

# **Introduction to the CyberGISX libraries**

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*Geospatial Fellows Program @ Zoom  
Oct 13, 2020*

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# Introduction

- Challenges to conduct reproducible and replicable geospatial research
  - Data-intensive
  - Computation-intensive
  - Collaboration-intensive
- Geospatial analytics
  - Open source stack and open geospatial technologies
  - The diversity versions
  - Maximum coverage of different spatial libraries

# Workflow

- Building CyberGISX-Lib
  - Testing the spatial library
  - The spatial dependency analysis for different spatial libraries
  - Installing developing environments
  - Installing spatial libraries with specifying the version
  - Running CyberGISX-Lib

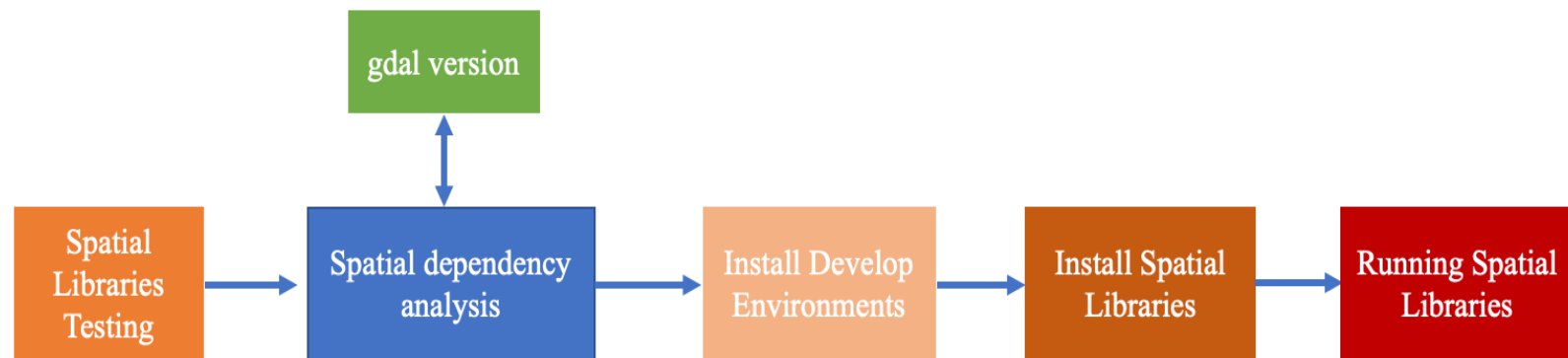


Figure 1: Workflow for building CyberGISX-Lib

## • Classes of python-based libraries

- utility libraries
- geospatial data processing
- spatial analysis
- geovisual analytics
- spatial simulation
- geospatial applications

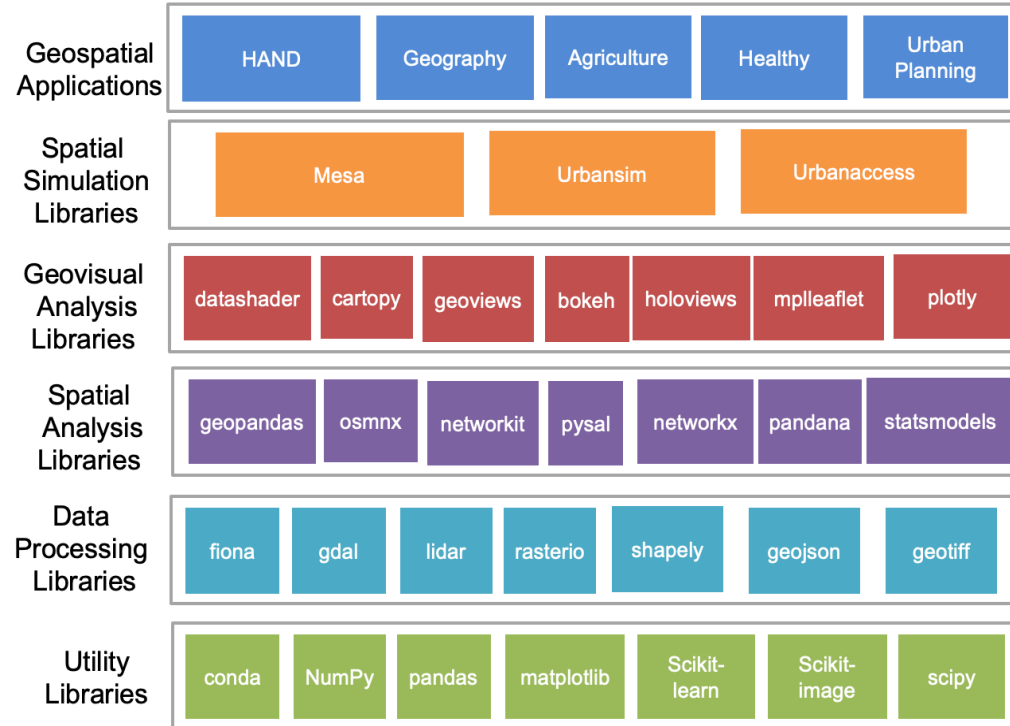
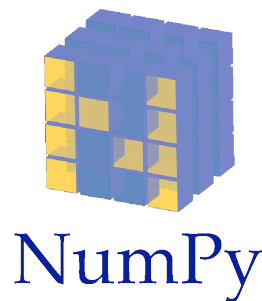
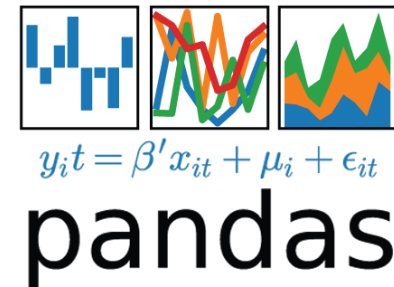


