

# Lab Instructions - session 2

## Working with images

Reading and displaying a grayscale image:

```
>>> import numpy as np
>>> import cv2
>>> I = cv2.imread('masoleh_gray.jpg', cv2.IMREAD_UNCHANGED)
>>> I.shape
>>> I.dtype
>>> I[10,20]
>>> cv2.imshow('Masoleh Village', I);
>>> cv2.waitKey(10000) # display the image for 10 seconds
>>> cv2.destroyAllWindows()
>>> I = cv2.imread('masoleh.jpg')
>>> I.shape
>>> I.dtype
```

Reading a color image:

```
>>> I = cv2.imread('masoleh.jpg', cv2.IMREAD_UNCHANGED)
>>> I.shape
>>> I.dtype
>>> I = cv2.imread('masoleh.jpg')
>>> I.shape
>>> I.dtype
>>> I[10,20]
>>> cv2.imshow('Masoleh', I);
>>> cv2.waitKey(10000) # display the image for 10 seconds
>>> cv2.destroyAllWindows()
```

Display the image using matplotlib:

```
>>> from matplotlib import pyplot as plt
>>> plt.imshow(I)
>>> plt.show()
```

- Are the image colors strange? Remember scipy/matplotlib use the RGB system, while opencv uses the BGR system. Reading an image with opencv and displaying with matplotlib makes the blue and red channels swapped.

```
>>> plt.imshow(I[:, :, ::-1])  
>>> plt.show()
```

Remember, `I[:, :, ::-1]` reverses the order of the last dimension (the channels) and hence converts BGR (opencv) to RGB (for displaying with matplotlib).

## Set the green channel equal to zero

(remember openCV uses BRG, Blue: 0, Green: 1, Red: 2):

```
>>> I[:, :, 1] = 0  
>>> plt.imshow(I[:, :, ::-1])  
>>> plt.show()
```

## Saving an image

```
>>> cv2.imwrite('masoleh_nogreen.jpg', I)
```

## Displaying red, green and blue channels

Open a **code editor** and write the following code (or open the file **brg1.py** in the instructions folder). It displays the original image, the blue channel, the green channel and the red channel of the image when the keys 'o', 'b', 'g' and 'r' are pressed respectively. Notice that the green channel is brighter in green areas. So are the red and blue channels.

```
import cv2  
import numpy as np  
  
I = cv2.imread('masoleh.jpg')  
  
# notice that OpenCV uses BGR instead of RGB!  
B = I[:, :, 0]  
G = I[:, :, 1]  
R = I[:, :, 2]  
  
cv2.imshow('win1', I)  
  
while 1:  
    k = cv2.waitKey()  
  
    if k == ord('o'):  
        cv2.imshow('win1', I)
```

```
elif k == ord('b'):  
    cv2.imshow('win1',B)  
elif k == ord('g'):  
    cv2.imshow('win1',G)  
elif k == ord('r'):  
    cv2.imshow('win1',R)  
elif k == ord('q'):  
    cv2.destroyAllWindows()  
    break
```

## Task 1:

The above code shows the B, G and R channels as gray scale images. Change the above code so that the blue channel is displayed in blue, green channel in green, and red channel in red. Notice that since these are color images they have to **m by n by 3** arrays. For a purely red image the green and blue channels are entirely zero. The following code may help:

```
B = np.zeros(I.shape, dtype=np.uint8)  
print(B.shape)  
B[:, :, 0] = I[:, :, 0]
```

Alternatively, you can create a copy of an image and change it:

```
B = I.copy()  
# now change B so that it only contains the blue channel
```

## Blending two images

Method 1:

```
import cv2  
import numpy as np  
  
I = cv2.imread('damavand.jpg')  
J = cv2.imread('eram.jpg')  
  
print(I.shape)  
print(J.shape)  
  
K = I.copy()  
K[:, :2, :2, :] = J[:, :2, :2, :]  
  
cv2.imshow("Image 1", I)
```

```
cv2.imshow("Image 2", J)
cv2.imshow("Blending", K)

cv2.waitKey(3000)
cv2.destroyAllWindows()
```

- What does not above piece of code do?
- What does  $K[:, :2, :2, :] = J[:, :2, :2, :]$  do? (notice that  $J[:, :2, :2, :]$  represents every second row and every second column of J)
- Why have we written  $K = I.copy()$  instead of  $K = I$ ?

## Method 2

```
K = I//2+J//2
```

- what is the difference between methods 1 and 2?

## numpy addition vs opencv addition

```
>>> a = np.array([1,2,3,4,5,6,7,8,9,10], dtype=np.uint8)
>>> a
>>> b = np.full((10,), 250, dtype=np.uint8)
>>> b
>>> a+b
>>> cv2.add(a,b)
```

- What is the difference between  $a+b$  and  $cv2.add(a,b)$ ? Which one do you think should be used for adding up images?

## Blending with arbitrary ratios

0.8 of image I plus .2 of image J.

```
K = (0.8*I + 0.2*J).astype(np.uint8)
```

- Why have we used  $.astype(np.uint8)$ ?  $print((0.8*I).dtype)$  to see why.

```
K = cv2.addWeighted(I, 0.8, J, 0.2, 0)
K = cv2.addWeighted(I, 0.1, J, 0.9, 0)
K = cv2.addWeighted(I, 0.3, J, 0.7, 0)
```

For floating point variables alpha, beta and gamma, running  
 $cv2.addWeighted(I, alpha, J, beta, gamma)$

is similar to running

```
(alpha*I + beta*J + gamma).astype(np.uint8)
```

## Task 2:

Make an animated smooth transition from image  $I$  to  $J$ . You can use `cv2.waitKey(n)` to delay for  $n$  milliseconds.

## References

- [https://docs.opencv.org/3.0-beta/doc/py\\_tutorials/py\\_gui/py\\_image\\_display/py\\_image\\_display.html#py-display-image](https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_gui/py_image_display/py_image_display.html#py-display-image)
- [https://docs.opencv.org/3.0-beta/doc/py\\_tutorials/py\\_core/py\\_table\\_of\\_contents\\_core/py\\_table\\_of\\_contents\\_core.html#py-table-of-content-core](https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_core/py_table_of_contents_core/py_table_of_contents_core.html#py-table-of-content-core)