



ArcGIS Pro: Your Spatial Data Science Workstation

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Spatial Data Science is...



Data
Engineering



Visualization
& Exploration



Spatial
Analysis



Machine
Learning & AI



Big Data
Analytics



Modeling
& Scripting



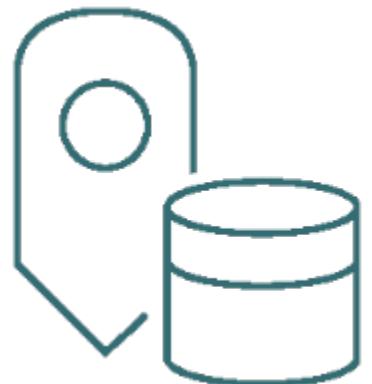
Sharing
& Collaboration

ArcGIS Pro is a powerful spatial data science workstation



Data Engineering

Transform your data with geography



Data Engineering

- Getting your data **ready for analysis**
 - What's missing?
 - What's wrong?
 - What can you add?
 - What should you transform?

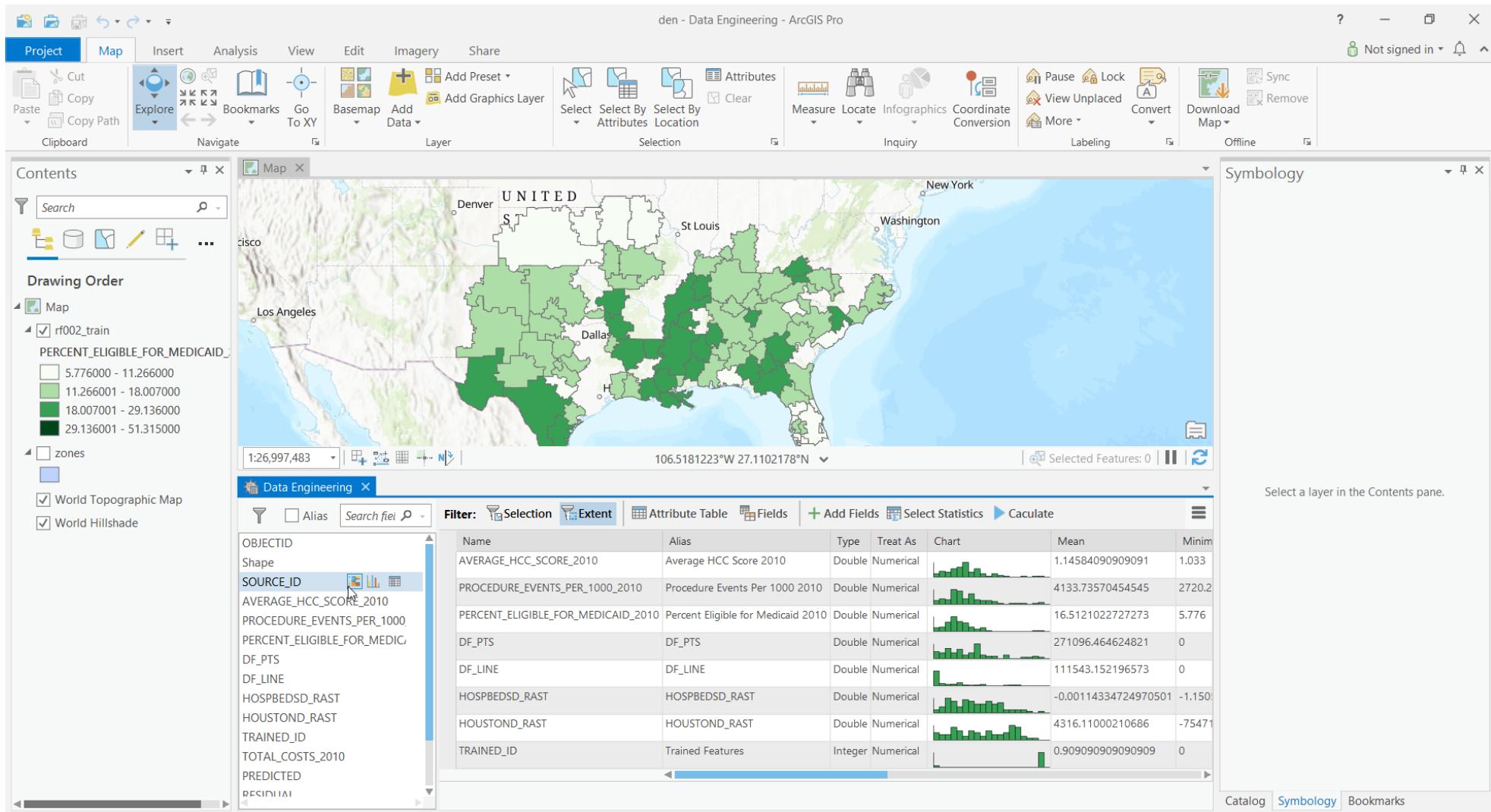
Data Engineering

The Fun Stuff



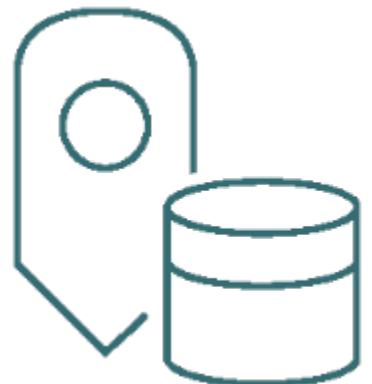
Data Engineering Experience

Sneak Peak



Data Engineering

Transform your data with geography



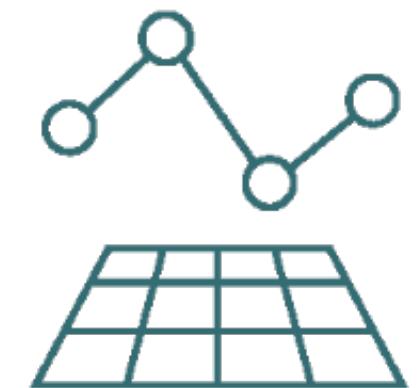
Visualization and Exploration

Make sense of your data



Spatial Analysis

Spatial problem solving



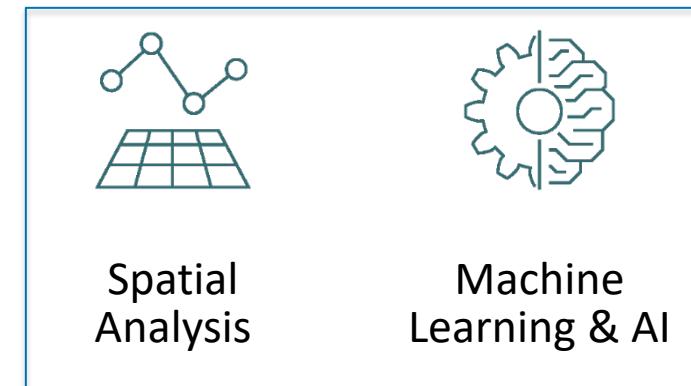
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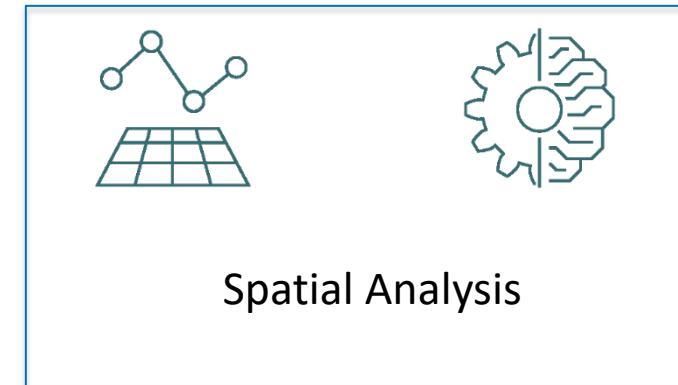
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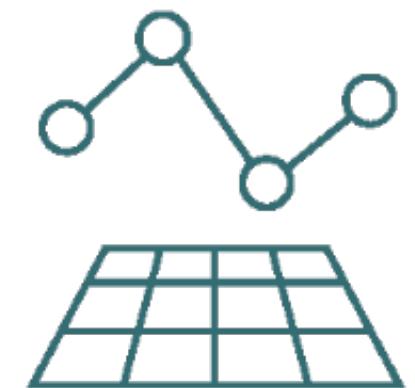


