Geospatial Analysis using Python - Working with Raster Data

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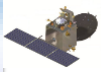
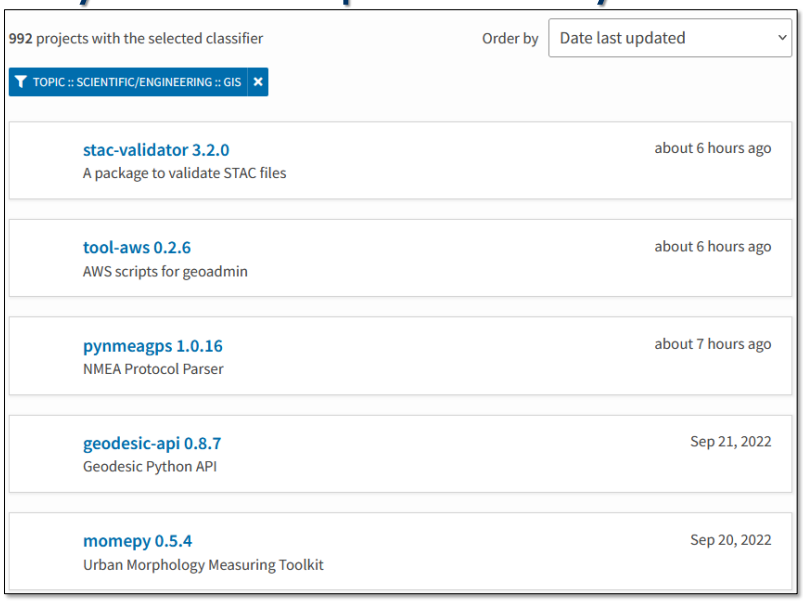


Geospatial Analysis using Python

- Contemporary proprietary software have limited traditional functionalities; Not suited for process modeling
- Convergence of artificial intelligence, big data, internet of things and geospatial sciences leads to demand for new tools, currently *not present* in conventional software
- Unthinkable to progress in geospatial research without automation
- Big data processing is impossible on standalone systems using conventional remote sensing (RS) and GIS softwares
- Large number of libraries supporting RS&GIS in Python

Python Geospatial Ecosystem



Popular Python Geospatial Libraries

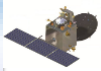
Vector based	Raster based
OGR	GDAL
Fiona	Rasterio
pyshp or shapefile	OpenCV
Geopandas	rasterstats
Shapely	scikit-image
PySAL	PIL / Pillow
Packages linked with other software	
grass.pygrass, pyqgis, arcpy, googlemaps, earthengine	

All are well maintained and documented. Each is meant for a specific purpose.

GDAL / OGR - History

- Launched in late 1998 by **Frank Warmerdam**
  - Core Team: Even Rouault, Howard Butler, Markus Neteler, and many more.
  - URL: www.gdal.org
- Software using GDAL (MIT license)
  - Nearly 112 listed on the website[1] (58 free; 53 paid)
  - Includes all popular software like ArcGIS, QGIS, Google Earth, GRASS GIS, IDRISI, ILWIS, SAGA, SkylineGlobe, Geoserver etc.

[1] https://gdal.org/software_using_gdal



What is GDAL?

- GDAL is a **translator library** for raster and vector geospatial data formats.
- X/MIT style Open Source License by OSGEO.
- As a library, it presents a **single** raster abstract **data model** and single vector abstract data model to the calling application for all supported formats.
- It also comes with a variety of useful **command line utilities** for data translation and processing.
- Written in C/C++; “Wrapped” for use with Python, Perl, VB, C#, R, Java …

Why GDAL?

- Supports all known GIS file formats
- Supported raster formats (**159 drivers**[2]):
  - Erdas Imagine **.img**, GeoTIFF, netCDF, HDF
  - OGC Web services: WCS, WMS, WMTS
  - ECW, MrSID
  - JPEG, JPEG2000, PNG, GIF, BMP
- September 2022 GDAL/OGR 3.5.2 release.

