Exercise for MA-INF 2201 Computer Vision I - WS1819
09.10.2018
Submission on 14.10.2018
Introduction to OpenCV

You are required to write your code in **python-3.5**. Please follow the instruction in the README to provide your solution. Please also properly **comment** your code.

1. **Installing Python-3.5 and OpenCV-3.4.x**

   (a) We will be using **python-3.5** during the complete span of this course. We encourage you to install a dedicated python **virtual enviroment** to hold all packages required for this course. Note that, for each exercise, we will provide a set of packages that can be used for any given exercise and you are not allowed to use any other package.

   (b) Install **opencv-python** and **numpy** in your virtual enviroment.

   (c) Print the version of your opencv. It should be `3.4.x`.

2. **Getting started with OpenCV and NumPy:**
   We highly suggest you to read the Introduction to Python-OpenCV before starting to code.

   (a) Write a program that reads the image `../images/bonn.png` and displays it using `imread` and `imshow`.
   (0.5 Points)

   (b) Convert the image into an intensity image using the function cvtColor and display it.
   (0.5 Points)

   (c) Multiply the intensity image I by 0.5 and subtract it from each color channel. Make sure that the values do not become negative, i.e. the new (B, G, R) values are (max(B 0.5I, 0), max(G 0.5I, 0), max(R 0.5I, 0)). Do this in a pixel-wise manner using a nested for-loop. Display the result. Hint: OpenCV reads the images in `BGR` format in contrast to the commonly adopted `RGB` format.
   (1 Point)

   (d) Perform the operation above in a one-line python statement. Hint: you can use `expand_dims` function in numpy to add additional dimension in a numpy array.
   (1 Point)

   (e) Extract a 16×16 image patch out of the original image centered at the middle of the image, display it, and copy the content to a random location of the image. Hint: you can use `random` python module to generate random numbers.
   (1 Point)

(f) Draw 10 random rectangles and 10 random ellipses on the image using rectangle and ellipse and display it. Fill the shapes with the colors of your choice.
(1 Point)

Some useful resources:

1. https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_setup/py_intro/py_intro.html
2. https://python.swaroopch.com/
3. https://realpython.com/python-virtual-environments-a-primer/
4. https://www.pyimagesearch.com/2018/05/28/ubuntu-18-04-how-to-install-opencv/