CG21-T2 Processamento de Imagens

Faça um notebook que:

1. Leia e exiba uma imagem RGB.
2. Ilustre com um grafico xy a variação dos canais red, green e blue na linha correspondente a metade da altura.
3. Transforme a imagem de RGB para uma imagem de luminância,Y, de acordo com a luminancia dos fósforos do sistema sRGB, explicada na pagina Relative luminance (https://en.wikipedia.org/wiki/Relative_luminance#cite_note-2) e exiba.
4. Transforme a imagem de luminância, Y, em imagem de "lightness", L, do sistema Lab
5. Exiba o histograma da imagem de luminância, Y, e responda qual a probabilidade de ao escolhermos randomicamente um pixel ele ter o valor a metade do valor máximo.
6. Aplique uma mascara de convolução que indique se um pixel pertence ou não a uma borda. Exiba o resultado desta convolução numa imagem em tons de cinza.
7. Exiba a imagem original no "estilo cartoon" (escureça os pixels que são borda).

Obs-Novas funções:

- matplotlib.pyplot.imread
- matplotlib.pyplot.imshow

In [ ]:

```
# Trabalho feito por Leonardo Monteiro Mastra Fontoura
# Matrícula:1721201
```

In [1]:

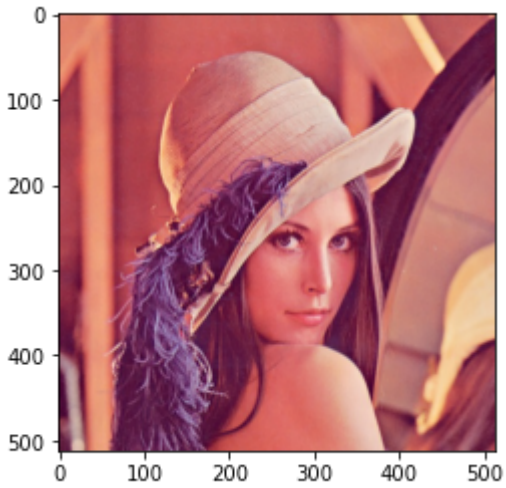
```
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```
#utilizei os arquivos na mesma pasta
path= ""
name= 'lenna.png'
fname = path + name
```

In [3]:

```
img = plt.imread(fname)

plt.imshow(img)
plt.show()
```



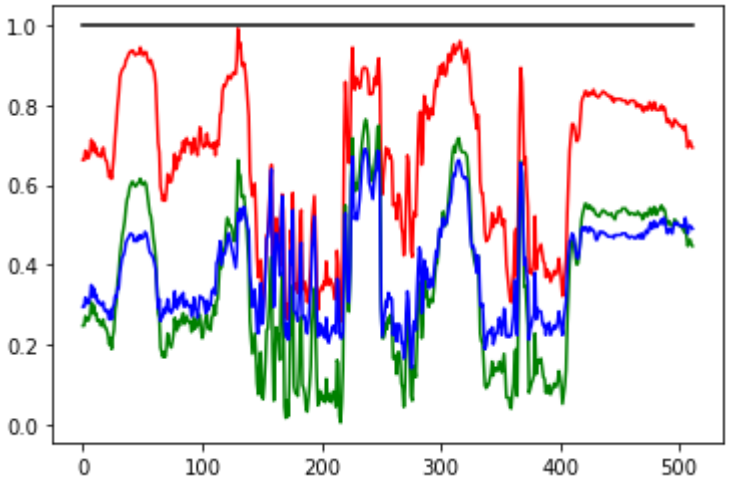
In [4]:

```
#numpy array com 4 canais, são 4 porque tem um canal alpha
print(img.shape)
```

```
(512, 512, 4)
```

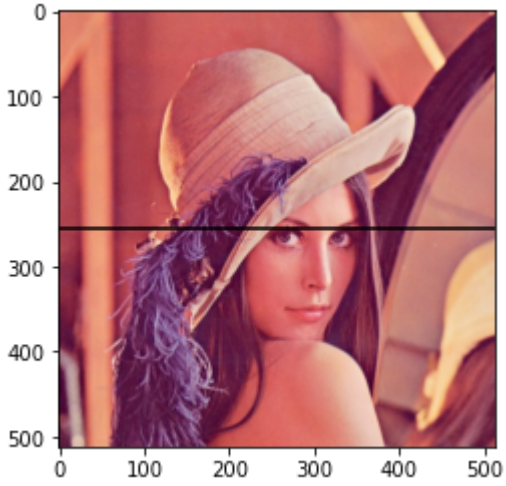
In [5]:

```
#altura e largura
h ,w = img.shape[:2]

red = img[h//2,:,0]
green = img[h//2,:,1]
blue = img[h//2,:,2]
alpha = img[h//2,:,3]
x = np.linspace(0,w-1,w)

plt.plot(x,red,'r')
plt.plot(x,green,'g')
plt.plot(x,blue,'b')
plt.plot(x,alpha,'k')
plt.show()
```