Sharing
& Collaboration

Focus on the problem

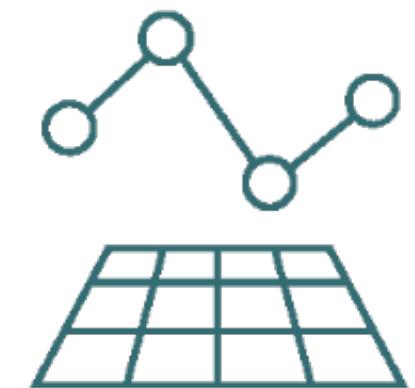
Spatial Analysis

Demo: Advanced Analysis in Pro



Spatial Analysis

Demo: R-ArcGIS Bridge



R-ArcGIS Bridge

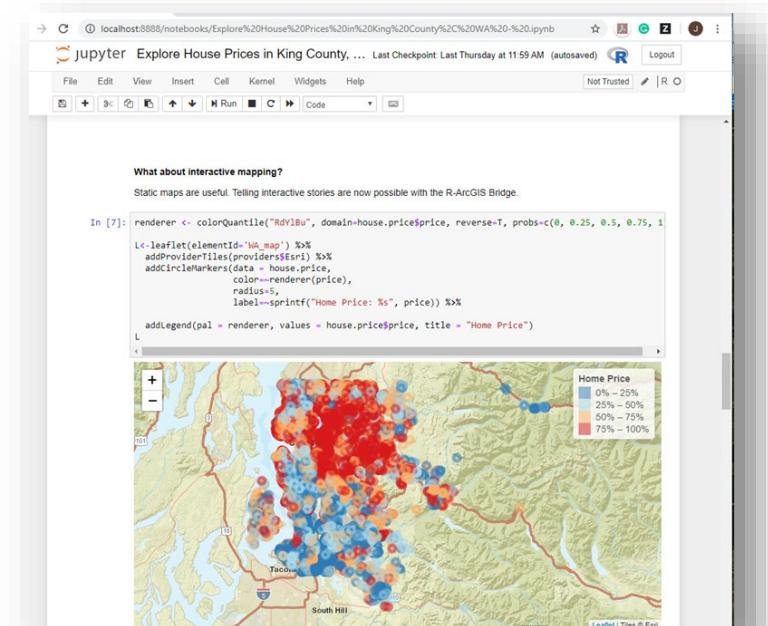
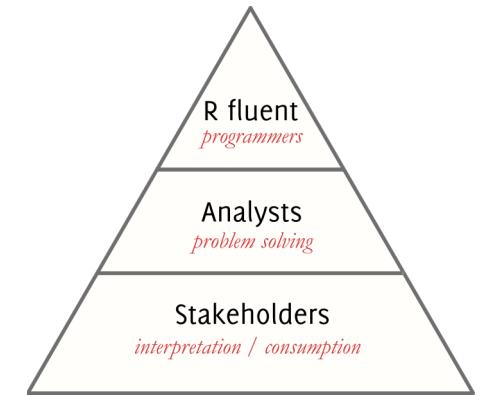


- **R Statistical Programming Language**
 - Powerful core data structures for analysis
 - Unparalleled breath of statistical routines
 - CRAN: 17000+ packages for solving problems