Figure 2: classifications for CyberGISX-Lib

- Utility libraries

- Support operations for reading numerical tables and time series, scientific computing for optimization, linear algebra, integration, interpolation, machine learning library with various classification, regression, and clustering.



- Geospatial data processing libraries
  - Support import/export geospatial datafiles (vector/raster/network, including shapefile, geojson files, geopackage), reprojection.
  - geospatial data abstraction library for reading and writing raster and vector geospatial data formats, building the spatial index, spatial data I/O, cartographic projections and coordinate transformations, and reading and writing spatial data.
  - Heterogeneous geospatial data sources can be pre-processed with data processing libraries.



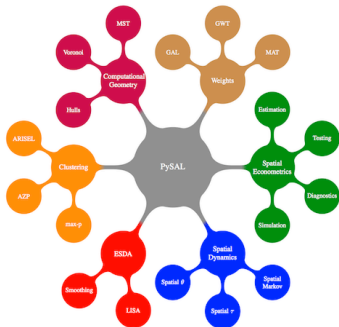
 rasterio

- Spatial analysis libraries

- Support building spatial index, spatial algorithms, spatial statistics, spatial interpolation, spatial optimization, spatial statistics, network analysis, and raster analysis.

 GeoPandas

 OSMnx  
stable



**NetworkX**

**NetworkKit**  
Large-Scale Network Analysis

 pandana

 Google OR-Tools



- Geovisual analysis libraries
  - Support creating maps, charts, tables, large scale datasets visual and mapping, visualize geographical, meteorological, and oceanographic datasets, statistical data visualization, and statistical data visualization.



