Spatial Data Analysis and Visualization with ArcGIS

Jian Lange

Spatial Data Lab Webinar

Effective Data Management and Spatial Analytics

June 22, 2021

ArcGIS is a Powerful and Comprehensive System for Spatial Analysis and Data Science

Data Engineering

Visualization & Exploration

Spatial Analysis

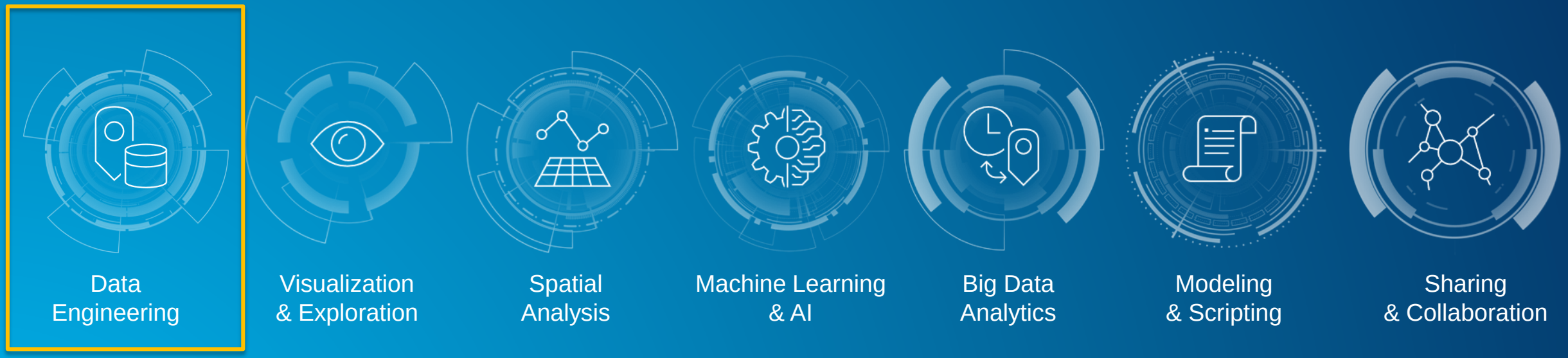
Machine Learning & AI

Big Data Analytics

Modeling & Scripting

Sharing & Collaboration

ArcGIS is a Powerful and Comprehensive System for Spatial Analysis and Data Science



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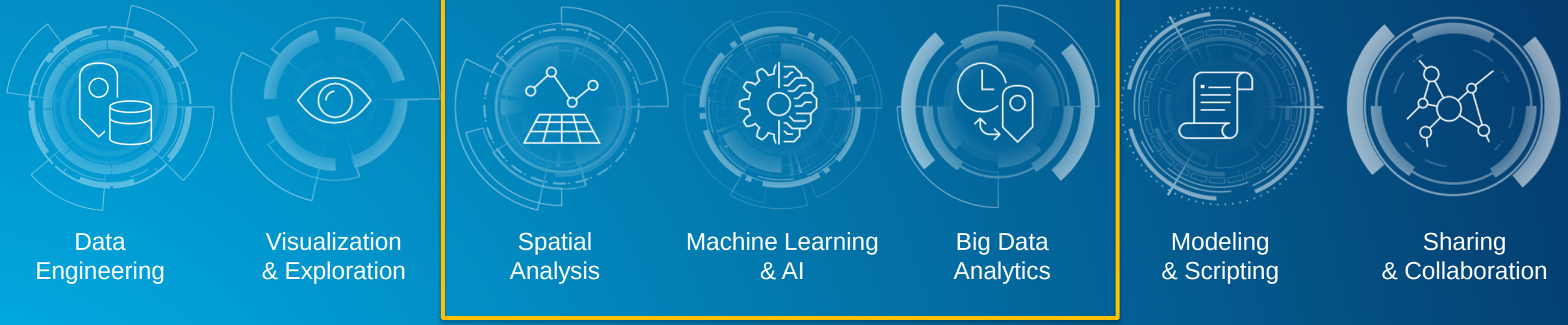

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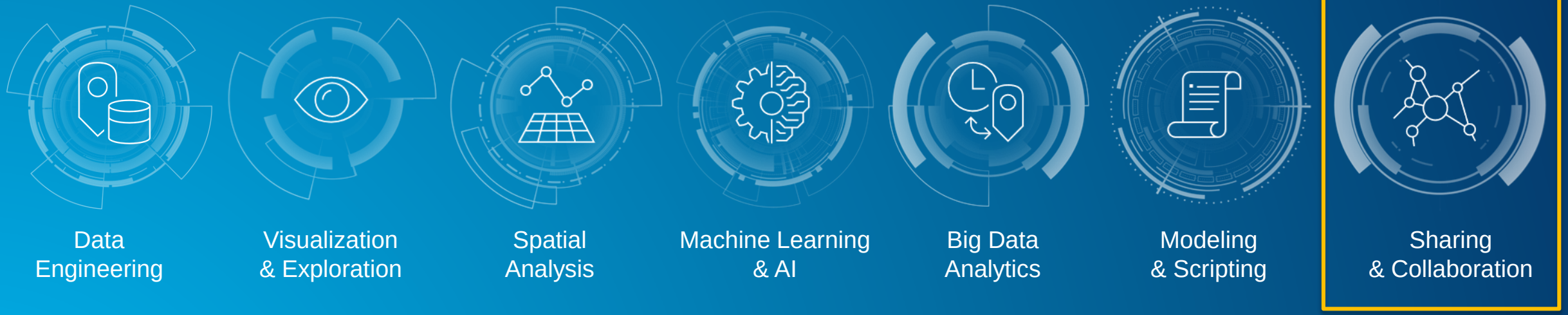

