Opencv Fundamentals

Loading & displaying Image from disk

To read an Image in Opencv you use the `cv2.imread()` (https://docs.opencv.org/4.2.0/d4/da8/group__imgcodecs.html#ga288b8b3da0892bd651fce07b3bbd3a56) function, the image will be read as a numpy array Usage:

```
image = cv2.imread(filename, [flag])
```

The Square brackets i.e. [ ] are used to denote optional parameters

Params:

- `filename:` Name of the image or path to the image.
- `flag:` There are numerous flags but three most important ones are these: 0,1,-1

If you pass in `1` the image is read in Color, if `0` is passed the image is read in Grayscale (Black & white) and if `-1` is used to read transparent images which we will learn in the next chapter, If no parameter is passed the image will be read in Color.

*Lets read an image and print it. *

In [2]:
```
#this is how you import the Opencv library
import cv2
#we are also gonna load the numpy library for later usage
import numpy as np
#we read our Image
img = cv2.imread('media/M1/two.png',0)
print(img)  # Can you guess which number we just printed
```

```
[[  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0 255 255 255 255 255 255 255 255 255 255   0   0   0   0
    0   0   0   0]
 [  0   0   0 255 255   0   0   0   0   0   0   0 255 255 255   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0 255 255   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0 255 255   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0 255 255 255   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0 255 255 255   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0 255 255 255   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0 255 255 255   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0 255 255 255   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0 255 255 255   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0 255 255 255   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0 255 255 255   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0 255 255 255   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0 255 255 255   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0 255 255 255   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0 255 255 255   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0 255 255 255   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [255 255 255   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]
 [  0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   0   0   0]]
```

Great, we have loaded the image in GrayScale , you can also call it a single channel image in which `0` represents black and `255` white color and all the numbers between `0` and `255` are different shades of gray. Since the above image has black background and `2` drawn with a white pen, you will only see only `0` and `255`

Shape of our Image

You can see the shape of the Image by doing `img.shape` , you can also count the columns and rows above

In [2]:
```
# Note for a color image you will also see a 3rd parameter retured called Channels
img.shape # returns rows , columns  or  height , width  or x , y
```

Out[2]: (21, 22)

Displaying Image with Matplotlib

Printing Images is not fun, Lets see how we can display this image in the notebook with matplotlib which is a popular library for visualizing graphs

In [1]:
```
#if matplot is not installed
#pip install matplotlib
```

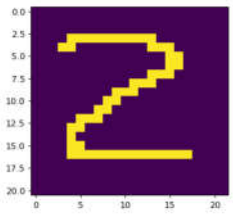
In [5]:
```
# From matplotlib import pyplot the plotting module
import matplotlib.pyplot as plt
# This is the magic command which is tells the notebook we are gonna be displaying graphs with matplotlib
%matplotlib inline
# You can finally show the image with plt.imshow()
plt.imshow(img)
```

Out[5]: <matplotlib.image.AxesImage at 0x3a5cab3ee0>

Instead of Inline Static graphs, you can make interactive graphs by using notebook magic command**

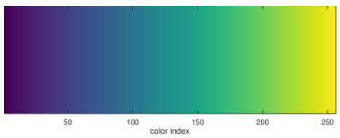
In [32]:
```
%matplotlib notebook
# You can finally show the image with plt.imshow()
plt.imshow(img)
```

```
<IPython.core.display.Javascript object>
```

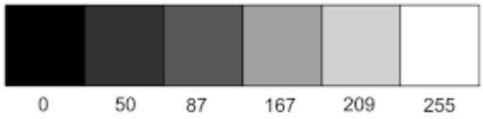


Out[32]: `<matplotlib.image.AxesImage at 0x1e66e00ffd0>`

What just happened ? , our Image is shown in color but we know we loaded in grayscale, so the issue here is that matplotlib displays single channel images with the default color_map called Viridis, you can see it how viridis displays `0-255`



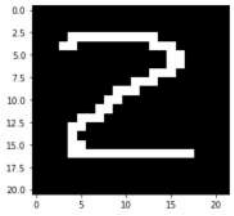
Now the color map for Grayscale image looks like this:



Now we will explicitly tell matplotlib to set the color map to grayscale by setting `cmap='gray'`

In [6]:
```
plt.imshow(img,cmap='gray')
```

Out[6]: `<matplotlib.image.AxesImage at 0x9f5391dd00>`



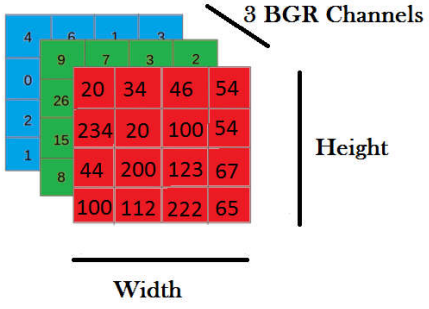
Display Color Image in Matplotlib

In [3]:
```
#Lets read a color image first.
img = cv2.imread('media/M1/party.jpg',1)   # remember to set the flag to 1 for color images (default is also 1)
```

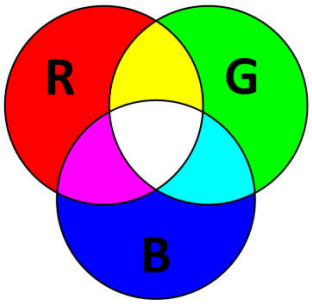
In [8]:
```
## lets see the Shape of our Image
img.shape
```

Out[8]: `(344, 535, 3)`

See we have 344 columns , 535 rows and 3 channels , since we are using a color image we wil get 3 primary color channels Red, Green, Blue RGB, but instead of giving us RGB Opencv gives us channels in reverse i.e. BGR Blue, Green , Red.



