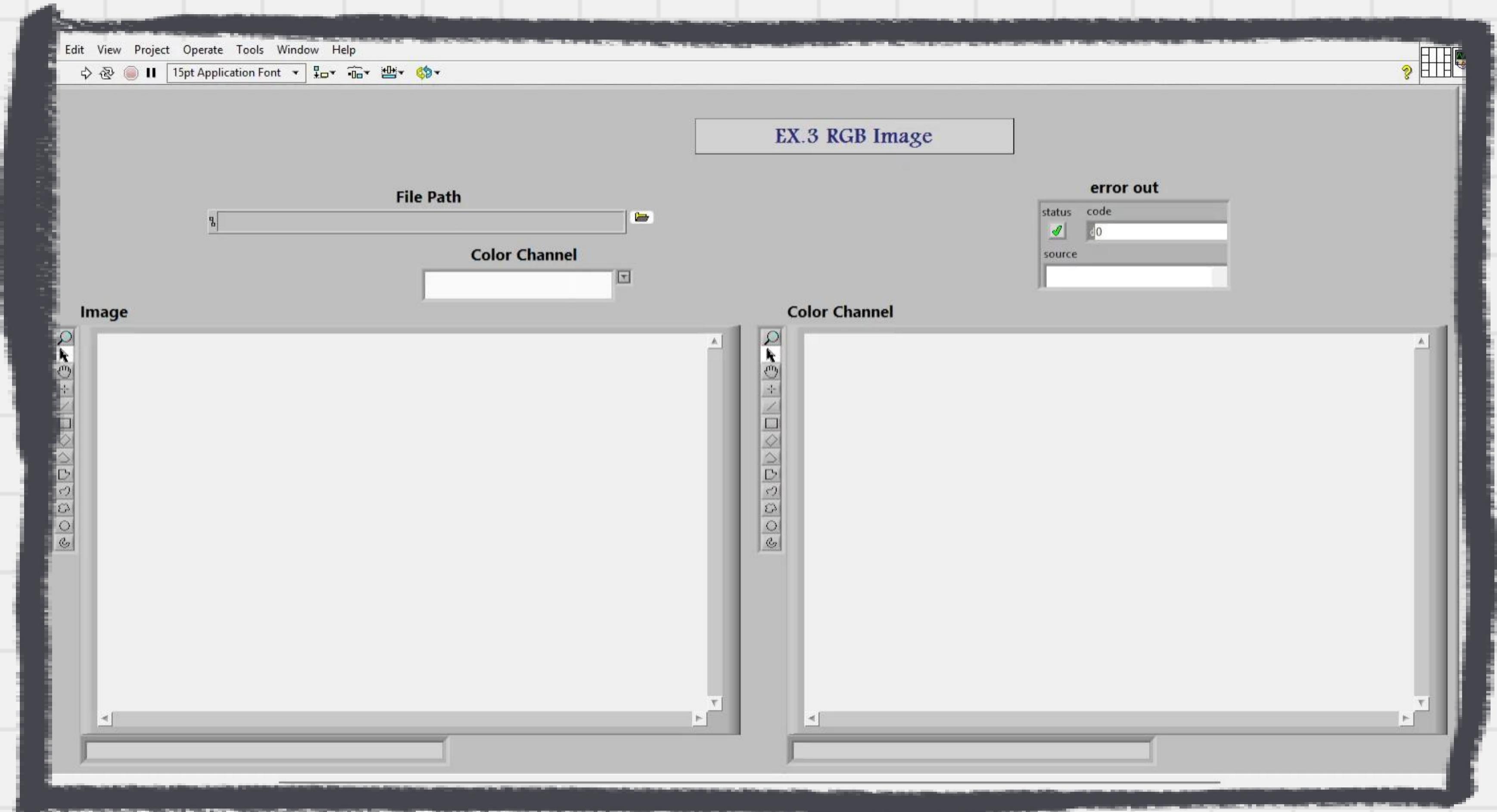
Grayscale (Weighted Method)