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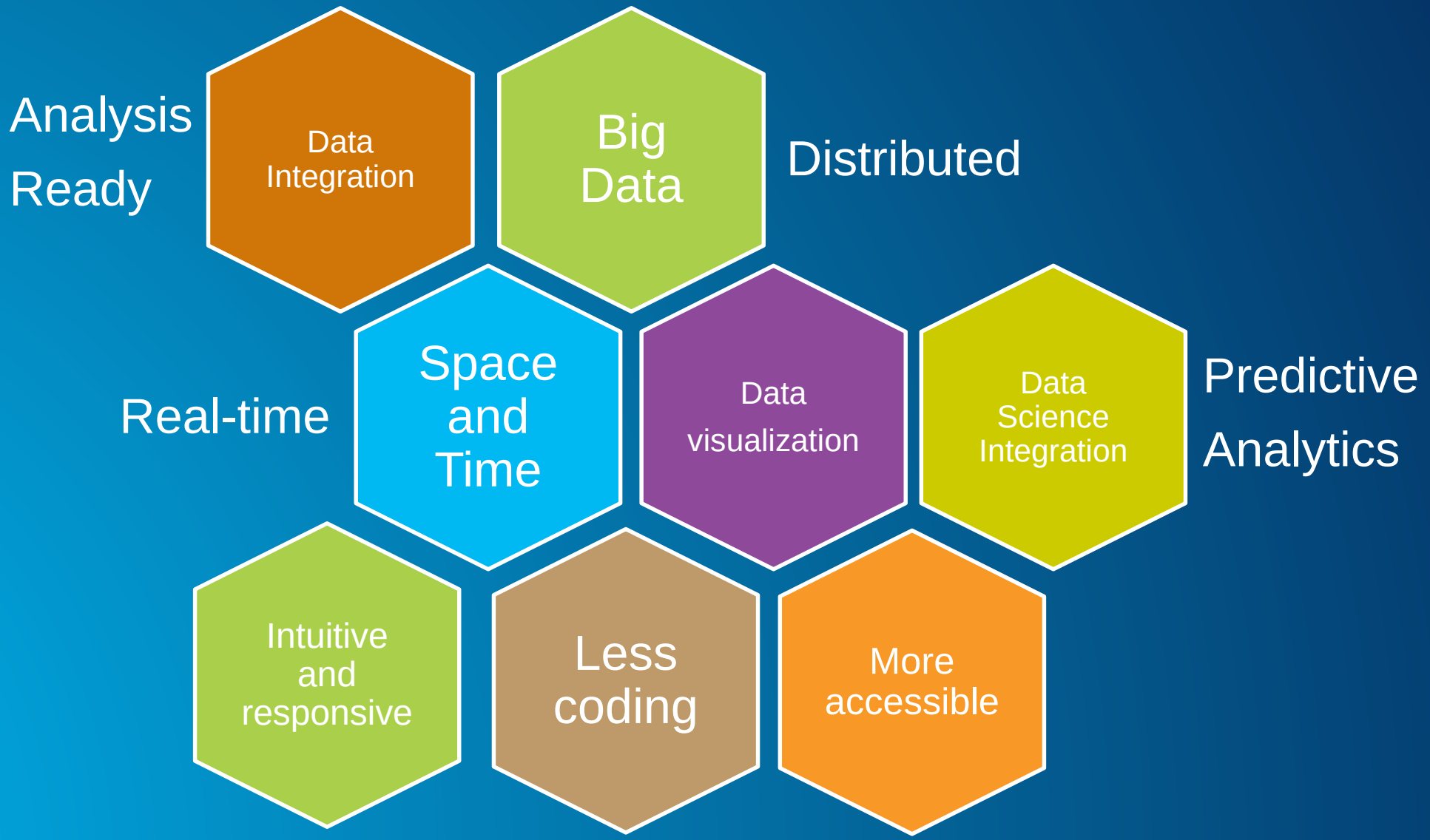
Spatial Analysis

Directions

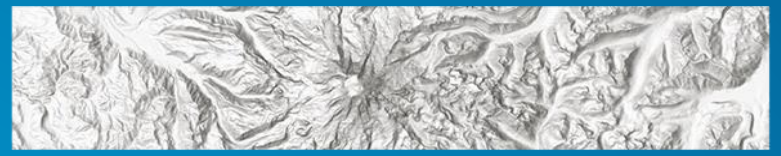


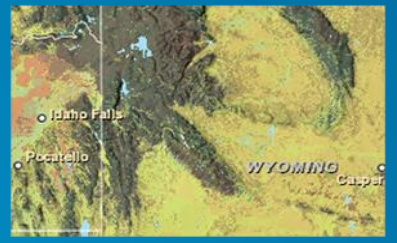
Data Integration

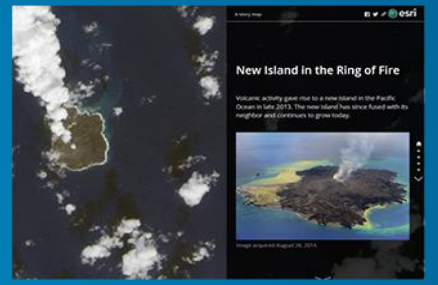
Analysis is only as good as the data

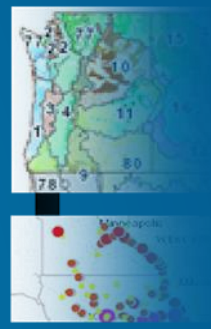
ArcGIS includes ready-to-use content

Maps, apps, layers, and more from Esri and the global GIS community - a Living Atlas







