Image Processing in Python

1. Create an environment.

(base) C:\Users\zua3>conda create --prefix G:\ImagePross python=3.9

2. Install and Update pip and conda

```
conda install -c anaconda pip
```

```
conda update -n base -c defaults conda
```

3. Activate the environment.

(base) C:\Users\zua3> conda activate G:\ImagePross

4. Image Processing Libraries

4.1.Scikit-image: a collection of algorithms for image processing

```
conda install scikit-image
```

4.2. OpenCV: (*Open Source Computer Vision Library*) is a library of programming functions mainly aimed at real-time computer vision

```
conda install -c conda-forge opencv
```

```
conda install --channel=conda-forge libopencv opencv py-opencv
```

4.3. Pillow: python Imaging Library adds image processing capabilities to your Python interpreter

```
conda install pillow
```

5. Machine Learning Libraries

5.1. PyTorch CUDA tool kit

An open source machine learning framework that accelerates the path from research prototyping to production deployment.

```
conda install pytorch torchvision torchaudio cudatoolkit=11.3 -c pytorch
```

Check Installation:

```
(F:\ImagePross) C:\WINDOWS\system32>python

Python 3.9.7 (default, Sep 16 2021, 16:59:28) [MSC v.1916 64 bit (AMD64)]
:: Anaconda, Inc. on win32

Type "help", "copyright", "credits" or "license" for more information.

>>> import torch

>>> torch.cuda.is_available()

True

>>>exit()
```

5.2. TensorFlow GPU

TensorFlow is an end-to-end open source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML powered applications

```
pip install tensorflow
```

Check Installation:

```
(F:\ImagePross) C:\WINDOWS\system32>python

Python 3.9.7 (default, Sep 16 2021, 16:59:28) [MSC v.1916 64 bit
(AMD64)] :: Anaconda, Inc. on win32

Type "help", "copyright", "credits" or "license" for more
information.

>>> import tensorflow as tf

>>> len(tf.config.list_physical_devices('GPU'))>0

True

>>> exit()
```

5.3. Scikit-Learn

Simple and efficient tools for data mining and data analysis and accessible to everybody, and reusable in various contexts. Built on NumPy, SciPy, and matplotlib

```
conda install -c anaconda scikit-learn
```

6. Installation of some important Python Libraries

Check installation status of following libraries (numpy, scipy, matplotlib). These three could be already installed during installation of above libraries.

6.1. Numpy

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

```
conda install numpy
```

6.2. SciPy

SciPy (pronounced “Sigh Pie”) is open-source software for mathematics, science, and engineering.

```
conda install -c anaconda scipy
```

6.3. Matplotlib

Matplotlib is a Python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms. Matplotlib can be used in Python scripts, the Python and IPython shells, the Jupyter notebook, web application servers, and four graphical user interface toolkits.

```
conda install matplotlib
```

```
(G:\ImagePross) C:\Users\zia20>python
Python 3.9.7 (default, Sep 16 2021, 16:59:28) [MSC v.1916 64 bit
(AMD64)] :: Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more
information.
```

```
>>> import numpy, scipy, matplotlib
>>>
```

6.4. Pandas

pandas is an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language.

```
conda install pandas
```

6.5. Statmodels

statsmodels is a Python module that provides classes and functions for the estimation of many different statistical models, as well as for conducting statistical tests, and statistical data exploration. An extensive list of result statistics are available for each estimator.

```
conda install -c conda-forge statsmodels
```

6.6. Seeborn

Seaborn is a Python data visualization library based on matplotlib. It provides a high-level interface for drawing attractive and informative statistical graphics .

```
conda install seaborn
```

6.7. Plotly

Plotly is a technical computing company headquartered in Montreal, Quebec, that develops online data analytics and visualization tools. Plotly provides online graphing, analytics, and statistics tools for individuals and collaboration, as well as scientific graphing libraries for Python, R, MATLAB, Perl, Julia, Arduino, and REST.

```
conda install -c plotly plotly
```

7. Geospatial Python Libraries

```
conda config --add channels conda-forge
conda update --all
```

7.1. GeoPandas

GeoPandas is an open source project to make working with geospatial data in python easier. GeoPandas extends the datatypes used by pandas to allow spatial operations on geometric types. Geometric operations are

performed by shapely. Geopandas further depends on fiona for file access and descartes and matplotlib for plotting.

GeoPandas depends for its spatial functionality on a large geospatial, open source stack of libraries (GEOS, GDAL, PROJ). See the Dependencies section below for more details. Those base C libraries can sometimes be a challenge to install. Therefore, advise you to closely follow the recommendations below to avoid installation problems. for installtion please see http://geopandas.org/install.html

Required dependencies:

- numpy
- pandas (version 0.23.4 or later)
- shapely (interface to GEOS)
- fiona (interface to GDAL)
- pyproj (interface to PROJ)
- six

```
conda install --channel conda-forge geopandas
```

7.2. GDAL

This Python package and extensions are a number of tools for programming and manipulating the GDAL Geospatial Data Abstraction Library. Actually, it is two libraries – GDAL for manipulating geospatial raster data and OGR for manipulating geospatial vector data – but we'll refer to the entire package as the GDAL library for the purposes of this document. It should install with GeoPandas.

Check GDAL Installation:

```
(G:\ImagePross) C:\Users\zia20>python
Python 3.9.7 (default, Sep 16 2021, 16:59:28) [MSC v.1916 64 bit (AMD64)] ::
Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> from osgeo import gdal
>>> exit()
```

```
conda install gdal
```

GDAL requires a pointer to a specific folder containing projection and transformation information, otherwise you will run into errors when using some functions. In the Windows environments variable menu, under "User variables" in the top section, create a new "GDAL_DATA" variable pointing to the folder: "F:\ImagePross\Library\share\gdal".

7.3. Rasterio

Rasterio can read and write GeoTIF and other raster formats and provides a Python API based on N-D arrays and and GeoJSON. Installing rasterio from the conda-forge channel can be achieved by adding conda-forge to your channels with:

```
conda install -c conda-forge rasterio
```

7.4 Earthpy

Earthpy is a set of helper functions to make working with spatial data in open source tools easier. This package is maintained by Earth Lab and was originally designed to support the earth analytics education program.

```
conda install -c conda-forge earthpy
```

8. Install Jupyter Notebook and Ipykernel

JupyterLab is the latest web-based interactive development environment for notebooks, code, and data. Its flexible interface allows users to configure and arrange workflows in data science, scientific computing, computational journalism, and machine learning. A modular design invites extensions to expand and enrich functionality.

```
conda install -c conda-forge jupyterlab
```

```
conda install -c anaconda ipykernel
```

```
python -m ipykernel install --user --name ImagePross --display-name
"Python 3.9 (Image_Pross)"
```