- **Esri: Integration with R-ArcGIS Bridge**
 - Access local and remote data
 - Transform to native R spatial data types: sf, sp, raster package
 - Selection and filtering to minimize memory footprint

- **Ways to use:**
 - Use in R Studio / R
 - Make GP tools which can call R
 - Jupyter Notebooks with R:

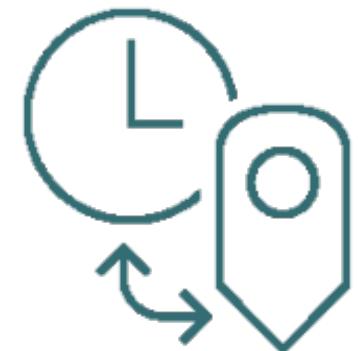
`conda install r-arcgis-essentials`



R Notebooks with Esri Leaflet and ArcPy

Big Data Analytics

Powered by distributed computing



Big Data Connections

- Read directly from **collections** of datasets in a directory
 - Delimited files
 - Shapefiles
 - Parquet
 - ORC

Name	Date modified	Type
AIS_ship_locations	6/15/2020 9:19 AM	File folder
Bus_locations_csv	6/15/2020 9:19 AM	File folder
Chicago_crimes_shps	6/15/2020 9:19 AM	File folder
EPA_Ozone_1980_to_2017_csv	6/15/2020 9:19 AM	File folder
hurricane_orc	6/15/2020 9:19 AM	File folder
lightning	6/15/2020 9:19 AM	File folder
mineplant_parquet	6/15/2020 9:19 AM	File folder
table_parquet	6/15/2020 9:19 AM	File folder
uberTrips_SanFrancisco_shp	6/15/2020 9:19 AM	File folder

lightning	lightning_01_2015.shp
	lightning_02_2015.shp
	lightning_03_2015.shp
	lightning_04_2015.shp
	lightning_05_2015.shp
	lightning_06_2015.shp
	lightning_07_2015.shp
	lightning_08_2015.shp
	lightning_09_2015.shp
	lightning_10_2015.shp
	lightning_11_2015.shp
	lightning_12_2015.shp

Project Geode

Sneak Peak

- Bringing spatial analysis and data engineering tools for vector and tabular datasets to **cloud infrastructure** that leverages Apache Spark
 - Google Cloud
 - Azure
 - AWS