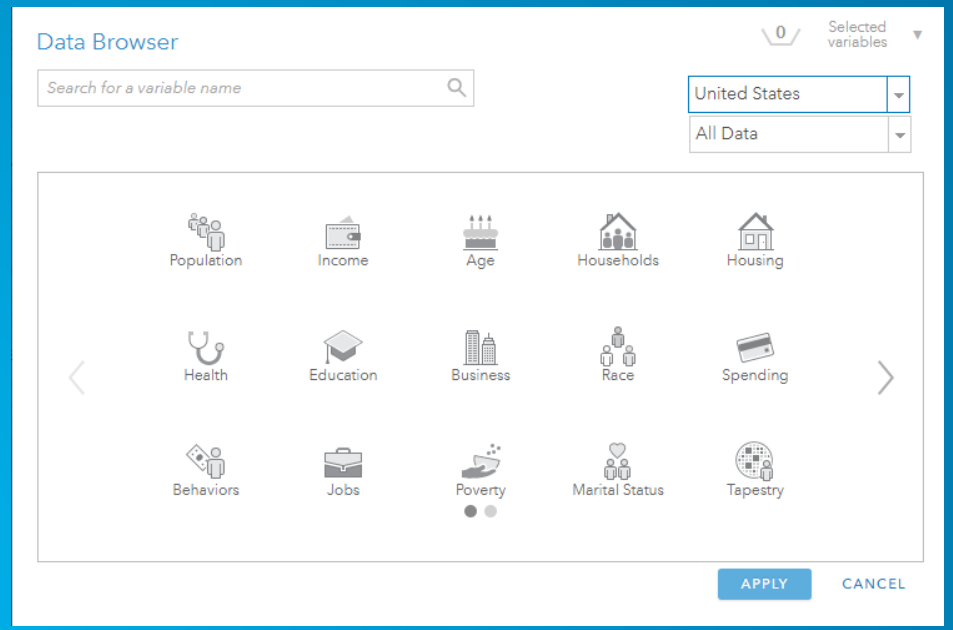


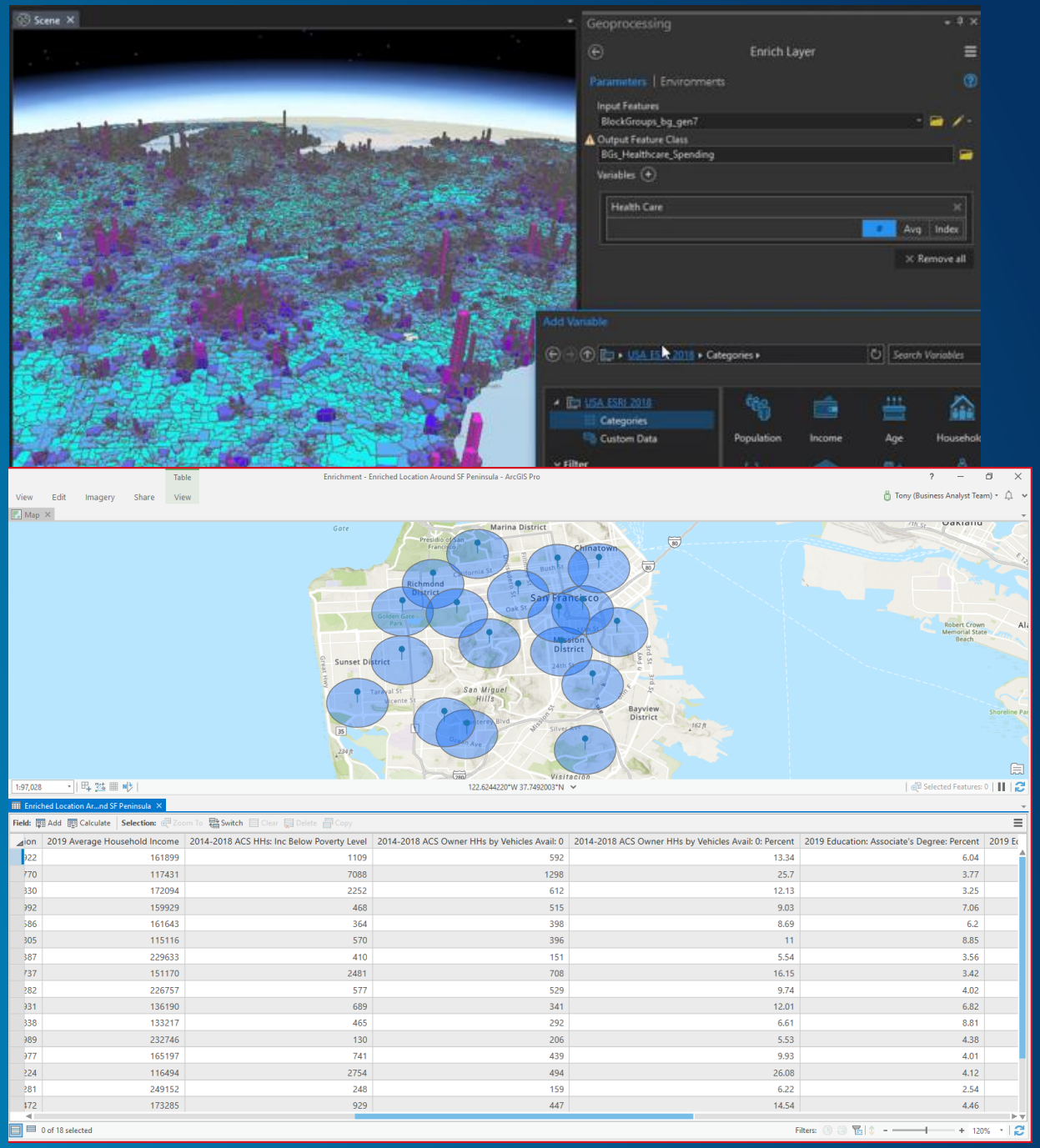
Transportation
Environment
Observations
Landscape
Infrastructure
Basemaps
Boundaries
Land Cover
Imagery
Weather
People
AI6 Layers
Demographics
Oceans
Historical
Hydro
Elevation
Hazards
Soils
Traffic
Business
Habitats
Places
POI
Trending
Movement

··· curated, authoritative content with continuous updates

ArcGIS GeoEnrichment

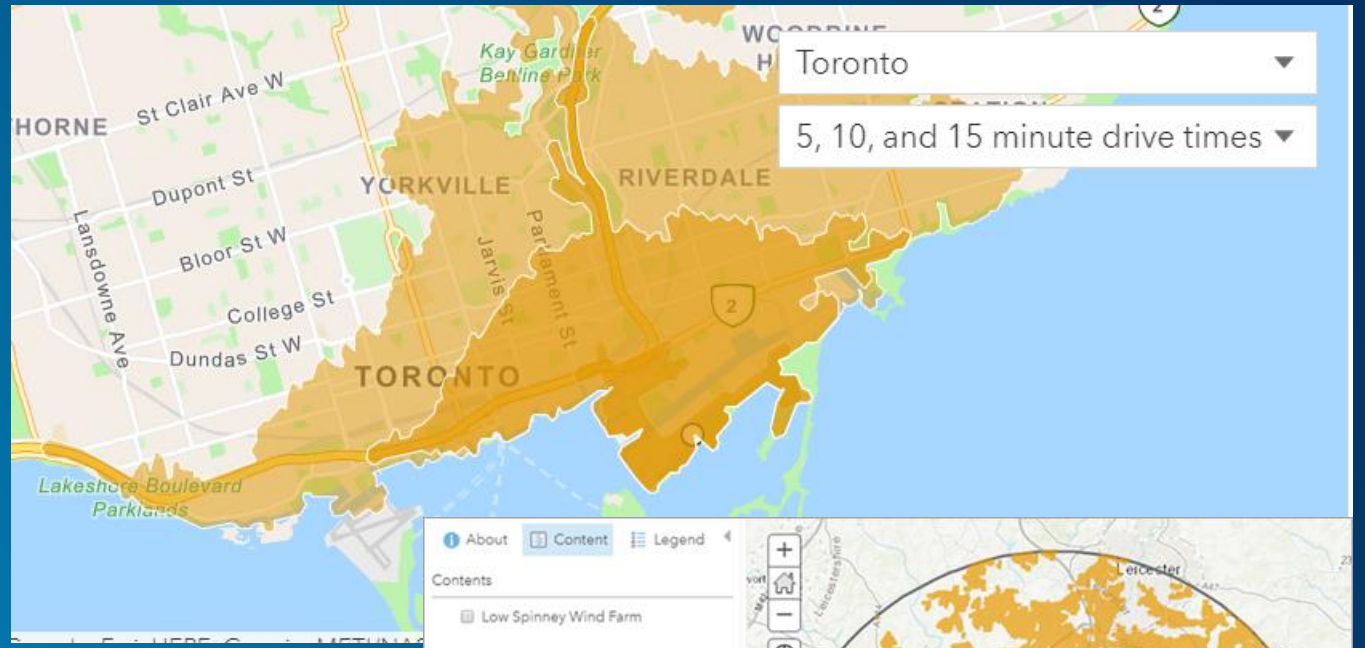
- Connect your existing data with Esri's authoritative datasets
- Esri-hosted location service powered by advanced spatial analytics and global business and demographic data
- Over 15,000 data variables from more than 130 countries