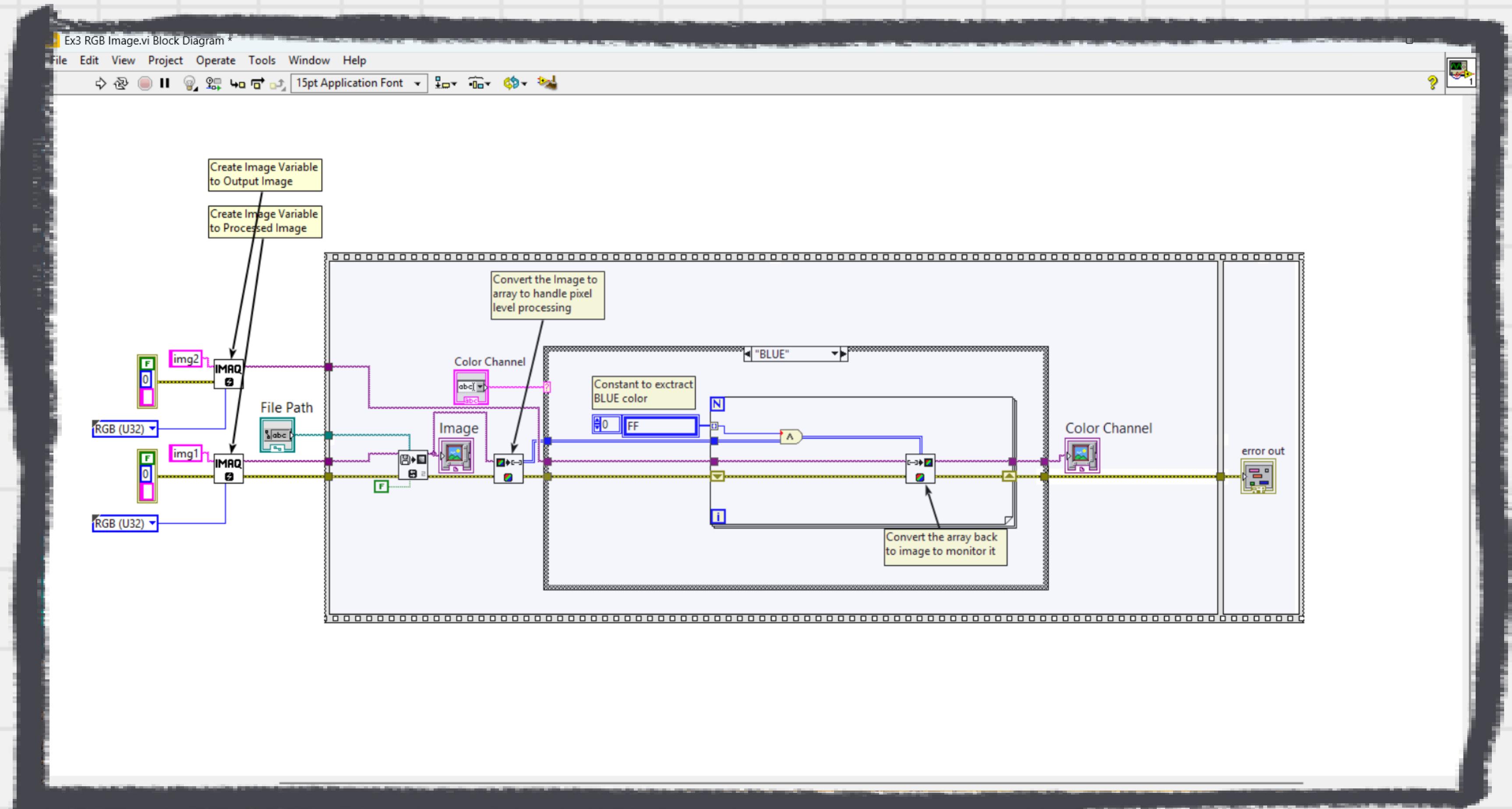


LabVIEW

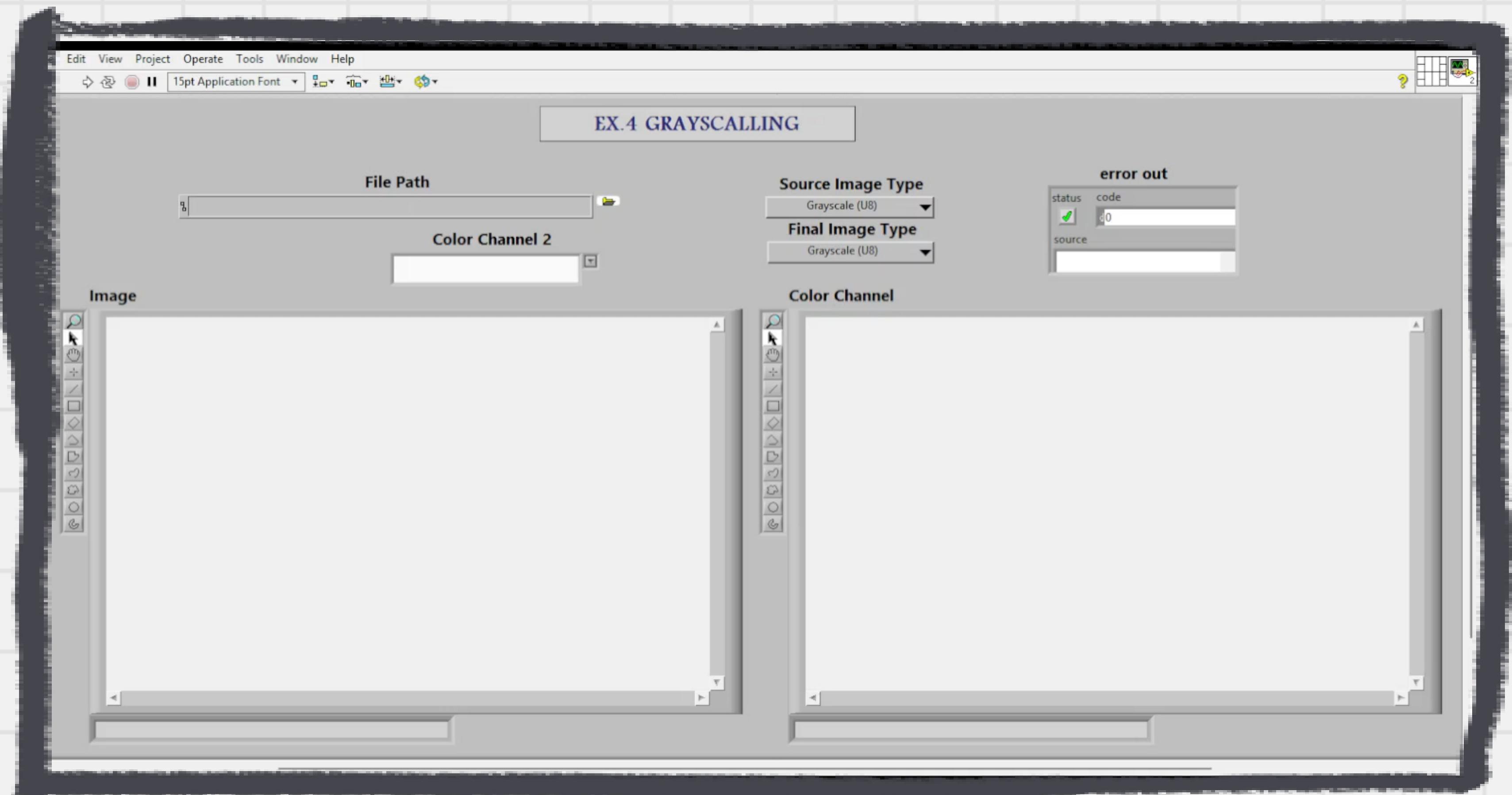
