

1. Given an image of size  $1024 \times 768$ , what is the size in bytes of the image if:
- is a binary one.
  - is a grayscale one with 256 levels.
  - is a RGB colored one with 8 bits per channel.
  - is a RGB colored one with 2 bits per channel.

a) binary image  $\Rightarrow 1$  bit/pixel

$$1024 \times 768 = 786432 \text{ pixels} \times 1 \text{ bit} = 786432 \text{ bits}$$

$$\Rightarrow \frac{786432}{8} = 98304 \text{ bytes}$$

b) 256 levels  $\rightarrow 8$  bits ( $2^8$ )

$$786432 \times 8 = 6291456 \text{ bits}$$

$$\hookrightarrow \frac{1}{8} = 786432 \text{ bytes}$$

c) RGB  $\rightarrow$  3 channels 8 bits each

$\rightarrow 24$  bits/pixel

$$786432 \times 24 = \dots \text{ bit}$$

$$\hookrightarrow \frac{1}{8} = \dots \text{ bytes}$$

d) 3 channels 2 bits each  $\rightarrow 6$  bits/pixel  $\dots$

2. A RGB image uses 2 bits per channel to code a pixel, how many different colors we can use ?

2 bits per channel  $\Rightarrow 2^2 = 4$  different values  
per channel

3 channels  $\Rightarrow 4^3 = 64$  different colors

3. Write the algorithm that transforms a gray scale image to a binary one.

- Read grayscale image  $G$
- Choose threshold  $T$
- For each pixel  $(i,j)$  in  $G$  :
  - \* if  $G(i,j) \geq T$  set  $B(i,j)=1$
  - \* else set  $B(i,j)=0$
- Return binary image  $B$

4. Write the algorithm that transform a grayscale image of 256 gray levels to a gray scale one with 16 levels.

for each pixel  $i, j$ : new $(i, j) = \left\lfloor \frac{\text{old}(i, j)}{16} \right\rfloor$

$\hookrightarrow \text{floor}$

7. What are the aspect ratios of the following images:

- a.  $300 \times 300 \rightarrow 1:1$
- b.  $600 \times 480 \rightarrow 5:4$
- c.  $1280 \times 960 \rightarrow 4:3$
- d.  $1440 \times 810 \rightarrow 16:9$