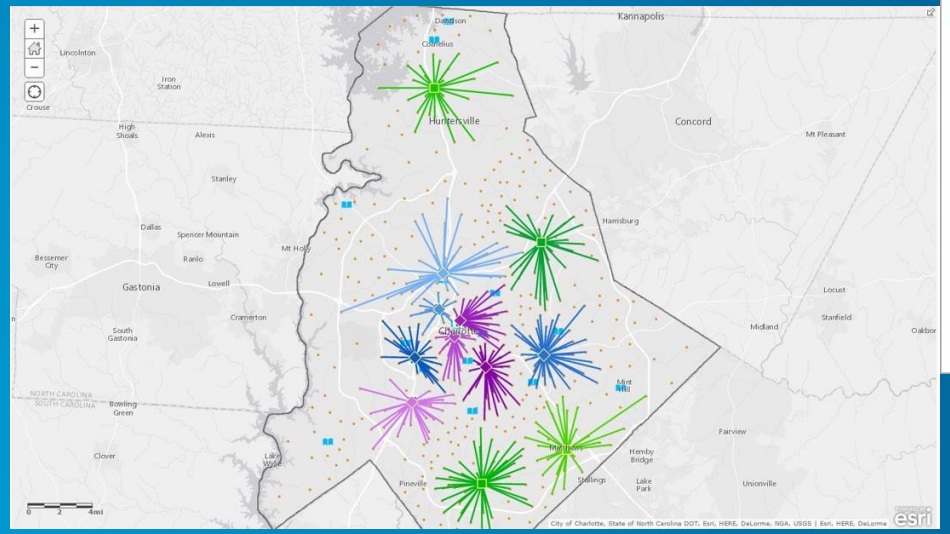


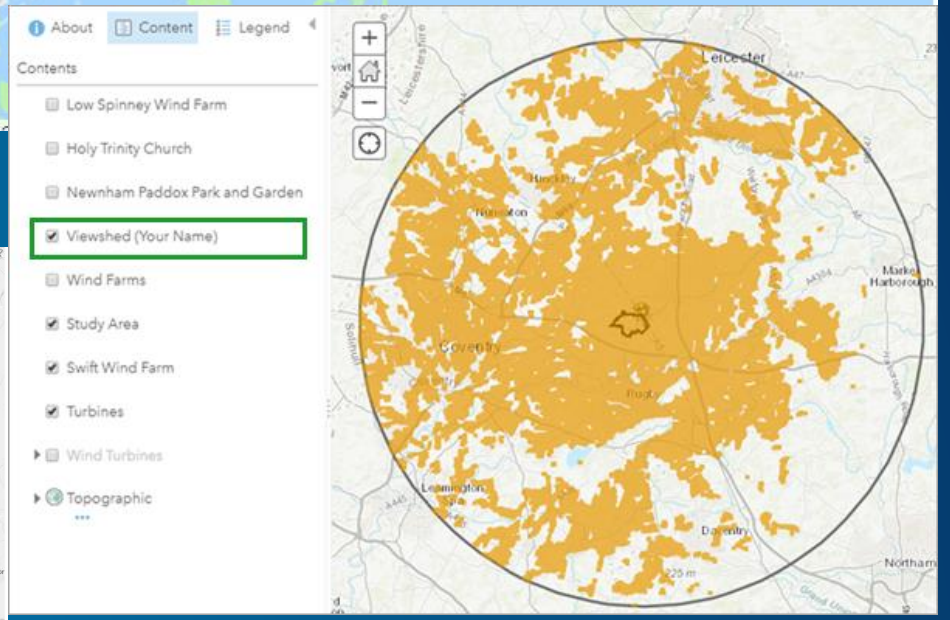


Ready-to-use Services

- Combines analysis services with authoritative content
  - Geocoding
  - Drive time areas
  - Location Allocation
  - Vehicle Routing Problem (VRP) Solver
  - Elevation
  - Hydrology







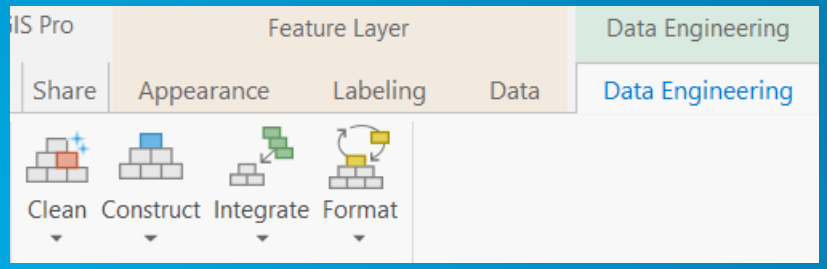
Quickly generate a drive time or watershed area without having to collect, maintain, or update data on local

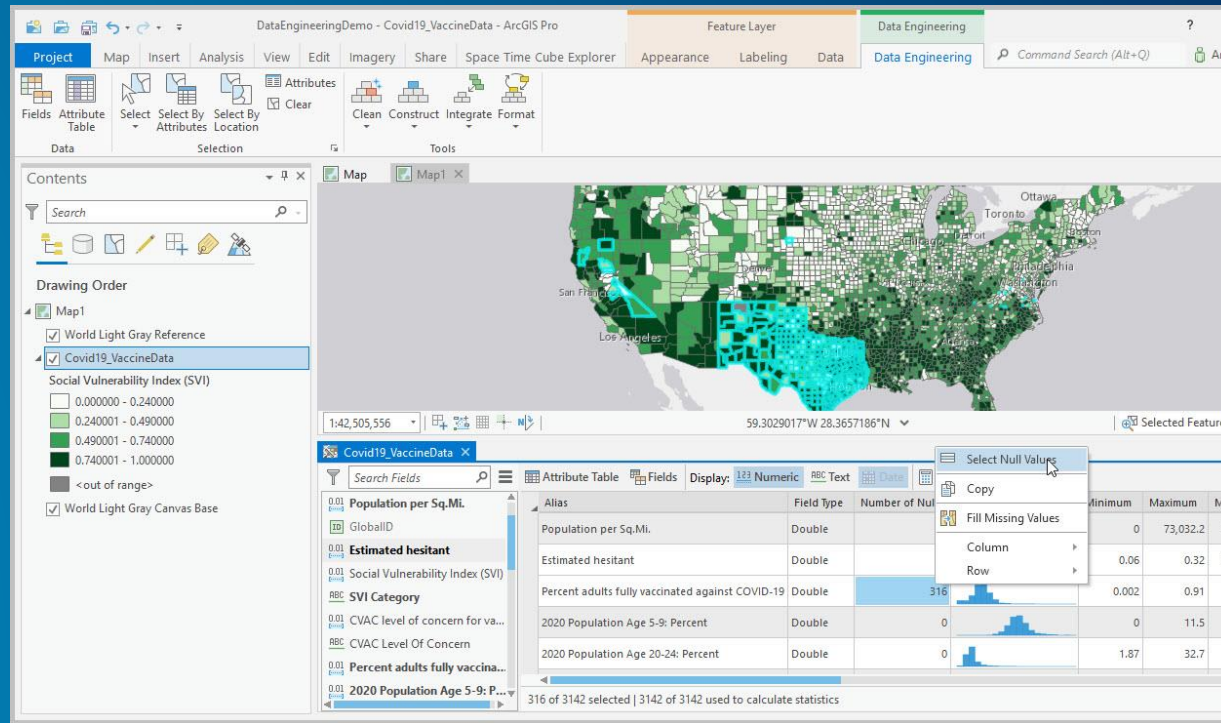
Data Engineering **new in ArcGIS Pro**

A new, unified experience to interactively prepare data for analysis

- Quickly evaluate data quality and fix common problems
- Explore data distribution and categories by quick configuring maps and viewing charts

A curated set of geoprocessing tools to clean, construct, integrate, and format your data



