What is an Image and How it is Stored on a Computer

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- A point in the image is called a **pixel**.
- Single-channel images (binary, grayscale) use one value per pixel.
- Colored images (e.g., RGB) use three values per pixel: $(r_{x,y}, g_{x,y}, b_{x,y})$.

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- **Image sampling**: digitization of spatial coordinates (x, y).
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- Pixel values are often integers (0–255) or floats (0–1).

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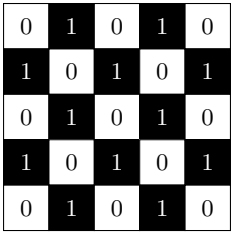
  - Grayscale: 2D array (width $\times$ height).
  - RGB: 3D array (width $\times$ height $\times$ 3).
- 2D or 3D arrays are used depending on the image type.

Single Channel: Black and White Image

Black & White Image (1 bit per pixel)



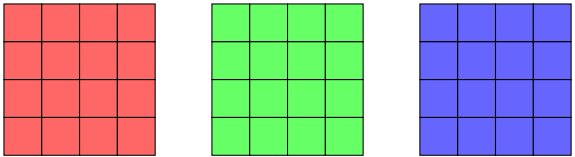
Single Channel: Grayscale Image

Grayscale Image (8 bits per pixel)

	25	50	75	100
25	60	95	100	135
50	95	110	125	170
75	100	125	150	175
100	135	170	175	210

Multi-Channel: Color (RGB) Image

Color Image (RGB: 3 channels)



Red Channel Green Channel Blue Channel

`3D array: height × width × 3`

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- Social media platforms like Facebook and Instagram use image processing to handle daily uploaded images.
- Industries innovate and apply many image processing algorithms to process user-uploaded content.

Reading, Saving, and Displaying an Image using PIL

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- We can access image properties: `width`, `height`, `mode`, `format`, etc.
- Use `show()` to display the image.

Sample Code to Read and Display an Image

Python Code

```
from PIL import Image
im = Image.open("brown_val1.jpg") # read the image
print(im.width, im.height, im.mode, im.format, type(im))
im.show() # display the image
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im_g = im.convert('L')                # convert to grayscale
im_g.save('brown_val1.jpg')           # save grayscale image
Image.open("brown_val1.jpg").show() # read & display
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Output

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Website

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LinkedIn Page

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Thank You!