Computer Vision

CVI620

Session 5
01/2025

Let’s have our daily standup ;)

Overview

Video

Shapes

Text

Point operators (add, subtract, multiply, divide, linear blend)

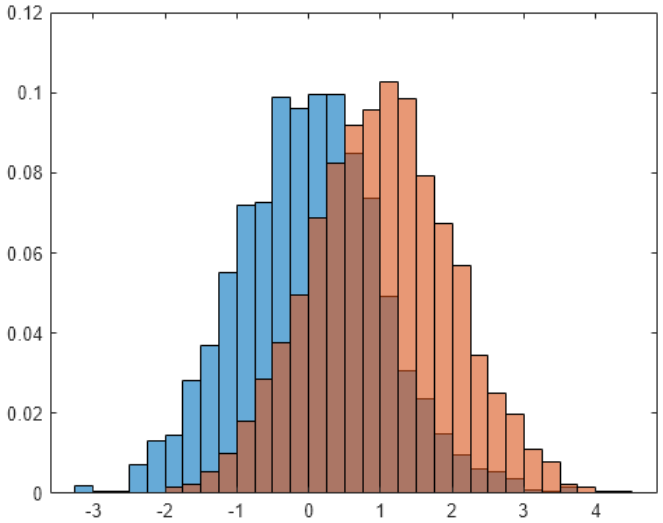
Color pixel extraction (will come back to it)

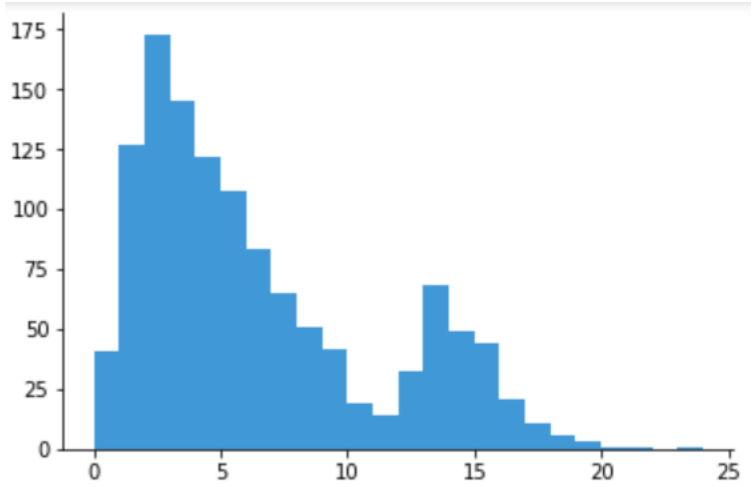
Agenda

Week of	Agenda/Topic
1/7	Introduction to Computer Vision and Imaging Systems Cameras
1/10	System Configurations Digital Cameras and Images Color Standards Introduction to OpenCV
1/14	Image Formats Image Compression OpenCV methods and operations PEP8 standard
1/21	Basic Image Arithmetic Pixel Transforms Histograms
1/24	Geometric Transformations Image Noise Linear vs. Nonlinear Filtering

Histogram

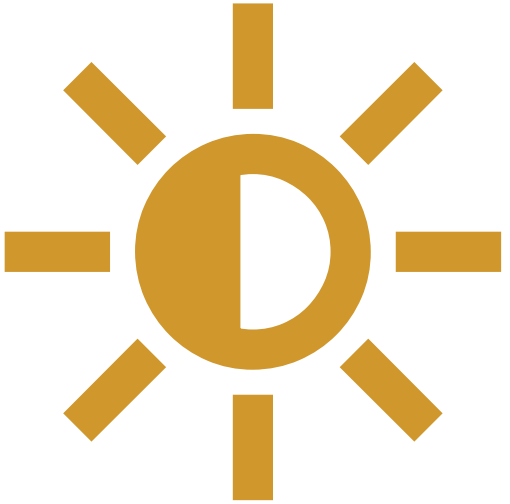
- One of the data exploration stages
- A graphical representation of the distribution of pixel intensities in an image.
- Shows how many pixels have a specific intensity value (e.g., 0–255 for grayscale).





Histogram

- Brightness and contrast measurement.
- Detect overexposure or underexposure.
- Histogram equalization for better contrast.
- Thresholding and region detection



Histogram

1. Convert to the desired color model
2. Flatten
3. x-axis: pixels
4. y-axis: number of pixels corresponding to x

np.ravel

`ndarray.flat`

1-D iterator over an array.

`ndarray.flatten`

1-D array copy of the elements of an array in row-major order.

