IMAGE PROCESSING FUNDAMENTALS

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In this part, you will discover the basic functions in order to load, manipulate and display images. Before starting, you need to install the following libraries

1. `pip install matplotlib`
2. `pip install numpy`
3. `pip install opencv-python==3.4.8.29`

OpenCV is a C++ programming library, with real-time capabilities. As it is written in optimized C/C++, the library can profit from multi-core processing.

Read image-video-webcam

Read image

```
1 import cv2
2 img=cv2.imread("path_to_image")
```

Show image

```
1 cv2.imshow("output",img)
2 cv2.waitKey(0)# delay to see image
```

If we put 0 into `waitKey(0)`, it means infinite delay. The other values equivalent to many milliseconds.

Read image-video-webcam

See matrix $M \times N$, which represents image in OpenCV

```
1 img=cv2.imread("fig/lena_color.png")
2 print(img.shape)
```

The result returns numpy.ndarray with shape (512, 512, 3), where $M = 512$ rows $\sim$ height, $N = 512$ columns $\sim$ width and 3 channels $\sim$ number of channels. In case of RGB color image, by default of OpenCV, the order of the channels is BGR.

```
(512, 512, 3)
[[[121 133 222]
  [121 133 222]
  [129 137 226]
  ...
```

Read image-video-webcam

Import and display video

```
1 import cv2
2 cap=cv2.VideoCapture("video/videoplayback.mp4")
3 while True:
4     success,img=cap.read()#success return true/false
5     cv2.imshow("video",img)
6     if(cv2.waitKey(30) & 0xFF==ord('q')): #add the delay & wait
          the keyboard to quit
7         break
8 cv2.destroyAllWindows()
```

Read image-video-webcam

Import and display Webcam

```
1  import cv2
2  cap=cv2.VideoCapture(0)# replace it with ID of camera
3  #set specific size for camera object
4  cap.set(3,400)#3: width
5  cap.set(4,400)#4: height; #10 for brightness ...
6  while True:
7      success,img=cap.read()#success return true/false
8      cv2.imshow("video",img)
9      if(cv2.waitKey(30) & 0xFF==ord('q')): # add the delay & wait
           the keyboard to quit
10         break
```

If you just have one camera (or laptop), you can put 0 and this will use default camera.

