

Exercise 1: Introduction to image manipulation using Python

Introduction

In this exercise we will manipulate and analyze Sentinel-2 images using Python libraries. Please use the Jupyter Notebook provided to complete this exercise.

Info

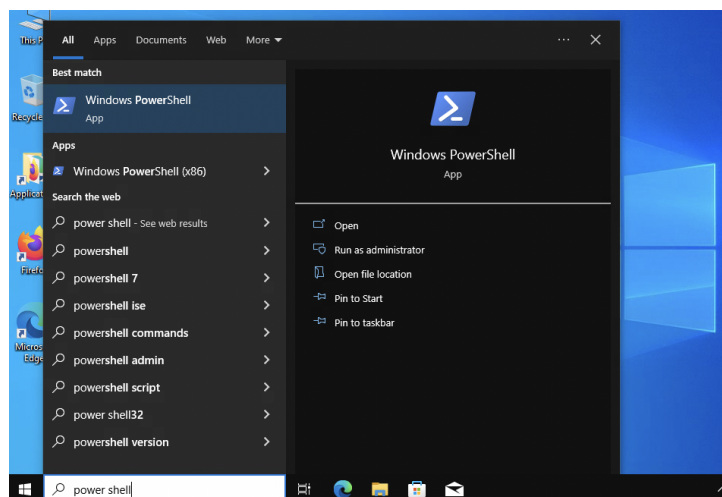
All parts in the code that require your input for completion are marked with flag “#TODO”.

Tasks

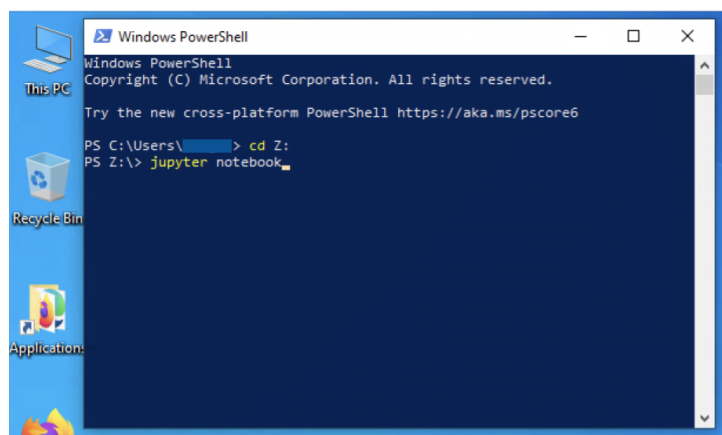
1 Setup

Follow the next steps to open the Jupyter notebook of the exercise, in the computers of the classroom. In case you want to work on your own computer, we recommend you to use Anaconda, you can find a tutorial to setup it in the folder Exercise 1 on Moodle.

- 1.1 Download all the files of the Exercise 1 available on Moodle, in your drive Z: if you are using the computers in the classroom.
- 1.2 Open Power Shell. This is a terminal where you can execute commands.



- 1.3 In the terminal type `cd Z:` and press Enter to move to the drive Z:, and then type `jupyter notebook` and press Enter again to open Jupyter



- 1.4 In Jupyter open the file `ex1.ipynb` by clicking on it.

2 Read images

Read the Sentinel-2 images using the function *imread* of the *skimage* library. You will find four image files when uncompressing the provided zip file (band2: blue, band3: green, band4: red, and band8: near infrared).

3 Save multi-band images on TIF files, and visualize them

3.1 Use the function *save_multiband_image* (provided in the Jupyter Notebook) to save, in tif files, the following images:

- Natural color image
- False color composite image
 - Near infrared → Red
 - Red → Green
 - Green → Blue

3.2 Read the saved images, normalize them using the function *get_normalized_image*, and use the function *imshow* of the *matplotlib* library to visualize the two saved images.

Q What changes significantly and what remains similar when comparing the false color composite image to the natural color image?

4 Crop images using bounding boxes

4.1 Use the function *crop_and_save_image* to crop the natural color image, and the false composite color image, using the following bounding boxes (pixel coordinates):

- Region 1 → *y_min*: 2500, *x_min*: 3090, *y_max*: 2590, *x_max*: 3180
- Region 2 → *y_min*: 920, *x_min*: 1830, *y_max*: 1120, *x_max*: 2030

4.2 Visualize the natural color image, and false color composite image of Region 1

Q Some objects of different categories have similar colors in the natural color image. Which objects are similar in the natural color image but very different in the false color composite image?

4.3 Visualize the natural color image, and false color composite image of Region 2

Q In general, with which colors are shown the roads, crops, and trees, in the false color composite image?

4.4 Let's analyze the size of the cropped regions

Q What is the shape of the numpy arrays of the two cropped regions?
Q The spatial resolution of the images is 10m. What is the area in square meters covered by each of the two cropped regions?