`ndarray.reshape`

Change the shape of an array without changing its data.

returns view ---> more efficient

numpy.ravel(*a*, *order='C'*)

cv2.calcHist

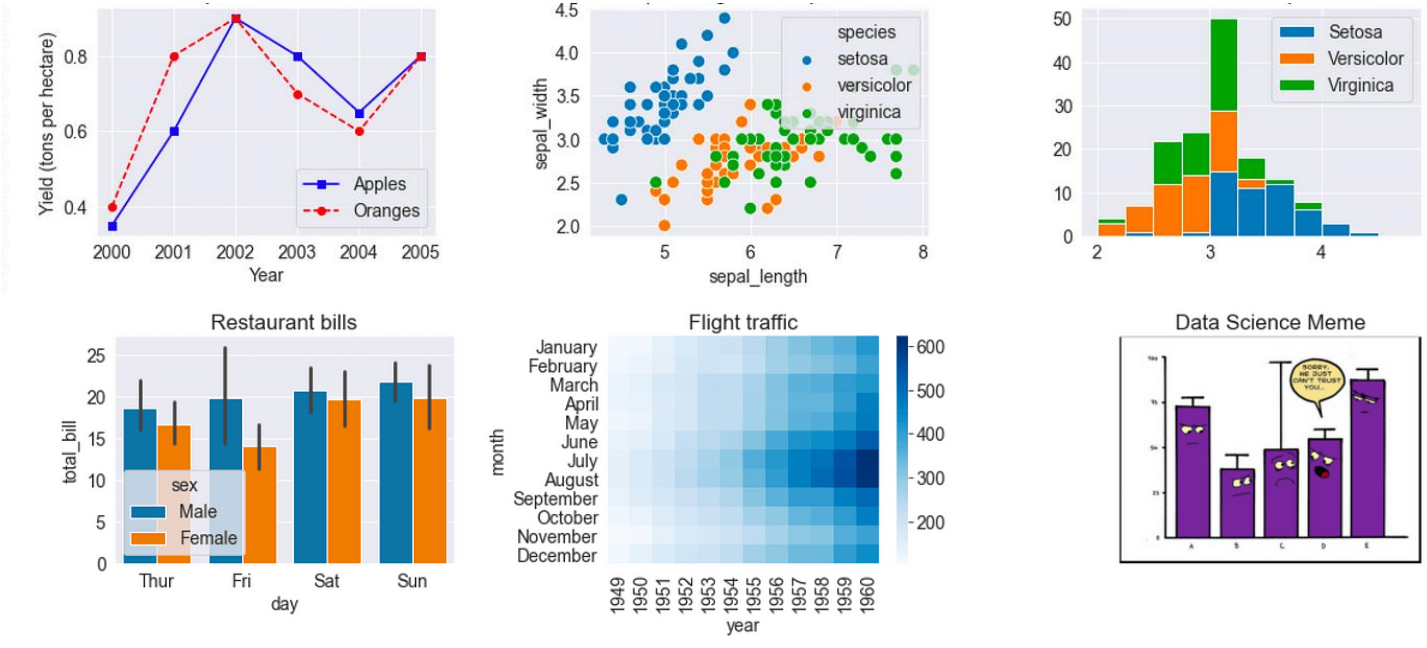
Syntax: *cv2.calcHist(images, channels, mask, histSize, ranges[, hist[, accumulate]])*

Parameters:

- ***images:*** *list of images as numpy arrays. All images must be of the same dtype and same size.*
- ***channels:*** *list of the channels used to calculate the histograms.*
- ***mask:*** *optional mask (8 bit array) of the same size as the input image.*
- ***histSize:*** *histogram sizes in each dimension*
- ***ranges:*** *Array of the dims arrays of the histogram bin boundaries in each dimension*
- ***hist:*** *Output histogram*
- ***accumulate:*** *accumulation flag, enables to compute a single histogram from several sets of arrays.*

matplotlib

- Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python.

