



INDIAN INSTITUTE OF REMOTE SENSING, DEHRADUN

Geospatial Analysis using Python - Working with Raster Data

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1



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

992 projects with the selected classifier

Order by Date last updated

TOPIC :: SCIENTIFIC/ENGINEERING :: GIS

stac-validator 3.2.0 A package to validate STAC files	about 6 hours ago
tool-aws 0.2.6 AWS scripts for geoadmin	about 6 hours ago
pynmeagps 1.0.16 NMEA Protocol Parser	about 7 hours ago
geodesic-api 0.8.7 Geodesic Python API	Sep 21, 2022
momepy 0.5.4 Urban Morphology Measuring Toolkit	Sep 20, 2022

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 website¹ (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



Nyall Dawson
@nyalldawson

This is your periodic reminder that if @EvenRouault is ever hit by a bus, the ****whole**** spatial community is well and truly doomed 🙏

2:30 AM · Jun 25, 2019 · [Twitter for Android](#)

12 Retweets **55** Likes





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)

The screenshot shows the Anaconda Navigator application window. The 'Environments' tab is selected on the left sidebar. In the center, the 'myenv' environment is listed. At the bottom, the 'Create' button is highlighted with a red box. On the right, the 'Channels' tab is open, and the 'gdal' package is highlighted in the search results. The table below shows the installed packages:

Name	Description	Version
gdal	Gdal is a translator library for raster and vector geospatial data formats that is released under an x/MIT style open source license by the open source geospatial foundation.	3.0.2
kealib	The kea format provides an implementation of the gdal specification within the the hdf5 file format.	1.4.7
libgdal	The geospatial data abstraction library (gdal)	3.0.2

3 packages available matching "gdal"

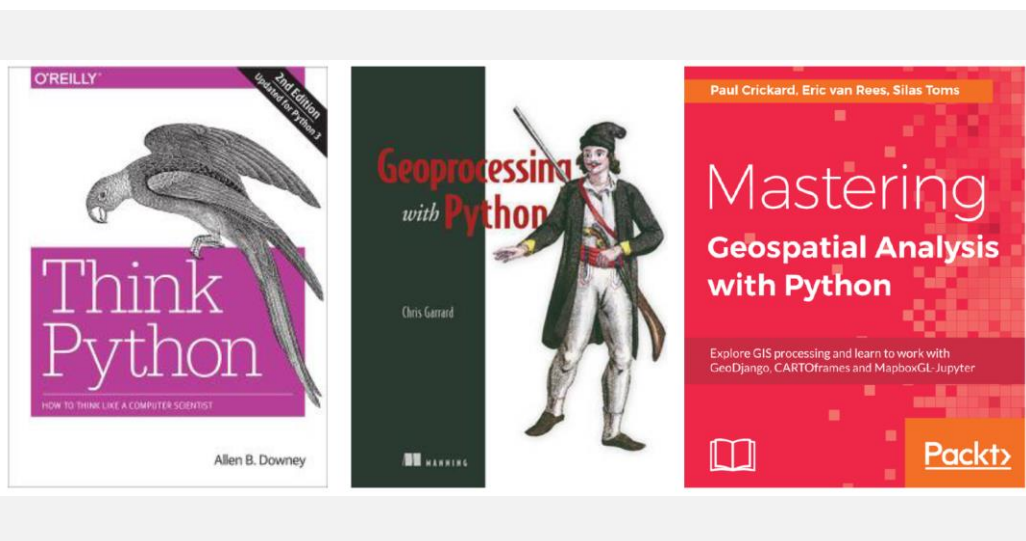
Installing GDAL using Anaconda Prompt

- 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



The screenshot shows the Anaconda Prompt interface. On the left, a sidebar lists various Anaconda tools. The main window displays the command: `(base) C:\>conda create -n geo gdal geopandas`. A blue arrow points from the text "Environment name" to the `-n geo` part of the command. Another blue bracket and arrow point from the text "Packages to be installed" to the `gdal geopandas` part of the command.

Books





Time for some hands-on
using Python



Thank You

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