INT3404E - Image Processing: Homework 1

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March 2024

1 Goals

The goals of this homework are:

1. Learn basic Python, the structure of Python programs, and common libraries such as Numpy, OpenCV, Matplotlib, etc.

2. Get used to the Google Colaboratory and Virtual Environments such as Anaconda

3. Document with Latex, code version control with GitHub

2 Preparatory Readings

Before you attempt the following exercises, read through the following Python, NumPy, and Matplotlib tutorials:

1. For a concise summary of Python, see https://learnxinyminutes.com/docs/python3/. Focus on the simpler functionalities like for-loops and manipulating lists.

2. See the NumPy and Matplotlib section of the Stanford CS231n course Python Tutorial: `https://cs231n.github.io/python-numpy-tutorial/`.

3. (Optional) Matplotlib Tutorial: `http://scipy-lectures.org/intro/matplotlib/index.html` or focuses more on image visualization: `https://matplotlib.org/stable/tutorials/images.html`

4. Latex guide: link, homework template link.

You may find the following reference (cheat) sheets are useful:

- NumPy cheatsheet: `https://assets.datacamp.com/blog_assets/Numpy_Python_Cheat_Sheet.pdf`

- Matplotlib cheatsheet: `https://s3.amazonaws.com/assets.datacamp.com/blog_assets/Python_Matplotlib_Cheat_Sheet.pdf`

3 Excercises

3.1 Basic Python

You have to complete all exercises on the UET course: link

3.2 Google Colaboratory

You have to complete the exercise on the UET course, and then submit the notebook to the Course and Github: link

Figure 1. The image coordinate system

3.3 OpenCV, Numpy, Matplotlib, and Latex

A picture or image can be represented as a NumPy array of "pixels", with dimensions H × W × C, where H is the height, W is the width, and C is the number of color channels. Figure 1 illustrates the coordinate system. The origin is at the top left corner and the first dimension indicates the Y (row) direction, while the second dimension indicates the X (column) dimension. Typically we will use an image with channels that give the Red, Green, and Blue "level" of each pixel, which is referred to in the short form RGB. The value for each channel ranges from 0 (darkest) to 255 (lightest). However, when loading an image through Matplotlib, this range will be scaled from 0 (darkest) to 1 (brightest) instead, and will be a real number, rather than an integer.

You will write Python code to load an image perform several manipulations to the image and visualize their effects. You'll need to get the file uet.png from the same place you downloaded this assignment.

- Implement all functions in the file ex1.py

- Report the result of the functions flip_image, rotate_image, grayscale_image using the above Latex template.

- Create a **public** repository on Github, create a new directory called HW1, and upload your ex1.py, your report, and the notebook of 3.2 and upload your repository link to Google Form link.