EX3. RGB Image



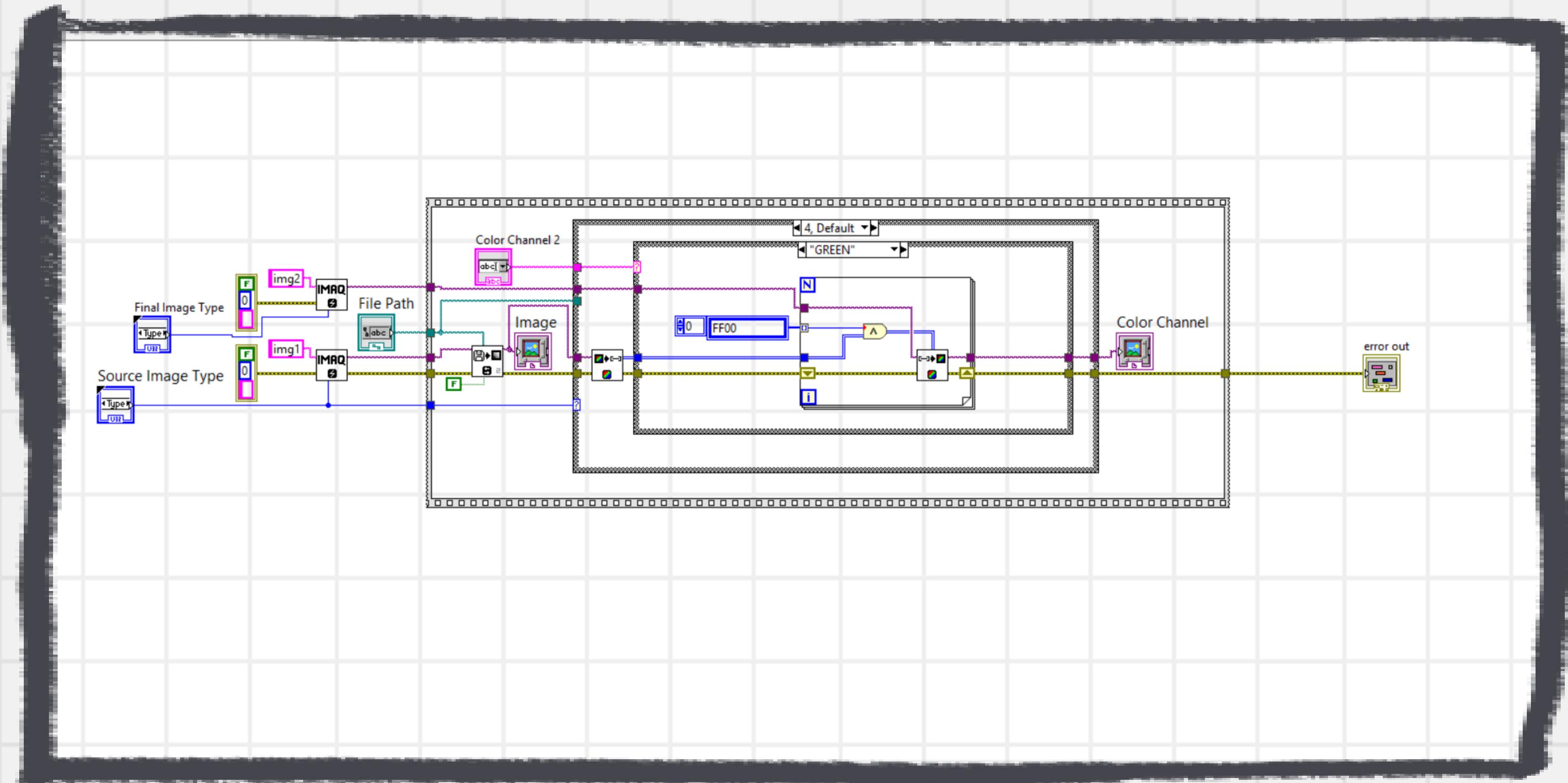
EX3. RGB Image