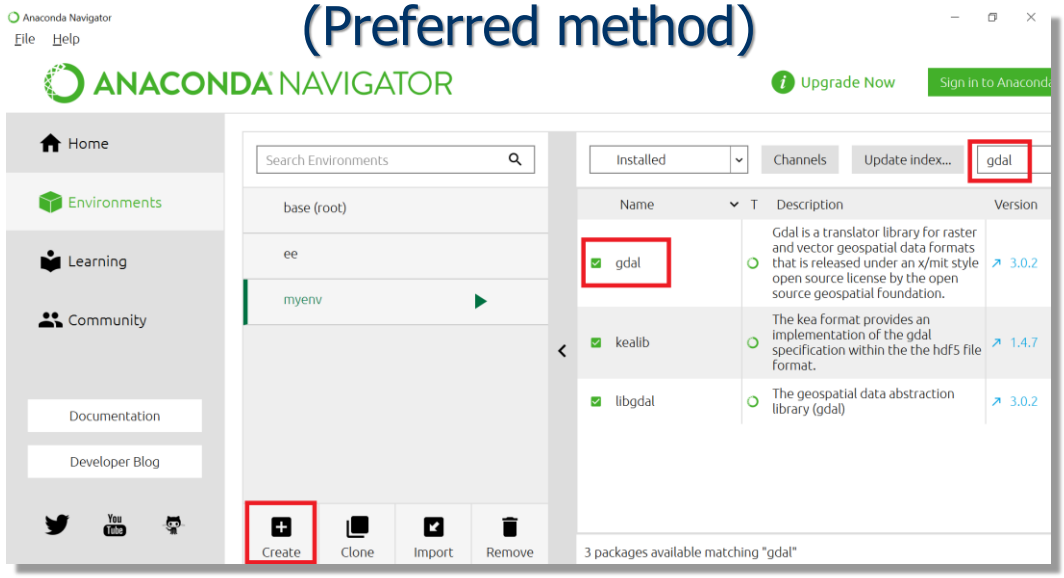
[2] https://gdal.org/drivers/raster/index.html

GDAL Command Line Utilities

- gdalinfo: Lists information about a raster dataset.
- **gdal_translate**: Converts raster data between different formats.
- **gdalwarp**: Image reprojection and warping utility.
- gdal_contour: Builds vector contour lines from a DEM.
- gdaldem: Tools to analyze and visualize DEMs.
- **gdal_rasterize**: Burns vector geometries into a raster.
- **gdal_grid**: Creates regular grid from the scattered data.
- gdal_proximity.py: Produces a raster proximity map.
- **gdal_polygonize.py**: Produces a polygon layer from a raster.
- **gdal_calc.py**: Command line raster calculator with numpy syntax.

and more …

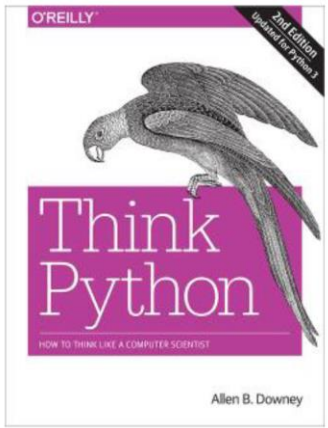
Installing GDAL using Anaconda Navigator (Preferred method)

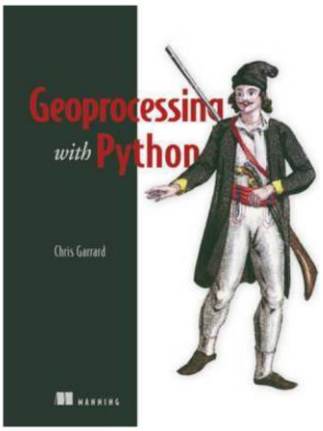


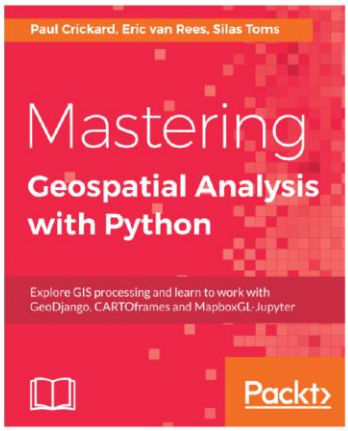
Installing GDAL using Anaconda Prompt

- Once the shown command is run, it will create a new **virtual environment** called “geo” containing the specified packages (GDAL and Geopandas)
- Dependencies (such as Numpy, Pandas etc.) will also get automatically installed

Books







Time for some hands-on using Python

Thank You

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