In [6]:

```
vx = [0,511]
vy = [h//2,h//2]
plt.imshow(img)
plt.plot(vx,vy,'k')
plt.show()
```

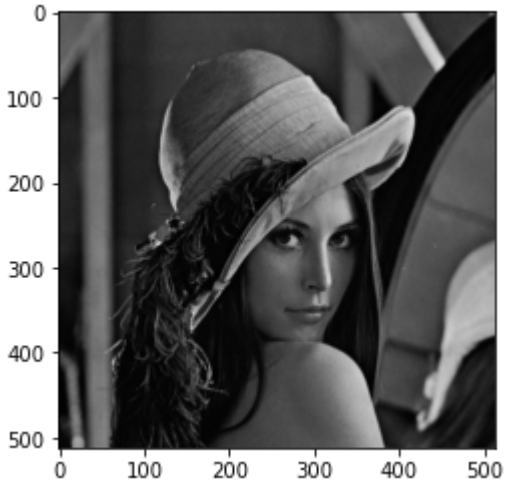


In [7]:

```
def gamainv(u):
    return 25*u/323 if u < 0.04045 else pow((200.*u+11)/211,12./5)

def lum(rgb):
    red = gamainv(rgb[0])
    green = gamainv(rgb[1])
    blue = gamainv(rgb[2])
    Y = 0.2126*red + 0.7152*green + 0.0722*blue
    return Y

Y = np.zeros((h,w),dtype=np.float)
for y in range(h):
        for x in range(w):
            Y[y,x]= lum(img[y,x,:])
```

In [8]:

```
plt.imshow(Y, cmap='gray')
plt.show()
```

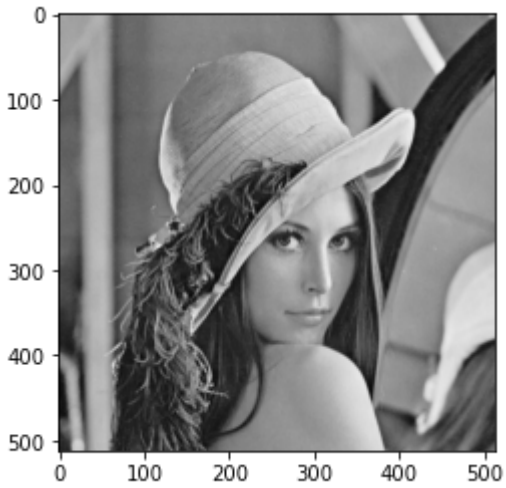


In [9]:

```
def lightness(Y):
    d = 6/29
    Y1 = pow(Y,1/3) if Y>pow(d,3) else Y/3*d*d+4/29
    L = 1.16*Y1-0.16
    return L
```

In [10]:

```
L = np.zeros((h,w),dtype=np.float)
for y in range(h):
    for x in range(w):
        L[y,x]=lightness(Y[y,x])
plt.imshow(L,cmap='gray')
plt.show()
```

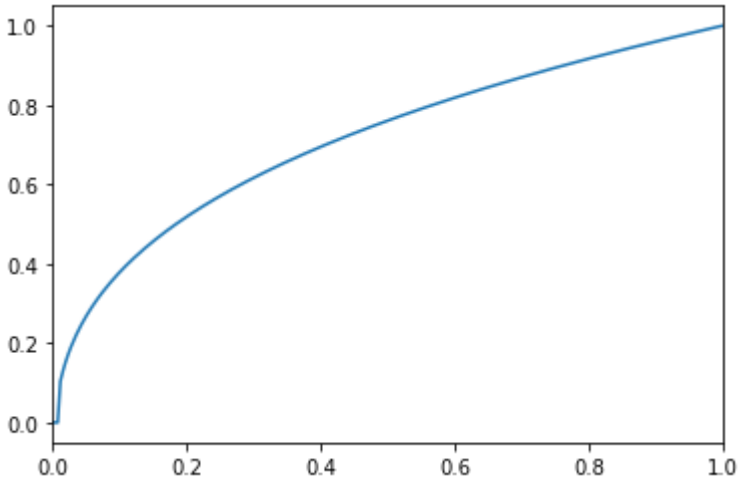


In [11]:

```
Y_ = np.linspace(0,1,256)
L_ = [lightness(y) for y in Y_]
```

In [12]:

```
plt.plot(Y_,L_)
plt.xlim([0,1])
plt.ylim()
plt.show()
```



Histograma e Função de densidade de probabilidade

In [13]:

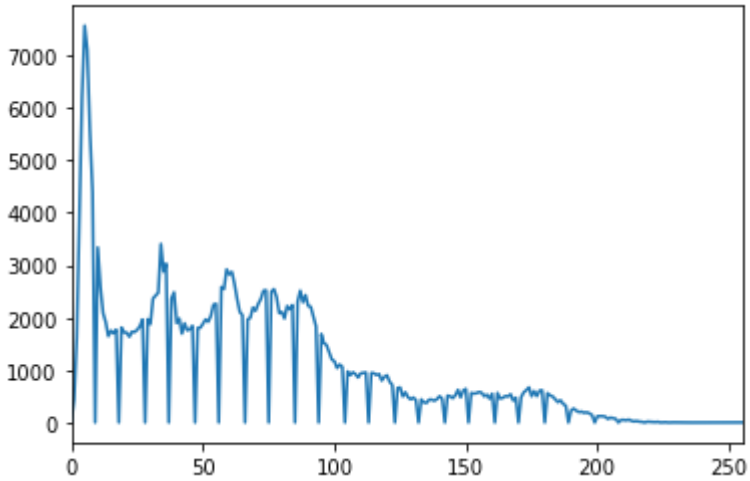
```
vals = np.round(255*Y)
vals = np.asarray(vals,dtype=np.int)
```

In [14]:

```
hist, _ = np.histogram(vals,bins=256)
```

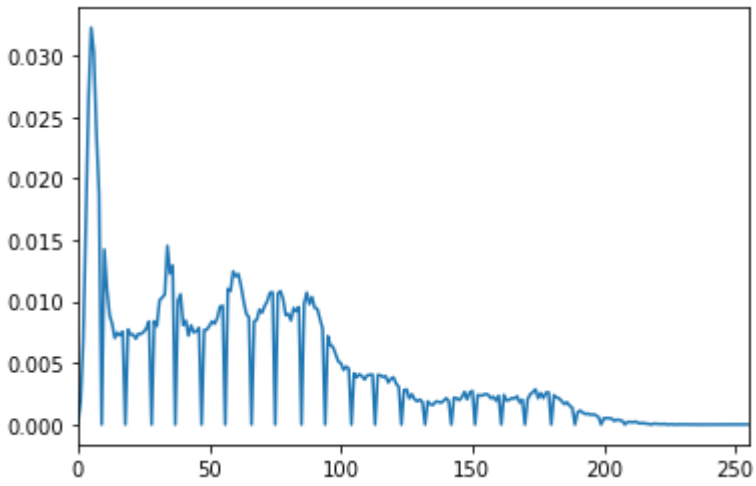
In [15]:

```
x = np.linspace(0,255,256)
plt.plot(x,hist)
plt.xlim([0,255])
plt.show()
```



In [16]:

```
hist2, _ = np.histogram(vals, bins=256,density=True)
plt.plot(x, hist2)
plt.xlim([0,255])
plt.show()
```



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Indicador de borda

In [17]:

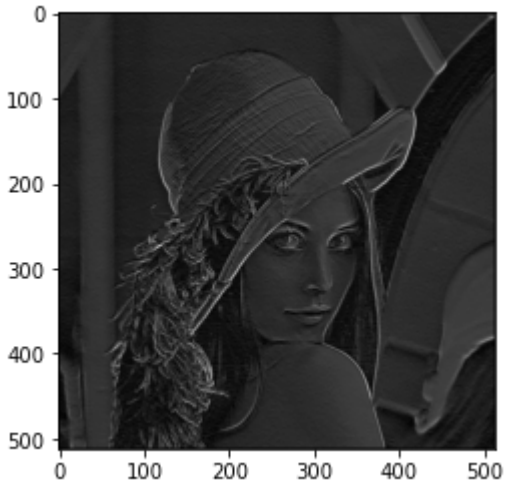
```
mask_dx = np.array([[1.,2.,2.],
                    [0.,0.,0.],
                    [-1.,-2.,-1.]])
mask_dy = np.array([[-1.,0.,1.],
                    [-2.,0.,2.],
                    [-1.,0.,1.]])
h,w = L.shape[:2]

edges = np.zeros(shape=(h,w))

for y in range(1,h-1):
    for x in range(1,w-1):
        patch = L[y-1:y+2,x-1:x+2]
        dx = np.sum(patch*mask_dx)
        dy = np.sum(patch*mask_dy)
        edges[y,x] = np.sqrt(dx*dx+dy*dy)
edges =  edges/np.amax(edges)
```