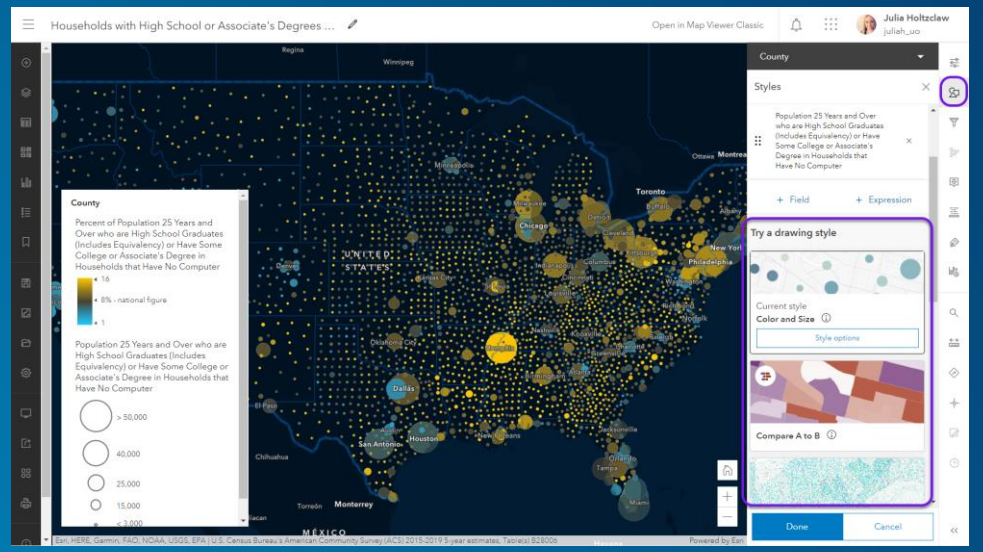


Visualization & Exploration

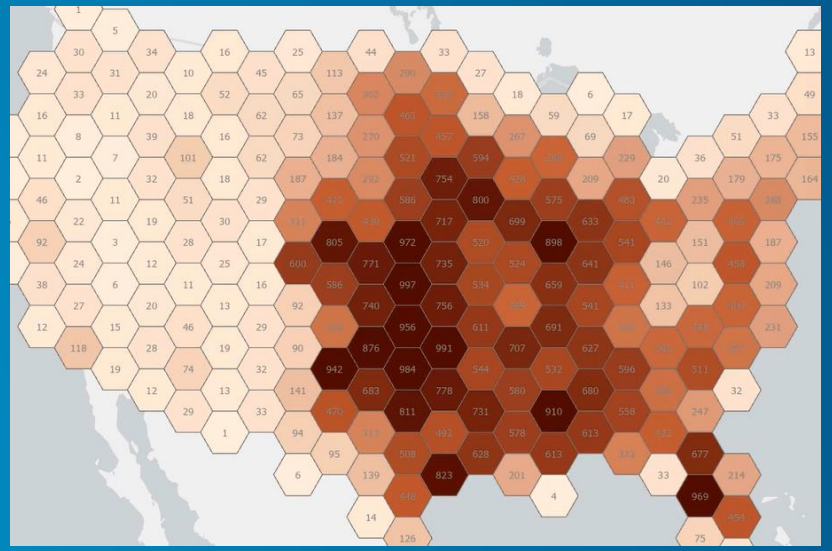
Make sense of your data

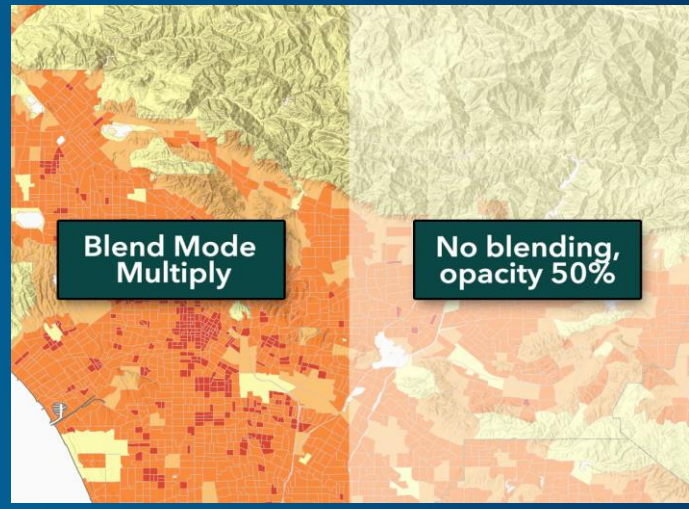
Mapping

- Mapping is at the heart of ArcGIS
- New map viewer in ArcGIS Online with interactive smart mapping
- Many mapping enhancements made in ArcGIS Pro
  - Voxel layers support
  - Dynamic feature binning
  - Feature and layer blending
  - Graphics layers
  - Projection improvements



New Map Viewer in ArcGIS Online



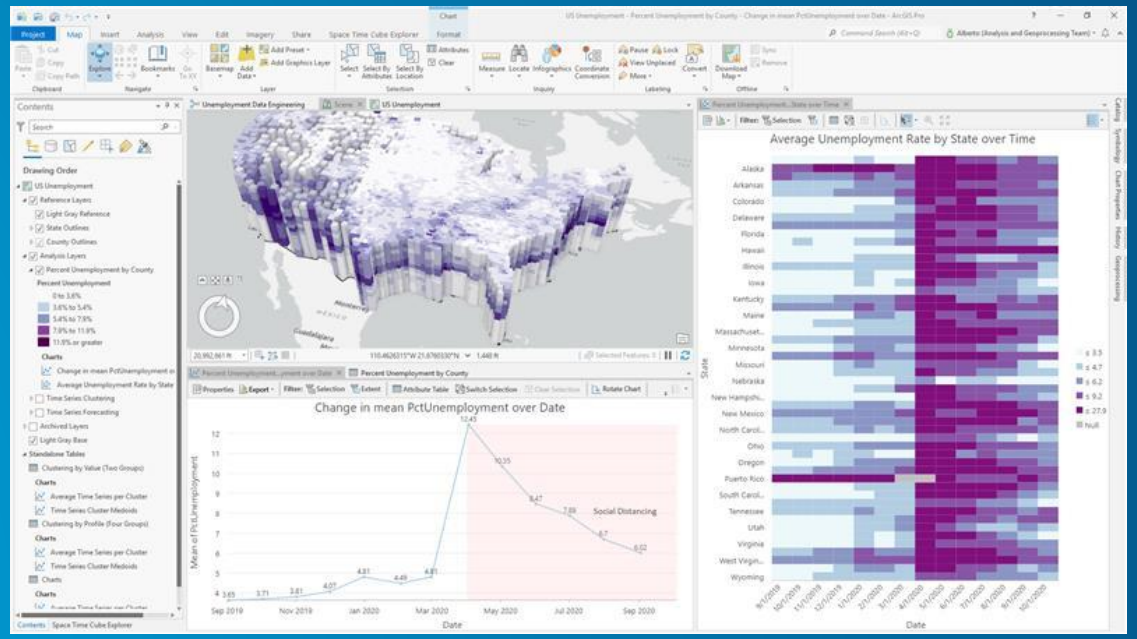


Charts

- Visualize and explore data to assess patterns and trend
- Part of analysis output
- Charts are now available in ArcGIS Online
- Same charting experience across the ArcGIS Platform

