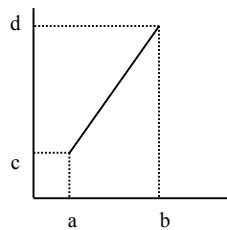


## AULA PRÁTICA 4. *PRACTICAL CLASS 4*

### 1. EXPANSÃO LINEAR DE CONTRASTE (ELC). *CONTRAST STRETCHING (ELC)*.

1.1 Programar e aplicar a ELC às imagens **sat.tif** e **meia\_cara.tif** de acordo com a expressão indicada. Apresente as imagens original e modificada, assim como os respectivos histogramas. Qual a diferença entre ambos os casos? *Program and apply the ELC to the images sat.tif and meia\_cara.tif according to the indicated expression. Present the original and modified images as well as their histograms. What is the difference between both cases?*




$$z_{out} = (z_{in} - a) \times \left( \frac{d - c}{b - a} \right) + c$$


1.2 Sobre as mesmas imagem, executar a alínea anterior com uma saturação de 2%. Compare os resultados. *On the same image, perform the previous paragraph with a saturation of 2%. Compare the results.*

```
h, r = np.histogram(Img, bins=256, range=(0, 256))


# com saturação
saturacao = 2./100 # percentagem (soma de ambos os lados)
p = h.astype(float)/(lin*col)
pa = np.cumsum(p)
a1 = float(np.count_nonzero(pa<=saturacao/2)-1)
b1 = float(np.count_nonzero(pa<=(1-saturacao/2))-1)
```



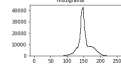
sat.tif



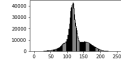
ELC com saturação



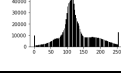
ELC com EHL e histograma igualado



Histograma



Histograma ELC



Histograma ELC sat

### 2. IGUALIZAÇÃO DO HISTOGRAMA. *HISTOGRAM EQUALIZATION*.

2.1 Aplicar a operação de igualização do histograma às imagens da pergunta anterior. *Apply the histogram equalization operation to the images from the previous question.*

```
# histograma acumulado
ha = np.cumsum(h)
# frequências absolutas
p = h/float(lin*col)
# frequências acumuladas
pa = np.cumsum(p)
# normalizacao de pa para o intervalo [0,n-1]
pa_norm = pa*(n-1)
# atribuição dos novos valores dos pixels
eq = np.zeros((lin, col))
for j in range(len(pa_norm)):
    eq = eq+(Img==j)*int(pa_norm[j])
```



sat.tif



imagem igualada



sat.tif



acumulado



igualada



igualada



3.1 Logaritmo (base 10). *Logarithm (base 10).*

```
L[:, :, i] = c * L0[:, :, i]
```

3.2 Exponencial. *Exponencial.*

```
E0[:, :, i] = base ** Img[:, :, i].astype(float)
```

3.3 Potência. *Power.*

```
P0[:, :, i] = Img[:, :, i]**p
```