**Datashader**



**Bokeh**

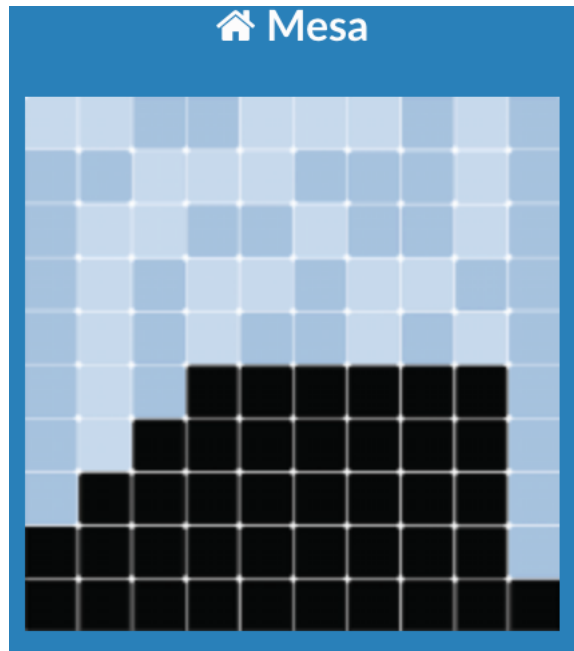


**GeoViews**

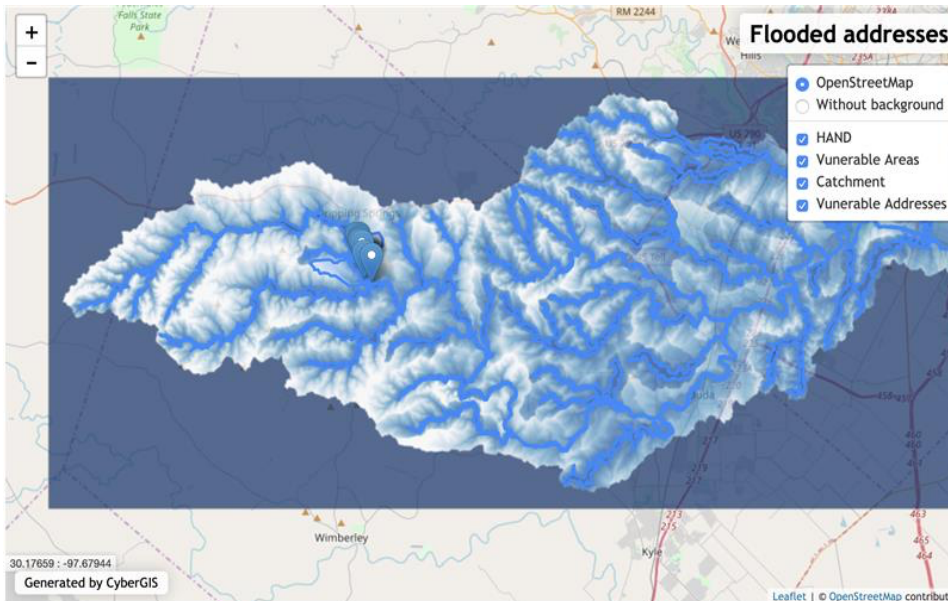


**HoloViews**

- Spatial simulation libraries
  - An agent-based modelling (ABM) framework and python toolkits for modelling and simulation urban land use (urbanism and urbanaccess).



- Geospatial applications
  - The CyberGISX support geospatial analysis in agriculture, geography, health, hydrology.



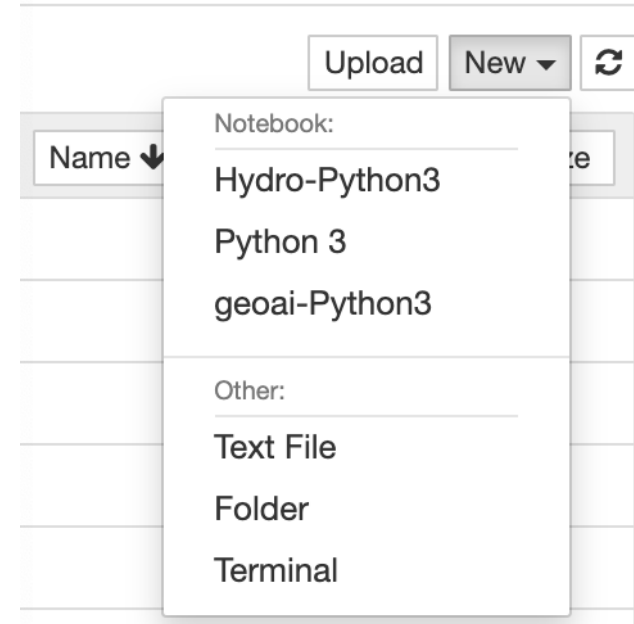
**GRASS GIS**

Bringing advanced geospatial technologies to the world

Figure 3: Flood address analysis with CyberGISX



- Different kernel
  - conda activate geoai-py3
  - conda install or pip install



```
jovyan@1b77b804eada:~$ conda activate geoai-py3
(geoai-py3) jovyan@1b77b804eada:~$ pip install torch==1.3.1
Collecting torch==1.3.1
  Downloading torch-1.3.1-cp36-cp36m-manylinux1_x86_64.whl (734.6 MB)
    |████████████████████████████████████████| 734.6 MB 31 kB/s
Requirement already satisfied: numpy in /opt/conda/envs/geoai-py3/lib/python3
Installing collected packages: torch
```

- Create a new kernel-qgis3 and install qgis
  - `conda create -y --name qgis3`
  - `conda activate qgis3`
  - `conda install -y -c conda-forge qgis=3.10.2 python=3.7`
  - `conda install -y -c anaconda ipykernel`
  - `/opt/conda/envs/qgis3/bin/python -m ipykernel install --user --name qgis3 --display-name qgis3`

# Deep learning with CyberGISX

- CPU-based Deep learning with CyberGISX
  - Tensorflow and keras
    - Install tensorflow with 'no avx'
  - Torch and fastai

<https://docs.google.com/document/d/1pOzueZa0wVtYhX3mw-sP-PPm-XEY8e9uKrq1LkwlHJk/edit>

# Supporting geospatial studies

- COVID-19 Accessibility
  - Kang, J., Michels, A., Lyu, F. *et al.* Rapidly measuring spatial accessibility of COVID-19 healthcare resources: a case study of Illinois, USA. *Int J Health Geogr* **19**, 36 (2020). <https://doi.org/10.1186/s12942-020-00229-x>
  - <https://github.com/cybergis/COVID-19AccessibilityNotebook>
- CyberGIS-Jupyter Notebooks
  - Examples and tutorials using cybergis-jupyter
  - <https://github.com/cybergis/cybergis-jupyter-notebook-repo>



# Acknowledgements

- National Science Foundation
  - 1443080
  - 1743184
- UIUC
  - CyberGIS center for Advanced Digital and Spatial Studies
  - School of Earth, Society and Environment

# Thanks !

- **Comments / Questions?**
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