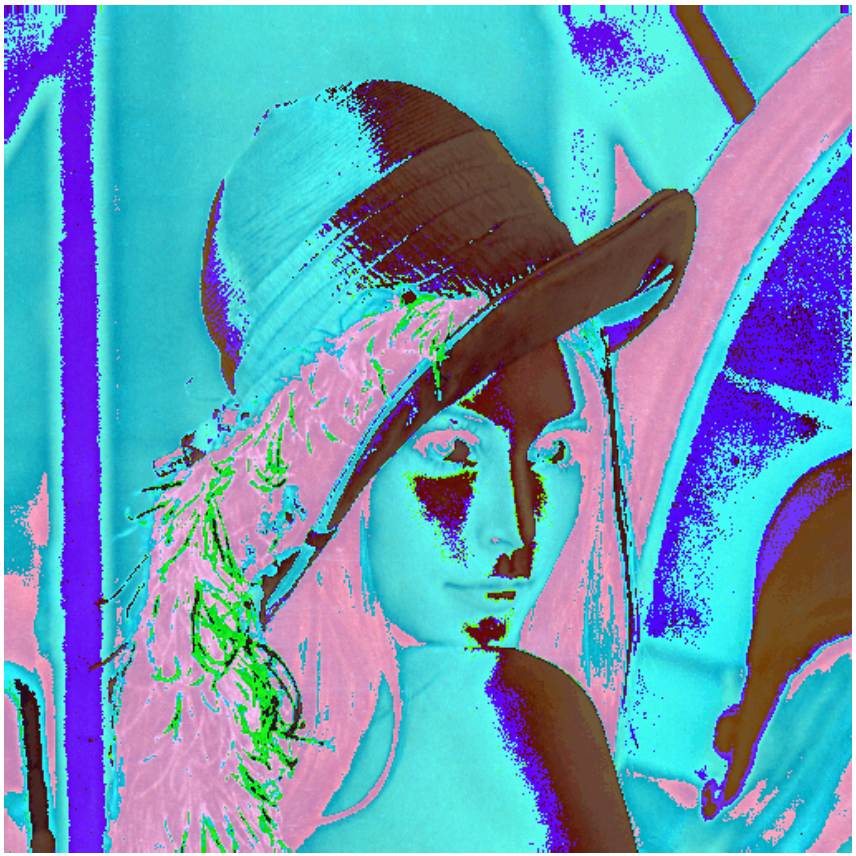
Sample code

The basic operations on the digital image

```
1  import cv2
2  import numpy as np
3  img=cv2.imread("fig/lena_color.png")
4  img1=np.zeros((img.shape[0],img.shape[1],img.shape[2]),np.uint8)
5  for i in range (img.shape[0]):
6      for j in range (img.shape[1]):
7          img1[i][j]=128-img[i][j]#+-*/
8  cv2.imshow("orignal",img)
9  cv2.imshow("new",img1)
10 cv2.waitKey(0)
11 cv2.destroyAllWindows()
```

Addition

(a) I



(b) $I + 128$

Subtraction

(c) I

(d) $128 - I$

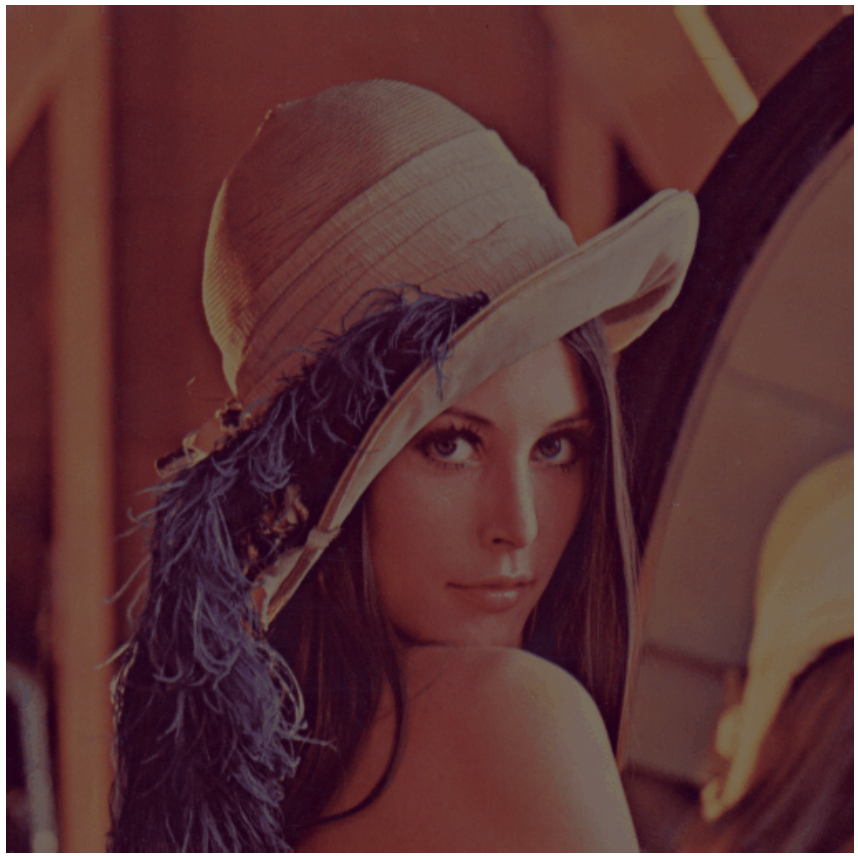
Multiplication

(e) I

(f) $I * 128$

Division

(g) I



(h) $I/2$

THANKS FOR YOUR ATTENTION!

Tài liệu tham khảo

Fernández, Alberto
Mastering OpenCV 4 with Python, 2019, Packt Publishing Ltd.