In [18]:

```
plt.imshow(edges,cmap='gray')
plt.show()
```



In [19]:

```
edges =  1 - edges
edges = edges*edges*edges
plt.imshow(edges, cmap='gray')
plt.show()
```

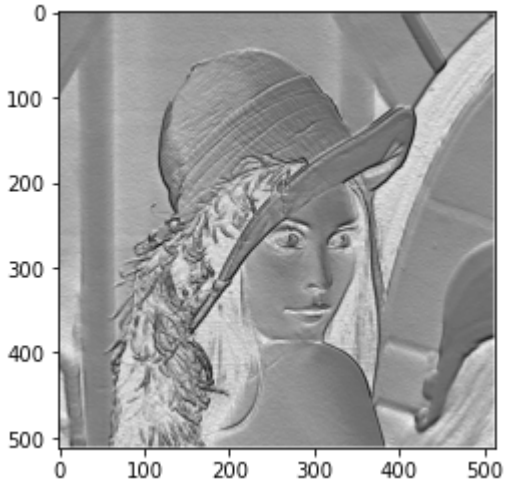


Imagem no estilo cartoon

In [20]:

```
cartoon = img[:,:,:3].copy()
print(cartoon.shape,img.shape)
```

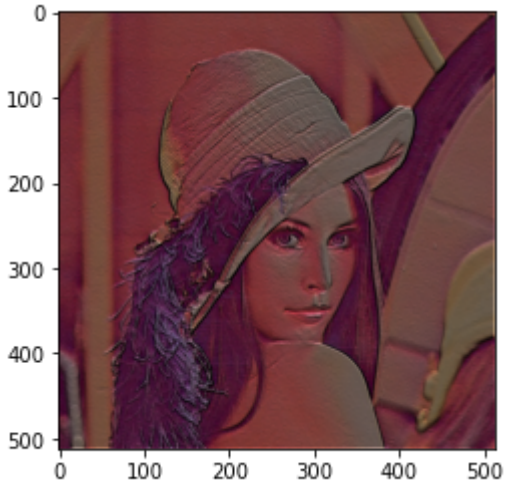
```
(512, 512, 3) (512, 512, 4)
```

In [21]:

```
cartoon[:,:,0]=edges*cartoon[:,:,0]
cartoon[:,:,1]=edges*cartoon[:,:,1]
cartoon[:,:,2]=edges*cartoon[:,:,2]
```

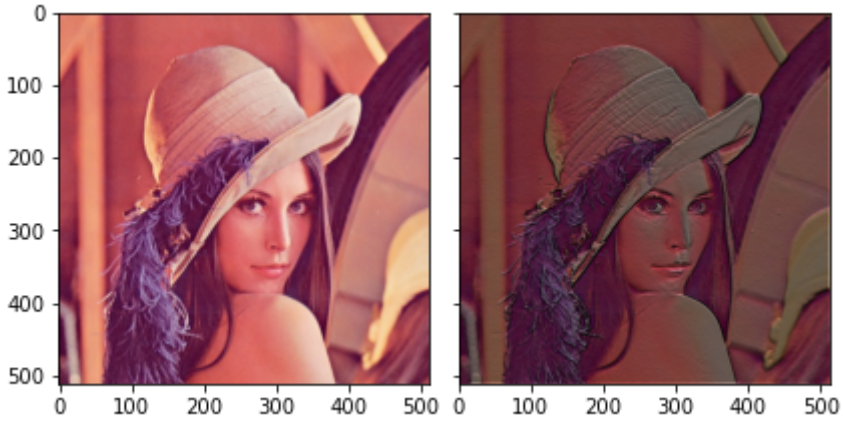
In [22]:

```
plt.imshow(cartoon)
plt.show()
```



In [23]:

```
fig, ax = plt.subplots(1,2,sharey=True,tight_layout=True)
ax[0].imshow(img)
ax[1].imshow(cartoon)
plt.show()
```



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