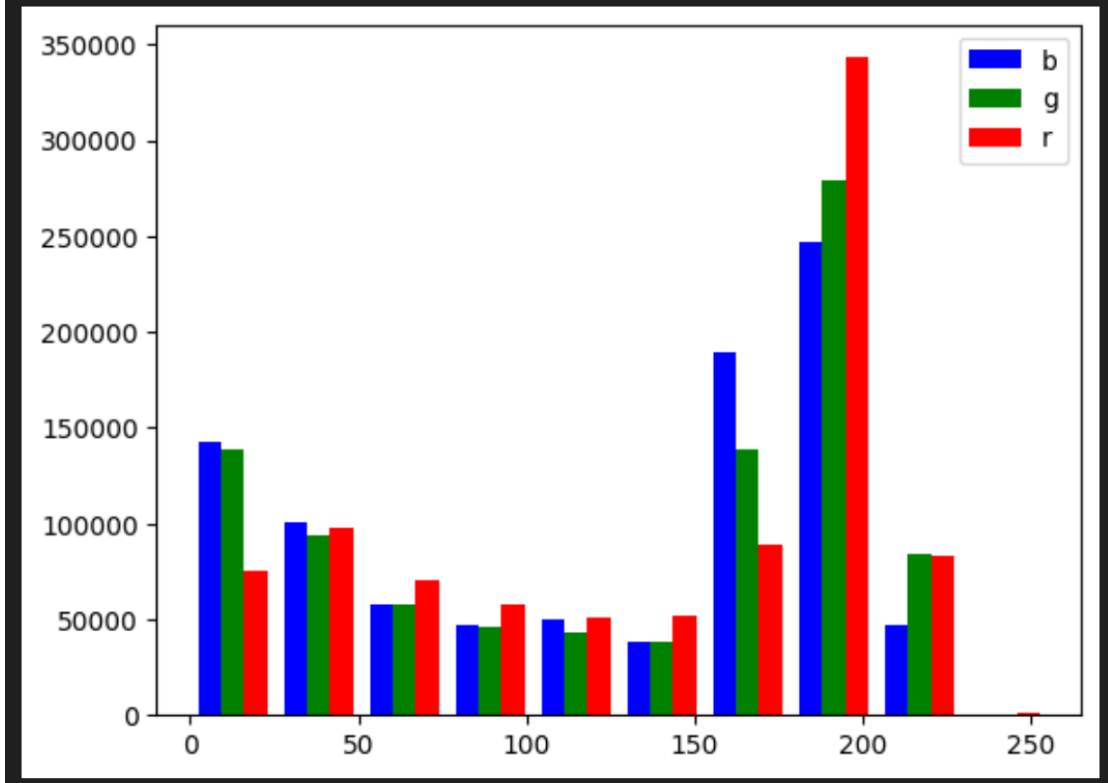


plt.hist

```
matplotlib.pyplot.hist(x, bins=None, *, range=None, density=False, weights=None,
cumulative=False, bottom=None, histtype='bar', align='mid',
orientation='vertical', rwidth=None, log=False, color=None, label=None,
stacked=False, data=None, **kwargs)                                    [source]
```

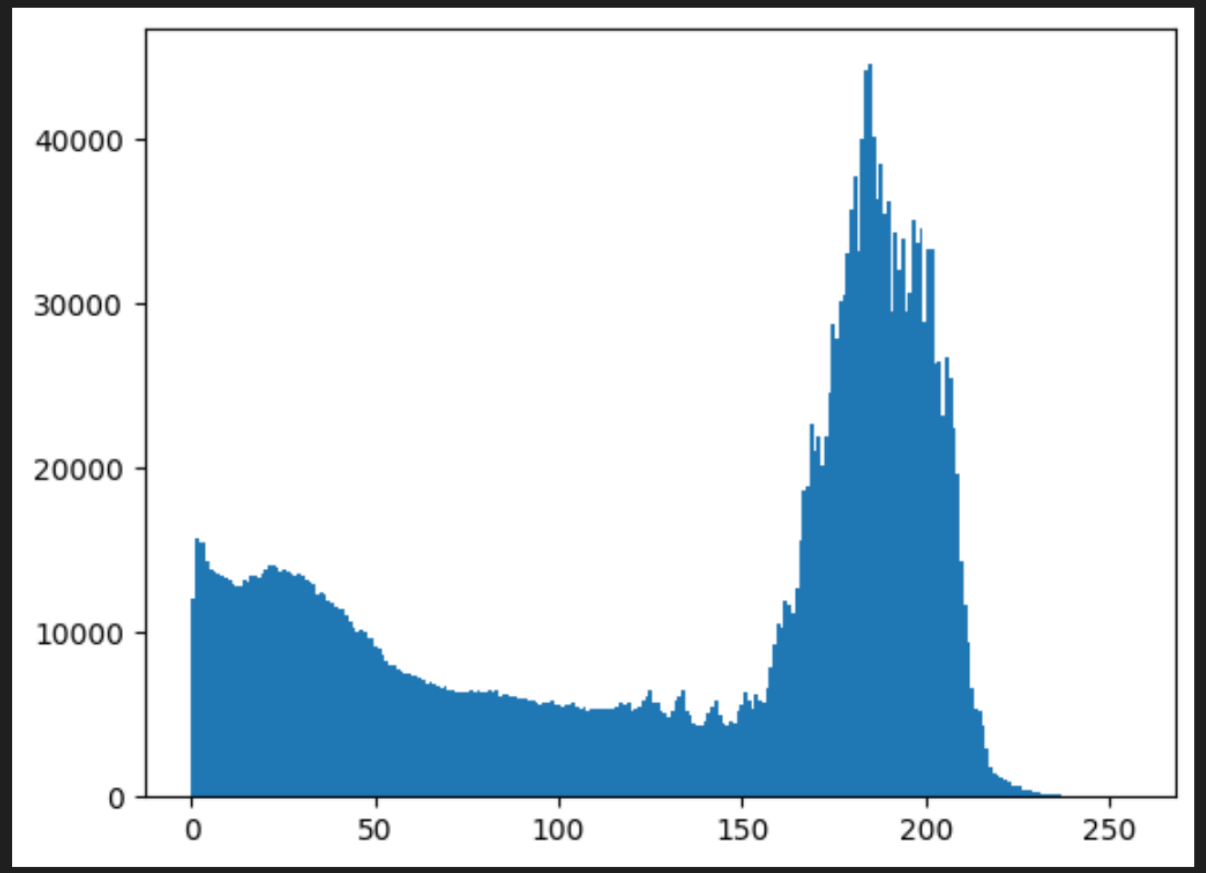
```
colors = ('b', 'g', 'r')

img_ravel = [image[:, :, 0].ravel(), image[:, :, 1].ravel(), image[:,:, 2].ravel()]
plt.hist(img_ravel, color=colors, label=colors)
plt.legend()
plt.show()
```