New in ArcGIS

Charts in ArcGIS Online



Advancing Spatial Science

The heart of spatial analysis

Advancing Spatial Science

Data Engineering

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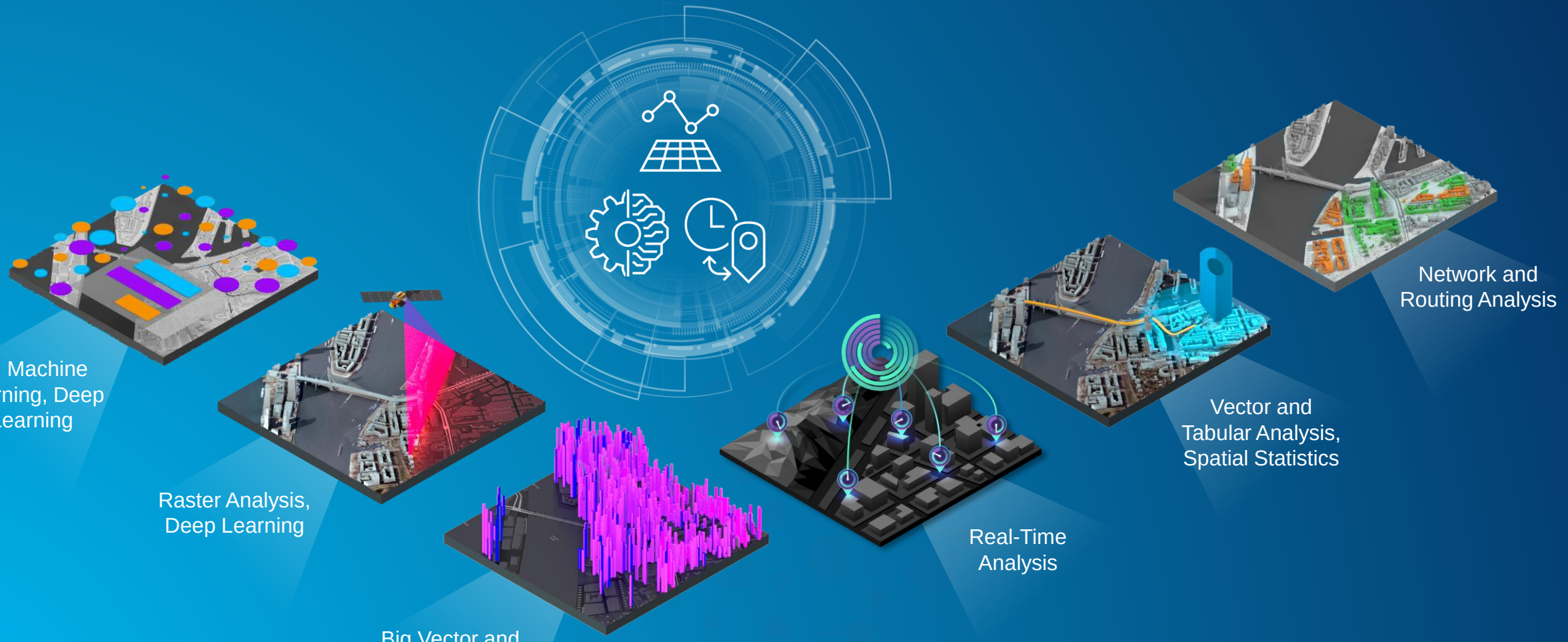
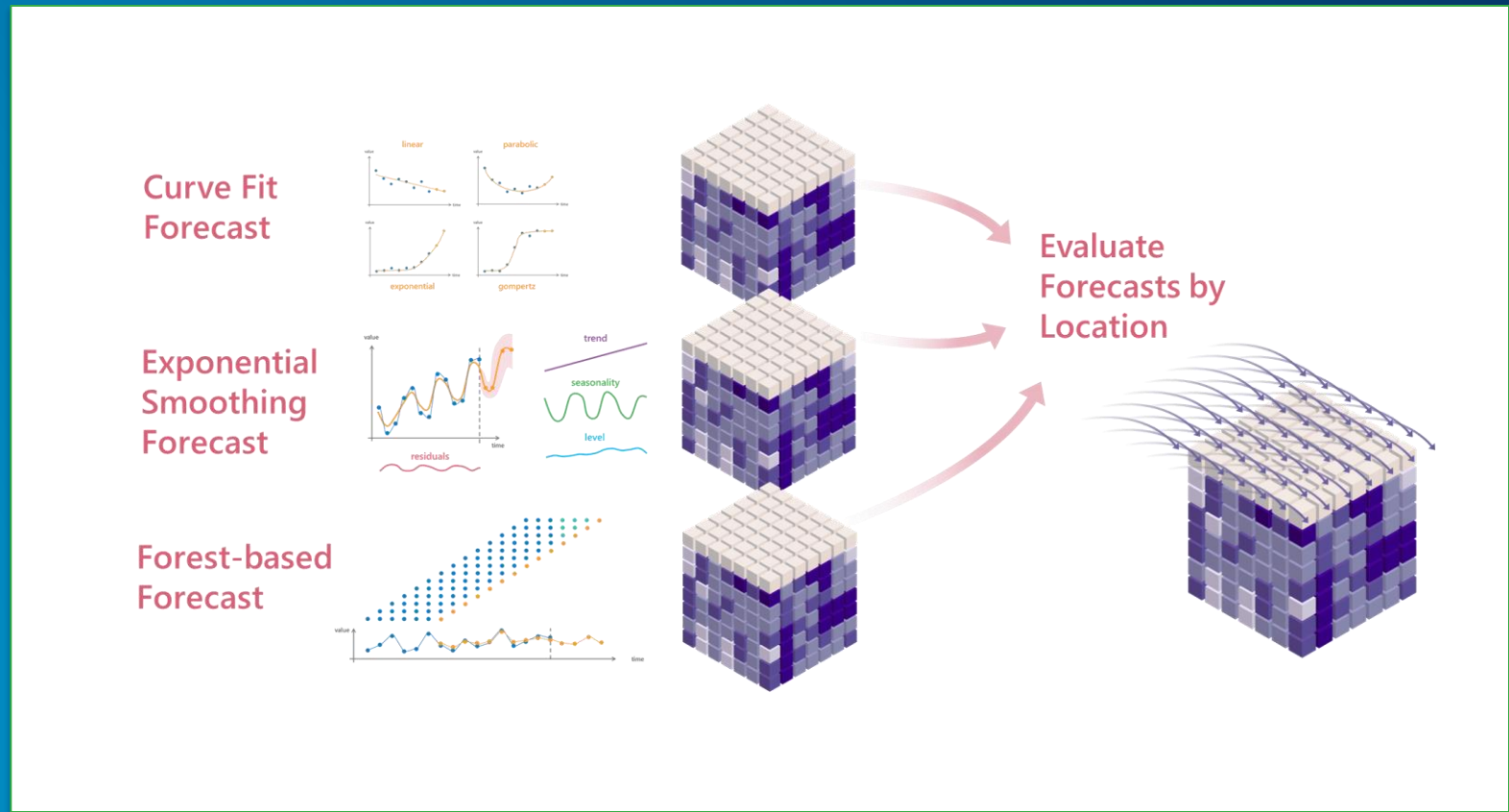
Advancing Spatial Science



Focused on finding the right tools to solve your problem

Spatial Statistics

- Many new capabilities focusing on spatial machine learning
  - Clustering
  - Classification
  - Regression
  - Time-series forecasting **New**



