Spatial Analysis: The Road Ahead

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Spatial Analysis
Gain value from location data to make better decisions

Understand where
Determine how things are related
Find the best locations and paths
Detect and quantify patterns
Make predictions
Spatial Analysis

Top Trends

- More accessible
- Big Data
- Distributed
- Real-time
- Space and Time
- Data visualization
- Data Science Integration
- Intuitive and responsive
- Less coding
- Analytics for new audiences
- Predictive Analytics
ArcGIS - Comprehensive Analytics Platform

Analysis Experience for Everyone

- Online Analytics
- Fast Data Discovery & Analytics
- Professional Desktop Suite
- Real-time Analytics
- Python Notebooks & R Integration
- Location-based Content & Services
- Big Data Analytics
- Focused Analytical Solutions
ArcGIS Pro
Analysis and Geoprocessing Road Ahead

Jian Lange
ArcGIS Pro: Analysis and Geoprocessing

Provide a powerful framework and diverse set of tools for both interactive and automated spatial analysis and data management, enable users to share analytics with their organization or community, and leverage the analytics power of Web GIS

- Geoprocessing tools and framework
- Charts and exploratory analysis
- ModelBuilder
- Python (ArcPy)
- Analytical extensions
ArcGIS Pro Analysis & Geoprocessing Road Ahead

- New Tools
- Enhanced Workflows
- More Chart Types
- Improving Performance
- Support Python Notebooks
New Tools

- Many new capabilities focusing on spatial machine learning techniques
  - Spatial Statistics
    - New Geographically Weighted Regression
  - General Linear Regression models
  - GPS Points to Road Network
Enhanced Workflows

- ModelBuilder
  - Automatically generate well formatted models from multiple sequentially run tools
Enhanced Workflows

- **ModelBuilder**
  - support two-way editing of variable values and tool parameters
More Chart Types

Scatter Plot Matrix
  Explore multiple relationships in one visualization

Bubble Plot
  Adding color and size to visualize more variables
Improving Performance

New parallelized geoprocessing tools for analyzing large desktop GIS data leveraging multi-core powerful desktop hardware

Leverage spatial capabilities in a number of databases to perform operations in the database instead of transferring data to client
ArcGIS Desktop has had an interactive Python command line since ArcMap 10

Useful for executing single lines or blocks of ArcPy or other Python code with syntax help and intellisense
Leverages the Desktop application to use layers and envs

Next generation of interactive scripting interface is the Notebook

Notebooks can be a local project item, or stored in the cloud
Similarly can be run on the Desktop or in the cloud
Empowered by both ArcPy and ArcGIS Python API, and united by data analysis with spatial data frames
In [2]: arcpy.SetPortalInfo()

Out[2]: 
{'SSL_enabled': False,  
'organization': 'ArcGIS Enterprise Build 8.320 Windows',  
'organization_type': '',  
'portal_version': '5.3',  
'role': 'org_admin'}

In []: arcpy.Buffer_analysis('c:\mydata\data.gdb\cities', 'cities_buffers', "10 Miles")
Python API Road Ahead
Noah Slocum
ArcGIS Python API

• Python API to your Web GIS

• Support geocoding, spatial analysis, distributed vector and raster analysis, and network analysis

• Integrate spatial analysis with the scientific Python ecosystem

• Support Jupyter Notebook
Python API: Road Ahead

- Realtime GIS
  - Automate GeoEvent admin

- Machine learning

- Publishing imagery/raster functions

- File Geodatabase
Python API: Road Ahead

- Hosted notebooks
  - Enterprise and Online
  - Share, secure notebooks items
  - Schedule notebooks to run at future date or at periodic intervals
ArcGIS GeoAnalytics Server

Tools for processing large vector and tabular data with both spatial (location) and temporal (time) components using distributed analytics and storage

- ArcGIS Enterprise server role released at 10.5
- Run analysis in Pro, Portal, or the ArcGIS Python API
- Distributes analysis over multiple machines for faster processing time
- Supports reading directly from common data sources
  - File shares, HDFS, Hive, Amazon S3, Azure Data Lake
- Most tools support spatiotemporal analysis
ArcGIS GeoAnalytics Server

The Road Ahead:

• Expansion of basic data management capabilities:
  - Clip, Merge, Dissolve

• Expansion of spatial statistics and machine learning capabilities:
  - Forest-based Classification and Regression, more in development

• Developer story:
  - Working on exposing GeoAnalytics functionality to developers
Raster Analysis Road Ahead

Steve Kopp
Geostatistical Analyst - 3D Interpolation

- Support requirements of ocean and atmosphere communities
- Extend geostatistical layer to 3D
- Leverage emerging Pro 3D scene layer capabilities
Spatial Analyst

- Site selection / suitability modeling
  - New easier user experience
  - New analysis tools

- Distance analysis
  - Support cost geodesic distance, and true cost distance

- Hydrologic analysis
  - New elevation processing techniques for high resolution data

- Optimize more key tools and expose in Image Server
Image Analyst – Deep Learning tools for Image Classification

- Leverage TensorFlow or CNTK as part of your ArcGIS imagery workflow
  - Export Training Data for Deep Learning
  - Detect Objects Using Deep Learning
  - Classify Pixels Using Deep Learning
Enterprise Image Server  (*big data raster analytics*)

- New suitability modeling dashboard web interface
- Function chain editor UI for building raster analytic workflows
- Continue to grow the collection of scalable distributed analytics tools
  - Path distance tools
  - Locate Regions
  - Neighborhood (focal) statistics tools
  - More new hydro tools
Real-Time Analytics Road Ahead

Ashely Pengelly
ArcGIS Enterprise

*with real-time capabilities*

Desktop

Apps

APIs

ArcGIS Enterprise with real-time capabilities

App ingestion

Desktop actuation

ArcGIS GeoEvent Server

Analytics

Spatiotemporal big data store

Visualization

Storage

Live & historic aggregates & features

Live features stream services
Road Ahead – Real Time Analysis

- Real-Time Analytics and Big Data GIS as a service on ArcGIS Online
- Utilizing cloud computing and storage
- No need to host your own IoT infrastructure
Configurable Processors

**GeoEvent Services**
- GeoEvent Server
- Buffer Creator
- Convex Hull Creator
- Difference Creator
- Envelope Creator
- Field Calculator
- Field Enricher
- Field Mapper
- Field Reducer
- Geotagger
- Incident Detector
- Intersector
- Projector
- Simplifier
- Symmetric Difference
- Track Gap Detector
- Union Creator

**Out of the Box**
- Add XYZ
- Bearing
- Ellipse
- Event Volume Control
- Extent Enricher
- Field Grouper
- GeoNames Lookup
- Motion Calculator
- Query Report

**Esri Gallery**
- Range Fan
- Reverse Geocoder
- Service Area Creator
- Symbol Lookup
- Track Idle Detector
- Unit Converter
- Visibility

**you can create your own processors**
Several of the more common add-on processors available through the Esri Gallery and our GitHub Repositories are being targeted for inclusion into the core product with the 10.7 release.
Online Analysis Road Ahead
Ashely Pengelly
Online Analytics

• Framework for running all “out of the box” analytic functionality

• Standard Tools
  - ArcGIS Online / Portal for ArcGIS
  - 29 tools
    - answer the most common spatial questions
  - Supported by:
    - Network analysis
    - Elevation
    - Hydrologic
    - GeoEnrichment services.
Road Ahead – Analytics Online

• New Tools
  - New Machine Learning tools (TBD)
    - Find Point Clusters (10.6.1/6.3)
    - Forrest Based Classification & Regression
  - Summarize Center and Dispersion (10.6.1/6.3)
  - Generate Tessellations (TBD)
Road Ahead – Analytics Online

• Charting
  - Support analysis workflows
  - Visually explore and understand results
Road Ahead – Analytics Online

• Tool history and job scheduling
  - Open
  - Run
  - View Details
  - Schedule
  - Delete
Road Ahead – Analytics Online

• **Future Enhancements**
  - Performance improvements
  - Results as feature collections or feature services
  - Overwrite result layers
  - Filter input layers

[Store analysis results as feature services]
Insights for ArcGIS Road Ahead
Linda Beale
Insights for ArcGIS

- Ease of accessibility to standard analytical approaches
  - Send computation to the database
  - Connect to SQL, ORACLE, SAP-HANA
  - Can connect to GeoAnalytics

- Analysis for spatial and non-spatial data
  - Maps, graphs and tables
Applicability of link analysis

- Which nodes are critical sections of a network?
  - Lines of communication in business or crime networks
  - Electrical transmission or water towers, distribution transformers or water mains etc.
  - Road intersections or bridges
  - Servers that are likely to get the most load
  - Key distribution centers, finding catchment and service areas
  - Spread of epidemic diseases
  - Critical transport routes by affected people
  - Flow of information of goods between people or places
Analytic Journals

- Page and card options
- Widgets
  - e.g. rich text card
The coming year

• Ease of accessibility to standard analytical approaches
• Expanding analytical capabilities
  - Trend analysis
  - Cluster analysis
  - More temporal analysis
• Including access to Python Notebooks and R
  - Providing ability to include customized analysis
• Ease of data connection
  - Continuing to extend our data connectors
  - Developing an API to allow developer extensibility
Spatial Analysis

Our Goal

Advancing Spatial Data Science

Location Intelligence for Everyone

Delivering quality tools meeting customer expectations
We like to hear your feedback

• Ideas:
  - Add to ideas website
    https://community.esri.com/community/arcgis-ideas/
  - Spatial analytics showcase
Please Take Our Survey on the App

Download the Esri Events app and find your event

Select the session you attended

Select the Feedback tab

Complete answers and select “Submit”