✓ 0.1s

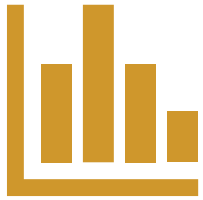



```
plt.hist(image.ravel(), bins=256, range = [0,255])
plt.show()
```

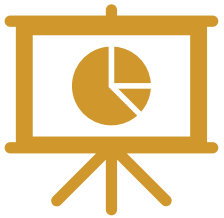
✓ 0.7s



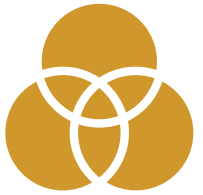
Data Exploration



Infer outcomes from histograms



Act upon histograms: change light, balance data, delete channels, or do nothing!



For image comparisons, make sure the basis of comparison (size, channel) is the same

Quiz Time

Provide an analysis of these histograms for different images. Describe what image you think they potentially describe?

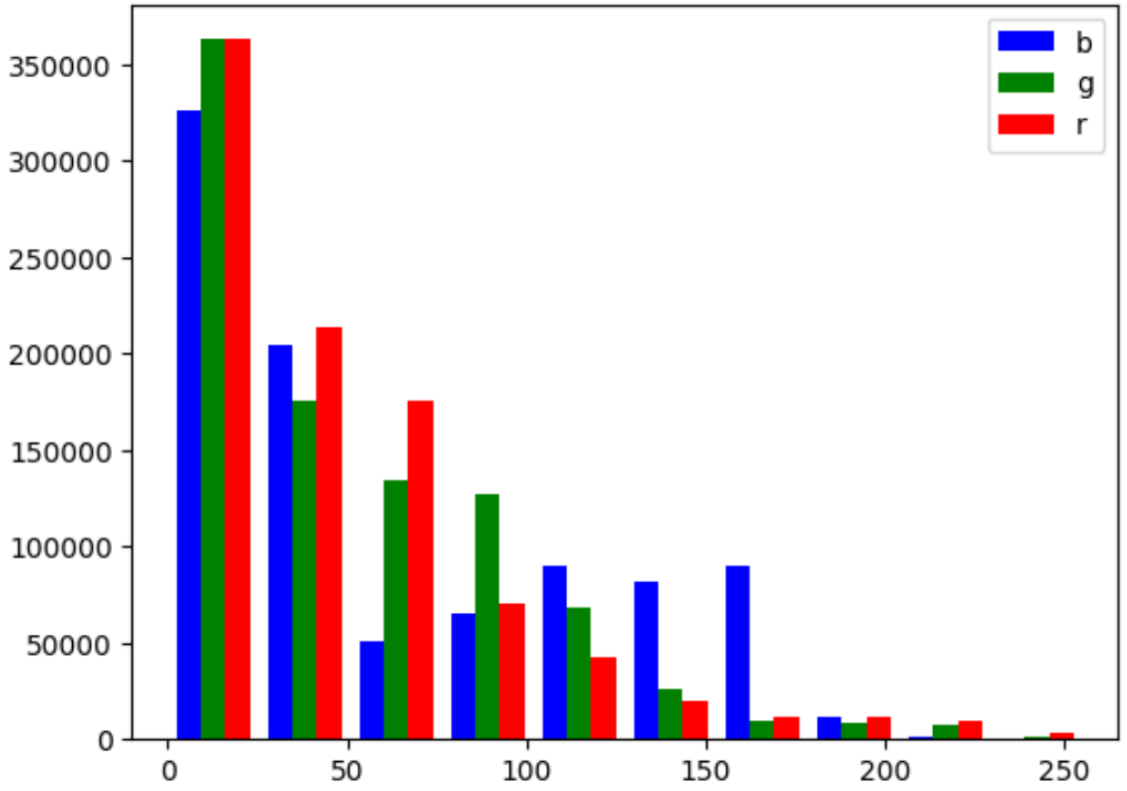


Image 1

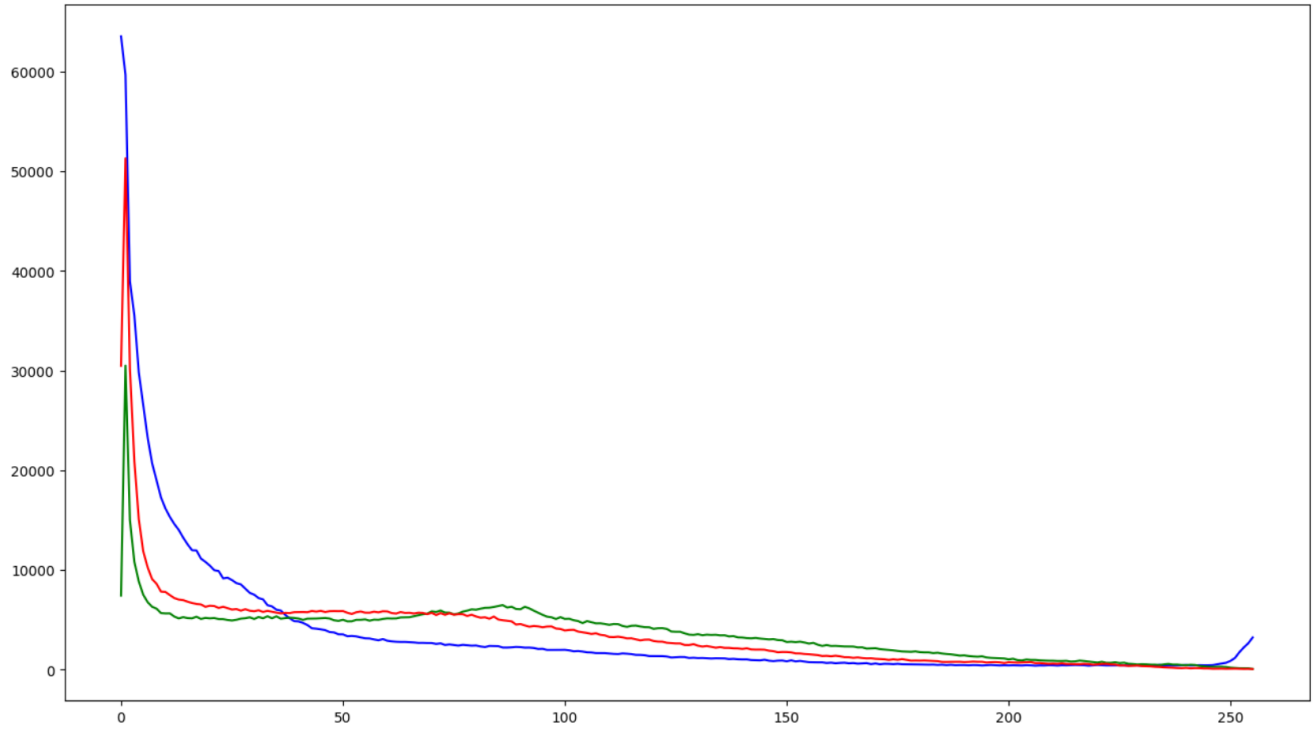


Image 2