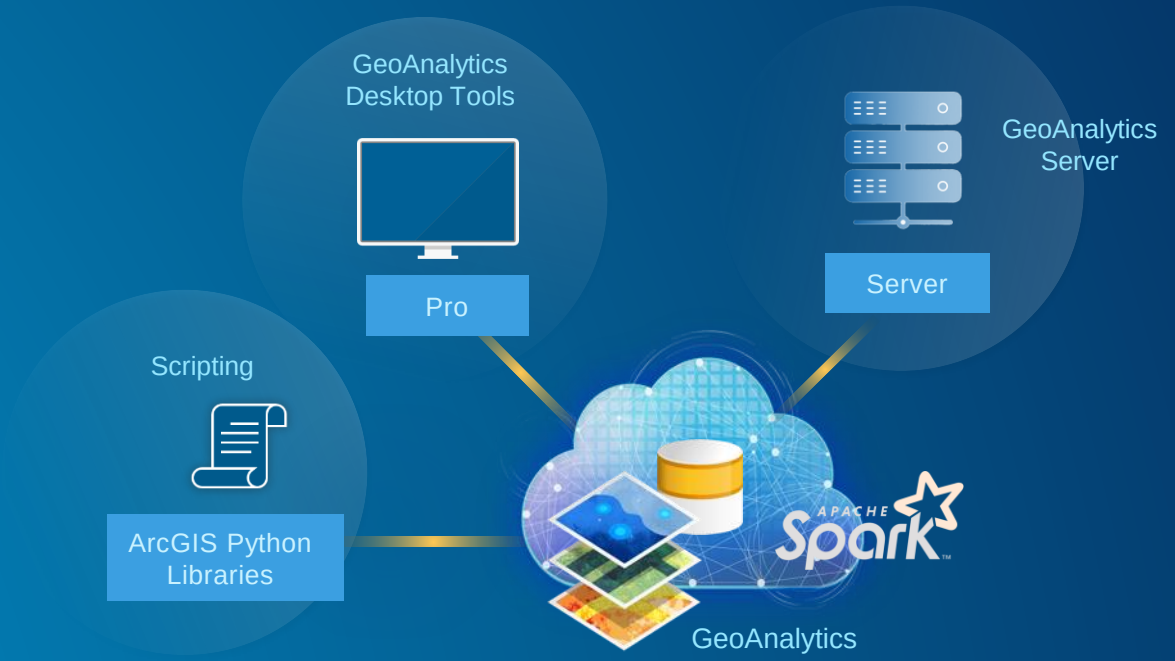
Big Data Analytics

- Analytics and Data Engineering for Spatial Big Data – GeoAnalytics

- Leverage Spark technology to distribute data and analysis

New

- Big Data Connection Wizard in ArcGIS Pro
  - Treats many individual files as a single big input



Leveraging and Analyzing Real-Time Data

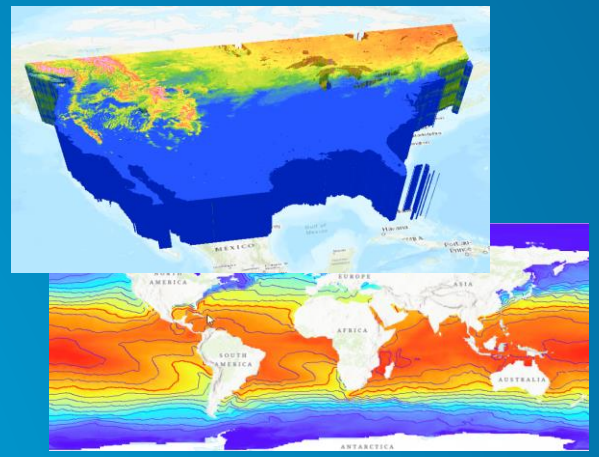
- **Ingest real-time sensor data**
- **Analyze data to detect incidents**
  - In real-time
  - In *near* real-time
  - Over time (GeoAnalytics tools)
- **Send alerts and take action**

New in ArcGIS

Real-time and big data capabilities for ArcGIS Online

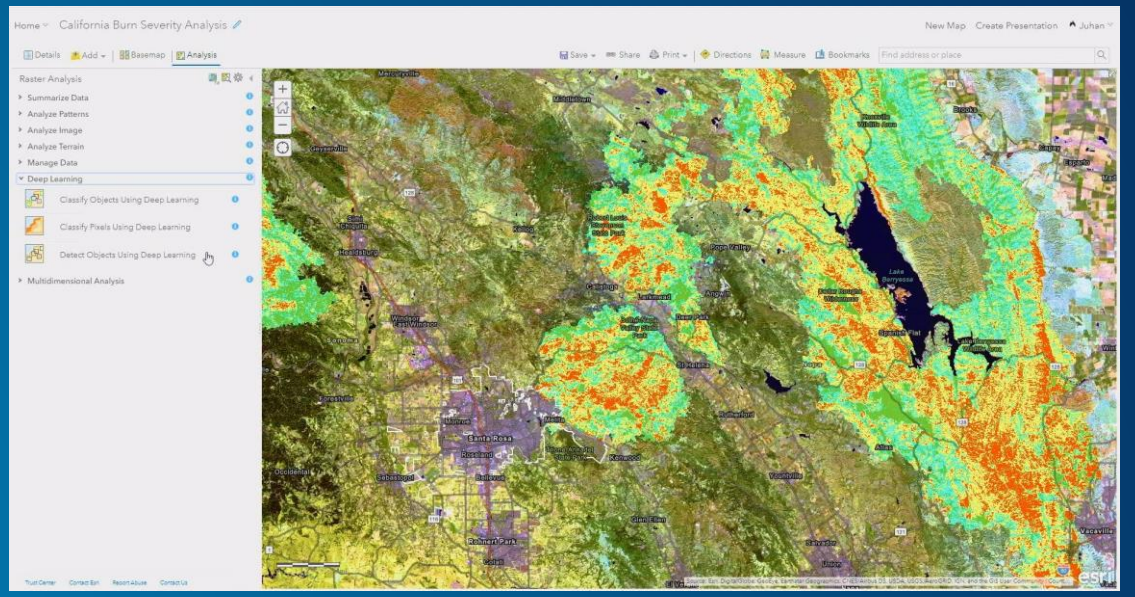
Imagery/Raster Analysis

- Terrain Analysis
- Suitability Modeling
- Map Algebra
- Hydrological Modeling
- Distance Modeling
- Multidimensional Analysis
- Change Detection
- Image Classification
- Machine Learning
- Deep Learning



New in ArcGIS

ArcGIS Image for ArcGIS Online

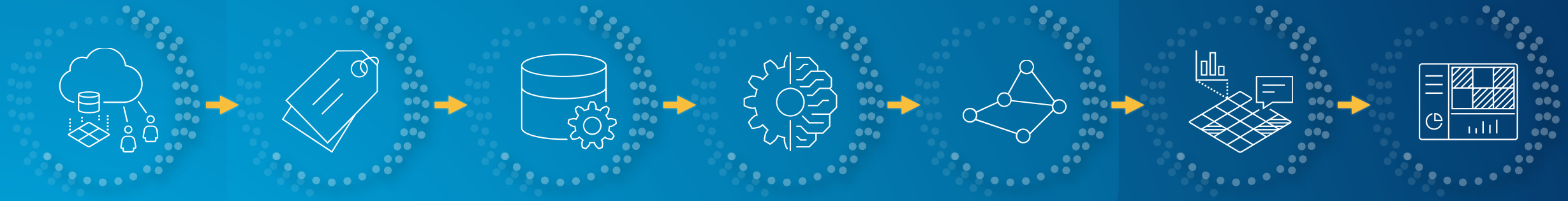


Leverage the imagery and raster data in your organization without having to maintain the infrastructure to manage, serve and analyze

