Introduction

1 General Notes

This exercise is intended to practice the material discussed in the computer vision course. The lecture follows the book by Szeliski: "Computer Vision: Algorithms and Applications", which is freely available online [1]. It is highly advised that you read the book, especially the chapters which are covered in this course. Apart from this, we also recommend the book "Multiple View Geometry in Computer Vision" by Richard Hartley, a sample chapter of which is available online [2]. Also, the university library offers a pdf version of this book, so you can get access to it from there.
The exercises are structured as follows:

- There are 5 exercise sheets. Excercises will not be corrected or graded. There will be questions on all excercises in the exam.
- The exercise sheets are meant to be solved during the lecture period. The lecture schedule indicates when an exercise should be solved.
- You may work on the exercises in groups.
- We will provide support with your exercises in the two excercise slots (in person) and via Microsoft Teams.
- You can find the Microsoft Teams invite link on Studon.

[1] http://szeliski.org/Book/
[2] https://www.cambridge.org/core/books/multiple-view-geometry-in-computer-vision/0B6F289C78B2B23F596CAA76D3D43F7A

2 Compile and Run

The exercises are written in Python and use the open-source library OpenCV. You may work on your own computer, on any OS and with any IDE. However, you we recomment to make sure that your solution (code) is working using the provided running scripts and testcases.**Note** : Students who want to install anaconda should have complete knowledge about it and only then set up conda environments in their system, otherwise we highly recommend to use system python and the steps suggested below.

Recommended version numbers: python : 3.6+
OpenCV : 4.1+

2.1 Install Python

Linux

```
sudo apt install python3
```

Windows
Tutorial
Doc

2.2 Setup Virtual Environment

Linux/Mac users

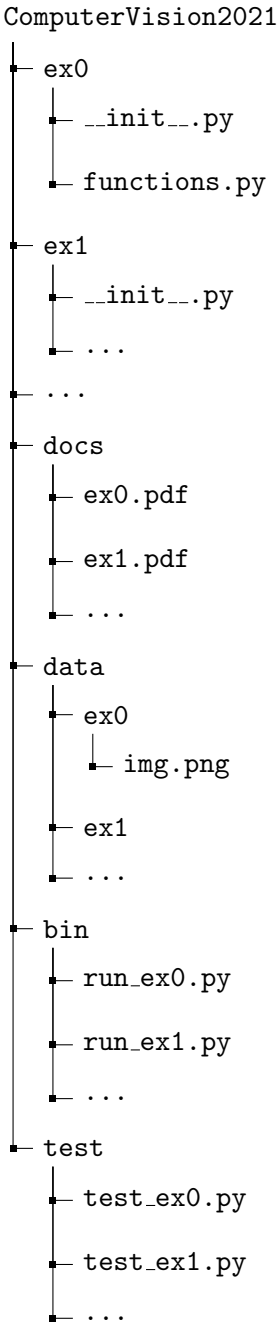
```
cd skeleton
python3 -m venv venv
source venv/bin/activate
pip install opencv-python numpy pytest
```

Windows users

```
cd skeleton
python -m venv venv
.\venv\Scripts\Activate.ps1
pip install opencv-python numpy pytest
```

2.3 Directory Structure

The project directory structure will be persistent across exercises. Submissions are expected to contain a snapshot of the project directory.


ComputerVision2021
ex0
__init__.py
functions.py
ex1
__init__.py
...
...
docs
ex0.pdf
ex1.pdf
...
data
ex0
img.png
ex1
...
bin
run_ex0.py
run_ex1.py
...
test
test_ex0.py
test_ex1.py
...

- Each exercise will consist of writing a python module.
- Each exercise will have it's own launching script found in ./bin. These scripts will usually be provided completed and demonstrate how the implemented module is given.
- Each exercise will have it's own pytest testcase found in ./test. Passing these test-cases will normally mean that the exercise is successful. Although you are allowed and encouraged to write you own test-cases, the original test cases should not be changed. Test cases passing are a good indication of a correct solution.
- Each exercise has it's announcement in docs/ex0.pdf, docs/ex1.pdf, ...

2.4 Run Code

```
# Go to exercise directory
cd skeleton
# Activate virtual environment
source venv/bin/activate [LINUX/MacOS]
.\venv\Scripts\Activate.ps1 [WINDOWS]
# Execute
python3 bin/run_ex0.py
# Test
pytest test/test_ex0.py
```

3 OpenCV Image Processing

To get used to the most basic OpenCV functions implement the following in `ex0/functions.py`:

3.1 Image Loading and Saving

Implement `show_images` and `save_images` in `ex0/functions.py`. Load the image `img.png` and display it on screen. Use the OpenCV functions `imread` and `imshow`. If your program exits, all created windows will close. Use the function `waitKey` to stall the program once all windows have been showed until a key has been pressed.

Similar to the loading, you can save the image by calling the function `imwrite`. Save the image as `img.jpg`

3.2 Resizing

Implement `scale_down` in `ex0/functions.py`. Resize the image by a factor of 0.5 in both directions with the OpenCV function `resize`. Show the resized image on screen and save it as `small.png`.

3.3 Color Channels

Implement `separate_channels` in `ex0/functions.py`. Create three images, one for each channel (red, green, blue). Make sure these objects have the same size and type as the input image. Iterate over every pixel of the input image and store each channel individually in one of the 3 images. A single row of an image is accessed in the following way:

```
// Set the blue channel of the fifth image column to 0
// Note: OpenCV stores images in BGR format.
img[i, 4, 0] = 0
```

Hint: An efficient solution has no loops in python/numpy.

Display the three images on screen. They should look like this:

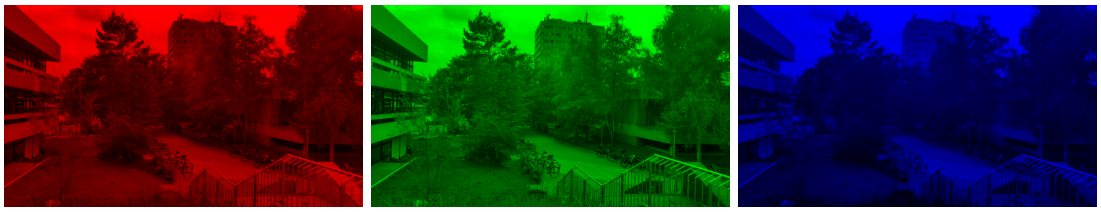


Figure 1: The red, green, and blue channel of the input image.