Modeling and Scripting

Automate and extend functionality

From Python to Spatial Data Science Workstation



Foundational: ArcPy, Pro, REST API

Growth: Deep Learning, Python API, C

ArcPy
Python Window

arcpy.da
Background
Geoprocessing

Python 3 in Pro
Python raster
functions

1,022

926

760

855

Jupyter
Notebooks
Environments in
Pro

Python API for ArcGIS
Conda
SciPy Stack

1,200

1,718

2010

2012

2014

2016

2018

2020

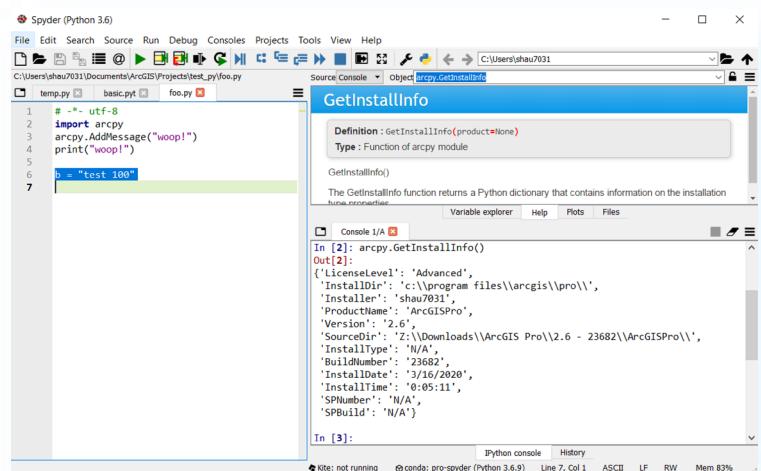
Geoprocessing tools

Modeling and Scripting

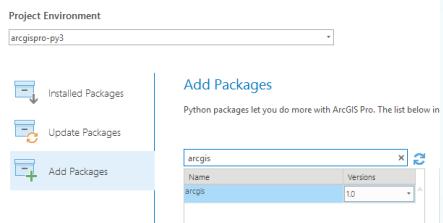
A comprehensive environment for automating, modeling and scripting your workflows and code

Pro components to help you:

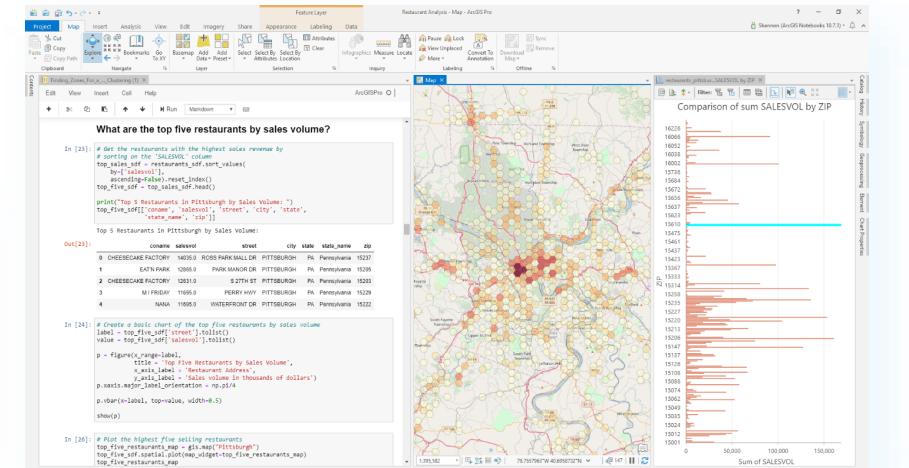
- Notebooks
- ModelBuilder
- Python and R script tools
- ArcGIS Python distribution
- Conda Environments



Python Package Manager



Conda



ArcGIS Pro with Notebooks + Charts

The screenshot shows a Jupyter notebook cell in Visual Studio Code. The code calculates point statistics and inspects geometry:`# calculate point statistics
arcpy.management.SelectLayerByLocation(points, "INTERSECT", "roads")
check if selection is None
counts = int(arcpy.management.GetCount(points))
if counts == 0:
 arcpy.AddError("No points are selected")
calculate sum, min, and max
arcpy.analysis.Statistics(points, output_table)
calculate sum, min, and max
for row in arcpy.da.SearchCursor(output_table, ["SHAPE@"]):
 arcpy.AddMessage("Number of points: {}").format(row[0])
 arcpy.AddMessage("Sum of values: {}").format(row[1])
 arcpy.AddMessage("Minimum value: {}").format(row[2])
 arcpy.AddMessage("Maximum value: {}").format(row[3])
 arcpy.AddError(e)`

```
In [3]: calculate_point_statistics()
Out[3]: calculate_point_statistics()
```

```
In [4]: arcpy.GetInstallInfo()
Out[4]: {'licenselevel': 'Advanced',
'InstallDir': 'c:\\program files\\arcgis\\pro\\',
'Installer': 'shau031',
'ProductName': 'ArcGIS Pro',
'Version': '2.6',
'SourceDir': 'c:\\downloads\\ArcGIS Pro\\2.6 - 23682\\ArcGISPro\\',
'InstallDate': '3/16/2020',
'InstallTime': '0:05:11',
'SPNumber': 'N/A',
'SPBBuild': 'N/A'}
```

The notebook also displays a code cell for inspecting geometry via its rich representation:`geoms = []
for row in arcpy.da.SearchCursor(infc, ["SHAPE@"]):
 geoms.append(row[0])`