With the Combination of these 3 Channels Any Color Can Be Created

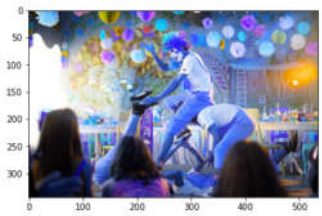


We will Discuss more about Image Channels in the next Tutorial

Now We wil Display this Clown Image with Matplotlib

In [9]:
```
plt.imshow(img)
```

Out[9]:
```
<matplotlib.image.AxesImage at 0x9f5398f460>
```



What Just Happened here, why did our Colored image got corrupted and got this blueish makeup, the reason is simple, like I previously mentioned OpenCV displays image in BGR and matplotlib displays it in RGB. So we have to reverse our channels or transform bgr to rgb and OpenCV has just the function to that

image = cv2.cvtColor(src, COLOR_CONVERSION_FLAG)

Param:

- `src`: Your Input Image
- `COLOR_CONVERSION_FLAG`: The color space you will convert to, for our purpose we will use `cv2.COLOR_BGR2RGB`

In [9]:
```
RGB_image = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
plt.imshow(RGB_image)
```

Out[9]:
```
<matplotlib.image.AxesImage at 0x3a5d2bf130>
```

Note: There are many color spaces that you can convert to for e.g lets turn our bgr image to grayscale by using the flag `cv2.COLOR_BGR2RGB`

In [8]:
```
GRAY_image = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(GRAY_image,cmap='gray')
```

Out[8]:
```
<matplotlib.image.AxesImage at 0x3a5d241130>
```

In [14]:
```
imggc = cv2.imread('media/M1/party.jpg',0)
imggc.shape
```

Out[14]:
```
(344, 535)
```

In [19]:
```
plt.imshow(imggc[:,::-1],cmap='gray')
```

Out[19]:
```
<matplotlib.image.AxesImage at 0x9f5572e550>
```

We can also just reverse our image channels manually by putting `::-1` in the Channels instead of using the opencv function everytime we want to display our Image.

In [13]:
```
# Remember the 3rd dimension are the channels, so we will just reverse that
plt.imshow(img[:,:,::-1]) # we can also do plt.imshow(img[...,::-1])
```

Out[13]:
```
<matplotlib.image.AxesImage at 0x9f557f0ac0>
```

Notice the scale dimensions appear on each image , we can get rid of it like this:

In [20]:
```
plt.xticks([]), plt.yticks([])  # to hide tick values on X and Y axis
plt.imshow(img[...,::-1]);
```

Matplotlib Subplots

Just like matplotlib normal plots we can display multiple subplots in a single cell You have to specify the number of rows, columns and the index of the subplot, for example we are going to display two image so we can either display 1 image per row , having 2 rows and 1 column or we can display 2 images per row having 1 row , 2 columns.

```
plt.subplot(n_rows,n_columns,index)
```

Params:

- `n_rows:` Number of rows
- `n_columns:` Number of Columns
- `index:` The index of plot

```
plt.title(Title)
```

- `Title:` The Title text of the subplot

In [43]:
```
# First we set the figure size we want to use
plt.figure(figsize=[10,10])

# If you're having less than 10 subplots you can skip the `,`
# 1 row,2 columns,index=1
plt.subplot(121)
plt.imshow(img[...,::-1])
plt.title("Color")

# 1 row,2 columns,index=2
plt.subplot(122);
plt.imshow(GRAY_image,cmap='gray')
plt.title("Gray_Scale")
```

Out[43]:
```
Text(0.5, 1.0, 'Gray_Scale')
```

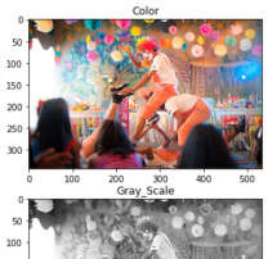
Now Show images in 2 rows

In [44]:
```
# First we set the figure size we want to use
plt.figure(figsize=[7,7])

# If you're having less than 10 subplots you can skip the `,`
# 1 row,2 columns,index=1
plt.subplot(211)
plt.imshow(img[...,::-1])
plt.title("Color")

# 1 row,2 columns,index=2
plt.subplot(212);
plt.imshow(GRAY_image,cmap='gray')
plt.title("Gray_Scale")
```

Out[44]: Text(0.5, 1.0, 'Gray_Scale')



In [10]:
```
#cropping
plt.imshow(RGB_image[50:100,200:300])
```

Out[10]: <matplotlib.image.AxesImage at 0x3a5d32c8e0>

In [ ]: