ArcGIS Pro: Analysis and Geoprocessing

Drew Flater and Jian Lange
Analysis & Geoprocessing in ArcGIS Pro

Is it faster?
About 10-20% for many tools. UX is more efficient.

esriurl.com/GPproFAQ

Does it have the same tools?
About 95% of the core ArcMap suite has been ported. Pro also has many new analytic tools that ArcMap does not have.

What does multi-threaded processing mean?
You can do other tasks in the app while a tool is running.

What is the benefit of 64-bit processing?
64-bit is not about performance. It lets you load more data into memory. It is more robust and many processes that used to hang, crash, or run out of memory may complete successfully.

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Can I use ArcGIS Online and Enterprise analysis tools?
Ready-to-Use service tools jump start your analysis and consume credits. Enterprise tools include Standard Feature, GeoAnalytics, and Raster Analysis.

Are tools licensed differently? How about analysis extensions?
Same as ArcMap.

Can I process the same data?
Personal GDB (.mdb) not supported, all other local and enterprise formats supported. Pro analysis natively supports layers from your Portal, service URLs, KML layers, and WFS layers.

Can I publish a geoprocessing service?
The Web GIS equivalent is sharing a web tool to your Enterprise. Support in 1.4.

Can Pro run my models and scripts?
With very little or no modification. There are established patterns for writing Python that works in py2 and py3. *arcpy.mp

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Any other reason to use Pro?
Charts are integrated in analysis workflow. R-ArcGIS bridge first-class citizen. Conda and Python Package Manager.
What is analysis?

Analysis transforms raw data into information or knowledge.

*Spatial analysis* does this for geographic or spatial data.

Spatial analysis is used to answer *where* or location questions

Where is the best location for a new community center?
Where is an area with statistically high crime rates?
Where has the landscape changed in the last 10 years?
Analysis in ArcGIS Pro

ArcGIS Pro provides incredible analysis capabilities in 2D, 3D, and 4D (time)
Scalable 64-bit execution, non-blocking threading, and improved visualization

Geoprocessing is the technology that enables spatial analysis in the ArcGIS Platform
What is geoprocessing?

**Geoprocessing** is a rich suite of tools for processing geographic data

Spatial analysis + GIS data management

A typical geoprocessing tool processes input data and produces an output

E.g. Buffer a map layer to create areas around the layer’s features

Geoprocessing is also a framework you can use to model and automate processes using ModelBuilder or Python scripts
Analysis in ArcGIS Pro

The **Analysis** ribbon tab provides access to:

- Gallery of commonly-used tools
- Suite of all ~800 geoprocessing tools
- ArcGIS Enterprise and Online analysis tools
- Geoprocessing History
- Python command line

Additional tools include:
- ModelBuilder
- Network Analysis
- Imagery processing / raster functions
- Data Interoperability Workbench
Geoprocessing in ArcGIS Pro

Full user experience driven through the Geoprocessing pane
  Search for tools or browse Toolboxes tree-view
  Open tool and set parameter and environment settings
  Run the tool and track progress

Easy migration for ArcMap users

Supports most* tools, models, and Python scripts that work in ArcMap
  *ArcObjects-based custom tools are not supported

Supports traditional feature and raster data sources as well as web layers

History provides a log of all tools you run

Share as a geoprocessing package or web tool
Create a geoprocessing workflow

Automate geoprocessing in a Python script
To get started, run the tool in Pro, then
*Copy Python command* and paste into script

```
arcpy.Buffer_analysis(input, output, "10 Miles")
```

Build a model of your workflow using ModelBuilder
Connect tools and data to make a diagram that represents your workflow
Python in ArcGIS Pro

Uses Conda environment manager and enhanced with built-in Python Package Manager

Makes it easy to find and install additional libraries, including Python API for ArcGIS for scripting portal operations

Includes new libraries: Pandas, SciPy, NetCDF4
Charts

Use charts to explore your data and communicate a message

Include as part of your analysis workflow to:

Understand patterns and relationships before running an analysis
Communicate information about your analysis results

Create a bar chart, scatter plot, histogram, line chart, profile graph or box plot

Fully interactive with the map layers and extent, attribute table, and range and time filters
Demo
Flood risk assessment
Spatial Statistics

Statistical tools for analyzing spatial distributions, patterns, processes and relationships

- Summarize key characteristics of a spatial distribution
- Identify significant clusters and outliers, hot and cold spots
- Model and explore spatial relationship through regression

Space-Time Pattern Mining

- Aggregate data into cube data structure and identifies hot and cold spot trends and outliers
- Visualize the cube in 3D (add-in makes it easy)
Spatial Statistics advancements

Create Space Time Cube From Defined Locations

Uses point or polygon locations where geography does not change but attributes are changing over time.

Fill Missing Values

Replaces missing or null values with estimates based on spatial and temporal neighbors.
R-ArcGIS Bridge

R is the most widely-used statistical computing language in the world

Includes thousands of libraries for diverse applications

R-ArcGIS Bridge makes it easy to use GIS data in an R script

R-based script tool provides familiar geoprocessing tool for GIS users, but executes in the R engine

Requires installation of R and R-ArcGIS bridge
Connected GIS
Integration with Web GIS

ArcGIS Pro

Pro is designed to be connected directly with ArcGIS Online and ArcGIS Enterprise

Access information and layers stored in your web GIS

Share custom analytics to ArcGIS Enterprise

Leverage the full analytic power of ArcGIS, including ArcGIS Online and ArcGIS Enterprise tools and services
Ready to use tools

Analytical operations hosted by ArcGIS Online, using Esri curated elevation, hydrologic, and street network data

Simply provide a few basic inputs

Uses ArcGIS.com credits and you must be connected to an ArcGIS online organization with analysis privileges
Contains tools for performing spatial analysis on feature data in your ArcGIS Enterprise

Only the use of ArcGIS Online utility services will consume credits

Run on a single server machine and are optimal for your standard sized data

Output layers in My Contents
ArcGIS Enterprise GeoAnalytics Tools

Run analytics against vector and tabular data that is too big for a single desktop machine, normally stored in a big data file share

Distributed processing using Spark on cluster of server nodes

Includes both spatial (location) and temporal (time) components

Output to a spatiotemporal datastore

Requires GeoAnalytics Server
ArcGIS Enterprise Raster Analysis Tools

Enable massive distributed processing and analysis of imagery and rasters

Leverage distributed processing

A capability of Image Server

A preconfigured set of tools, additionally supports custom raster function chains uploaded to image server
Analysis Extensions

ArcGIS Pro
Analysis Extensions

Extensions build on the core analysis capabilities of ArcGIS Pro

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Primarily comprised of additional geoprocessing toolboxes

Licensing same as ArcMap

Manage extension licenses the same way you license Pro (Named User, Single Use, Concurrent Use)
Spatial Analyst
Spatial Analyst

Extension available across the ArcGIS platform
Provide spatial modeling and analysis tools for raster data
Spatial Analyst key features

Suitability modeling
Density analysis
Distance and cost of travel analysis
Interpolation

Hydrologic analysis, watersheds
Powerful Map Algebra language & Raster Calculator
Spatial Analyst Highlights (1.3)

Site Selection Suitability Modeling
New Rescale By Function tool for assigning weights to model criteria

New Locate Regions tool for identifying most suitable regions from a suitability map.

Cost Distance Analysis
New Cost Connectivity tool makes it possible to quickly identify the optimal path between multiple locations in a non-networked cost distance problem.
New in 2.0: Slope and Aspect calculation improvements

**More accurate**, geodesic calculation
No scale factor needed with lat/long DEM
Locally parallel and **GPU aware**
Spline with Barriers
Now available in Pro

Create interpolated surfaces with discontinuities (faults)
Important tool for oil/gas industry and others
5x faster
Works with bigger data
Fixed many bugs
Distance Analysis improvements

More accurate algorithm
Better performance, especially with large data
Now supports direction of travel (moving toward or away from a location)
Improved default rendering of analysis results in Pro
Demo
Spline with Barriers
Geostatistical Analyst
Geostatistical Analyst

Statistical models and tools for interpolation

Predict values at new locations based on measurements in known locations
Creates statistically valid prediction surfaces along with prediction uncertainty or error

Off-the-shelf tool for calculating extremely accurate interpolation without configuration of statistical models
Empirical Bayesian Kriging

Interactive geostatistical modeling wizard
EBK Regression Prediction
A geostatistical multivariate prediction tool:
• to predict values of phenomena using secondary variables and,
• provide improved predictions at un-sampled locations

Better results by combining regression and kriging
Interactive Geostatistical Modeling

Geostatistical Wizard now in Pro

Visual step-by-step creation of robust models
Areal Interpolation
Now in the Pro Geostatistical Wizard

Transform aggregated polygon data to continuous surfaces or to other polygons
With an error estimate
Easy interactive model fitting
Demo
EBK Regression Prediction
Network Analyst
Extension drives street network analysis capabilities across ArcGIS Platform

20+ geoprocessing tools that automate network analysis

Ribbon-based workflow makes it fast and easy to get routes/directions, create service-area buffers, etc.

Workflow steps include

1. Create a network analysis layer
2. Add locations and configure layer
3. Solve

2D and 3D network analysis

Works with your network dataset or ArcGIS Online network service
Network Analyst key features

Routing / Directions
Closest facility
Drive-time / service areas

Location – Allocation
Vehicle routing problem
Origin – Destination matrix
3D Analyst
Elevation surface creation and analysis, using 3D vector geometries (multipatch), rasters, 3D TINs, terrains, and point clouds

Support for analysis, visualization, and classification of Lidar and point-cloud data through the LAS dataset format

Measuring distances/proximity and evaluating spatial relationships in 3D

Volumetric and visibility analysis
3D Analyst Highlights

Extract and Regularize Building Footprints from Lidar / LAS dataset

The Classify LAS Noise tool detects LAS points that likely represent anomalous measurements and classifies them as noise.

The Classify LAS Overlap tool detects LAS points from overlapping flight lines and classifies the points with larger magnitude scan angle values as overlap.

The LAS Building Multipatch tool creates building shells using existing footprints and Lidar rooftop points.

The Update Feature Z tool updates feature z-values through interpolation on an elevation surface.
Demo

Lidar Noise Classification
Learn more about spatial analysis & geoprocessing in Pro

pro.arcgis.com/en/pro-app/help/analysis
desktop.arcgis.com/en/analytics/casestudies/

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