Spyder

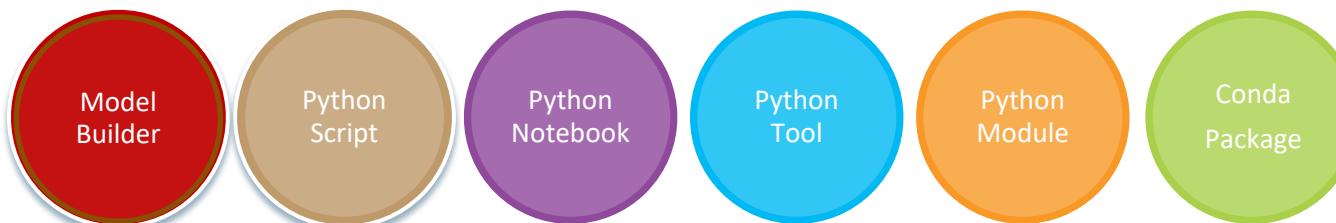
Visual Studio Code

Building tools and the Python Ecosystem

Once you've built a tool or notebook, you can deploy it:

- To a colleague's machine
- As a web tool, creating a service hosted in your enterprise or ArcGIS Online
- As a notebook to be run in hosted notebooks or ArcGIS Online

Start with what's available to you directly, in simple scripts and notebooks. Build up to more sophisticated models and tools to be kind to future you, and share your work with others



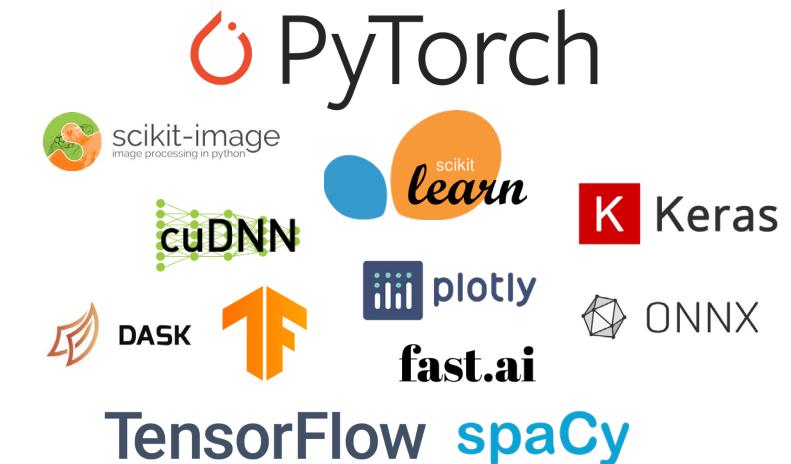
Extending Beyond

Deep Learning Frameworks Installer

Standalone installer with 98 packages

GPU optimized, use with GP tools, `arcgis.learn` models, and use the frameworks with your own code

<https://github.com/esri/deep-learning-frameworks>



Tie together with the Anaconda ecosystem

ArcPy is now conda installable – just add a product for it to access for licensing

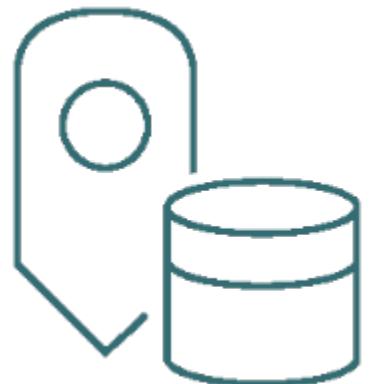
```
conda install -c esri arcpy
```

Use in conjunction with existing data science workflows

<https://anaconda.org/esri>

Sharing and Collaboration

The power of working together





<http://esriurl.com/SpatialDataScienceMOOC>

<https://learn.arcgis.com/en/>

<http://esriurl.com/spatialstats>

Please fill out a survey below