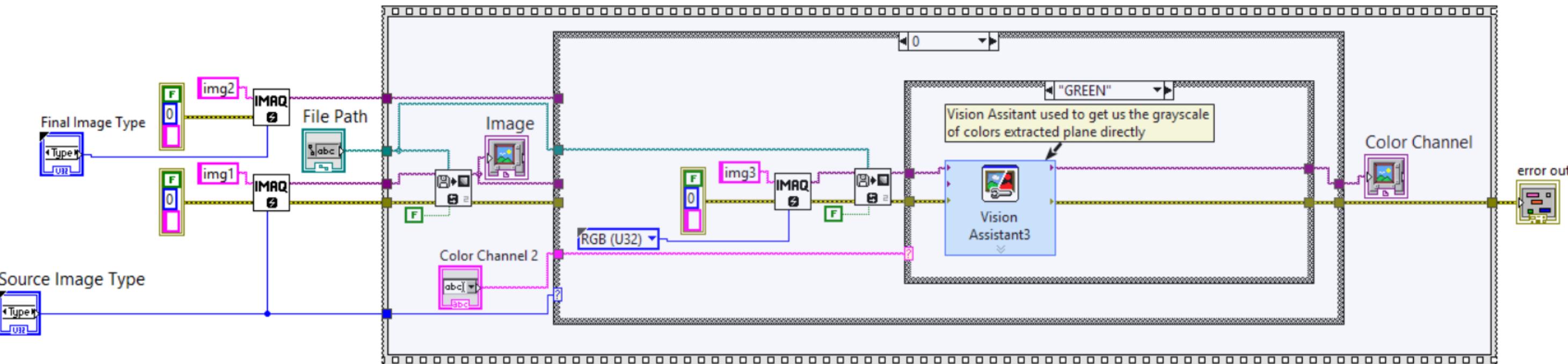
EX4. Grayscale



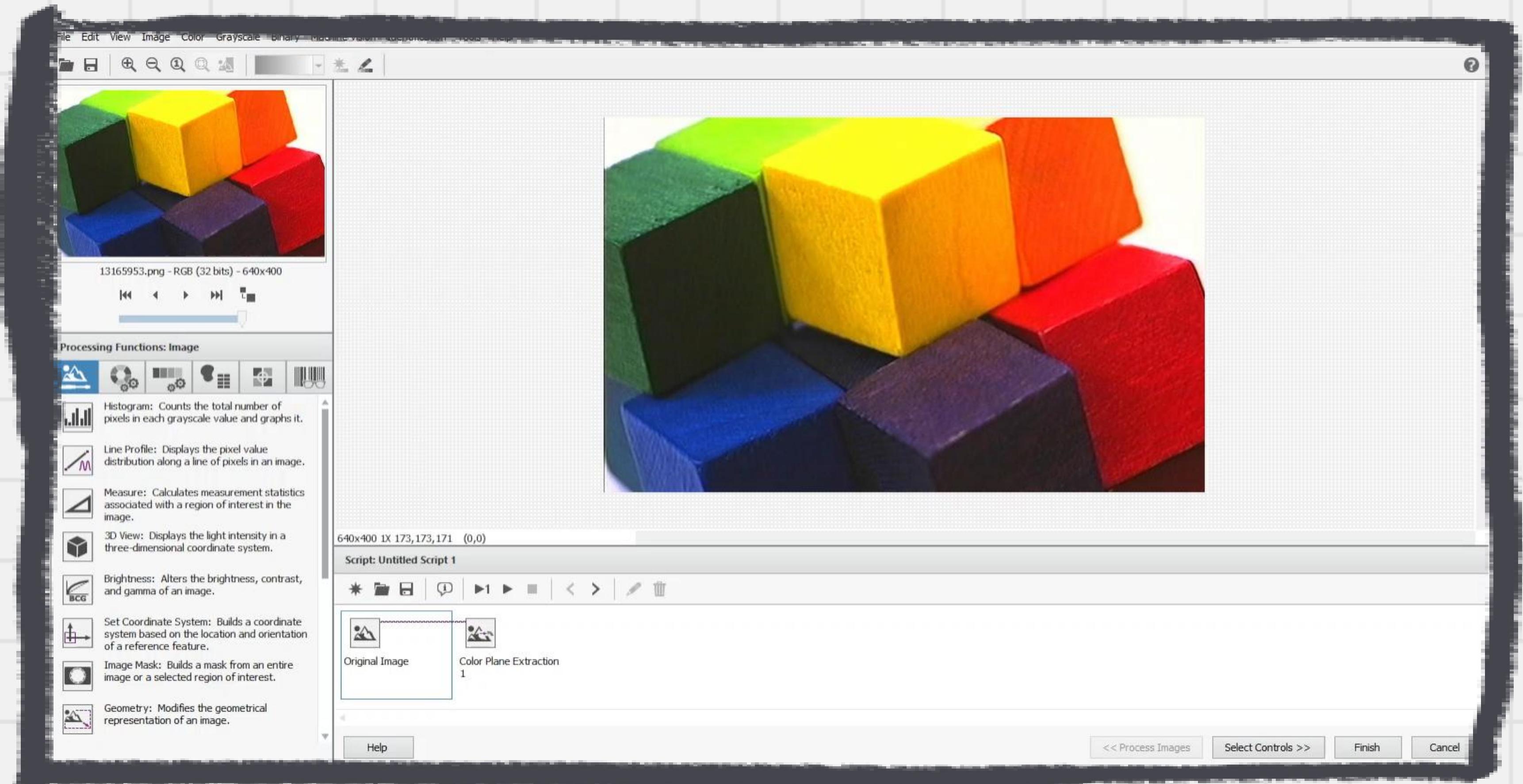
EX4. Grayscale



EX4. Grayscale



EX4. Grayscale



THANK
you