- 150 + raster functions
- 27 Ready-to-use tools
- Deep learning tools
- Raster function editor
- Server and Client-side processing

Deep Learning in ArcGIS

Data Management → Labelling → Data Prep → Train Model → Inferencing → Derive Insights → Sharing



ArcGIS provides comprehensive deep learning workflows

For Wide Range of Data Types

- Aerial
- Satellite
- Radar
- Text
- Lidar
- Features
- Motion Imagery
- Bathymetry
- Point Cloud
- Drone

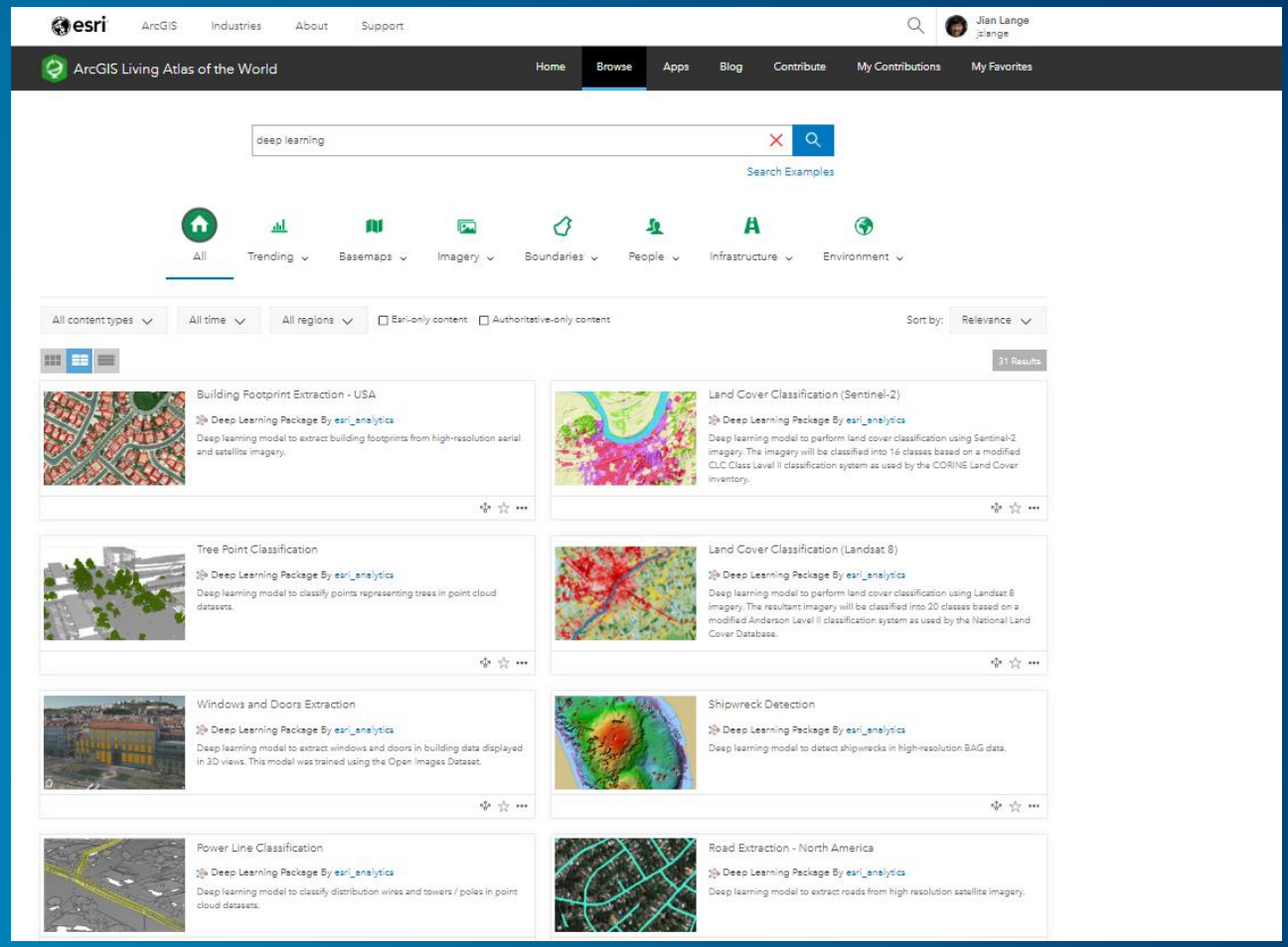
Implementing Many Tasks

- Object Classification
- Object Detection
- Pixel Classification
- Image Translation
- Object Tracking
- Scanned Maps
- Feature processing
- Unstructured text processing

Pre-trained geospatial deep learning models

- Ready-to-use geospatial AI models
- Have been trained on data from a variety of geographies
- Available from ArcGIS Living Atlas

- *Eliminates:*
  - *Imagery requirements for model training*
  - *Labelling requirements*
  - *Training AI models*
  - *Massive compute requirements*

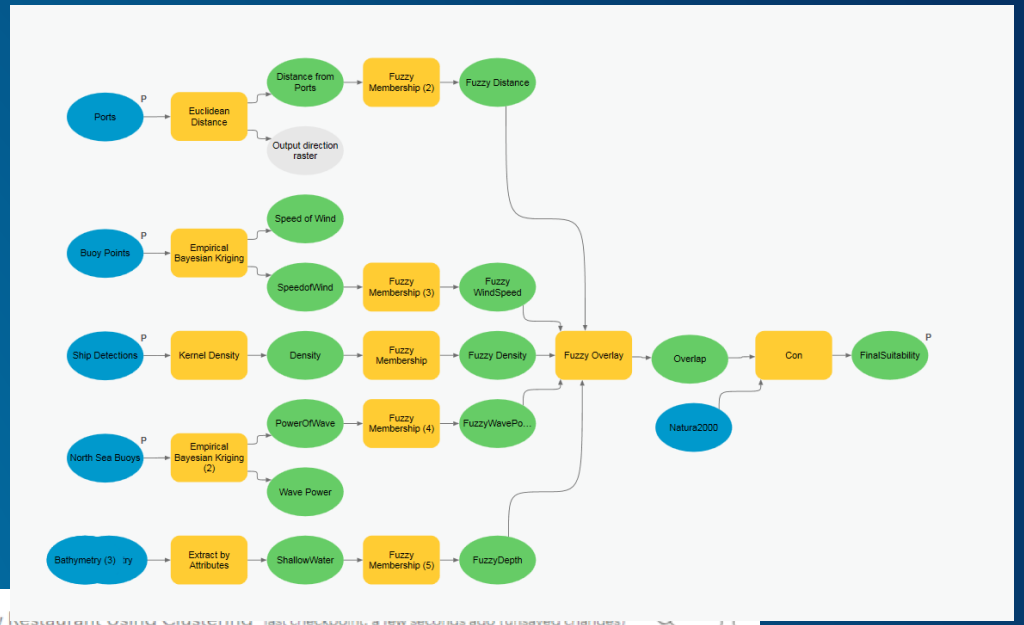


Modeling & Scripting

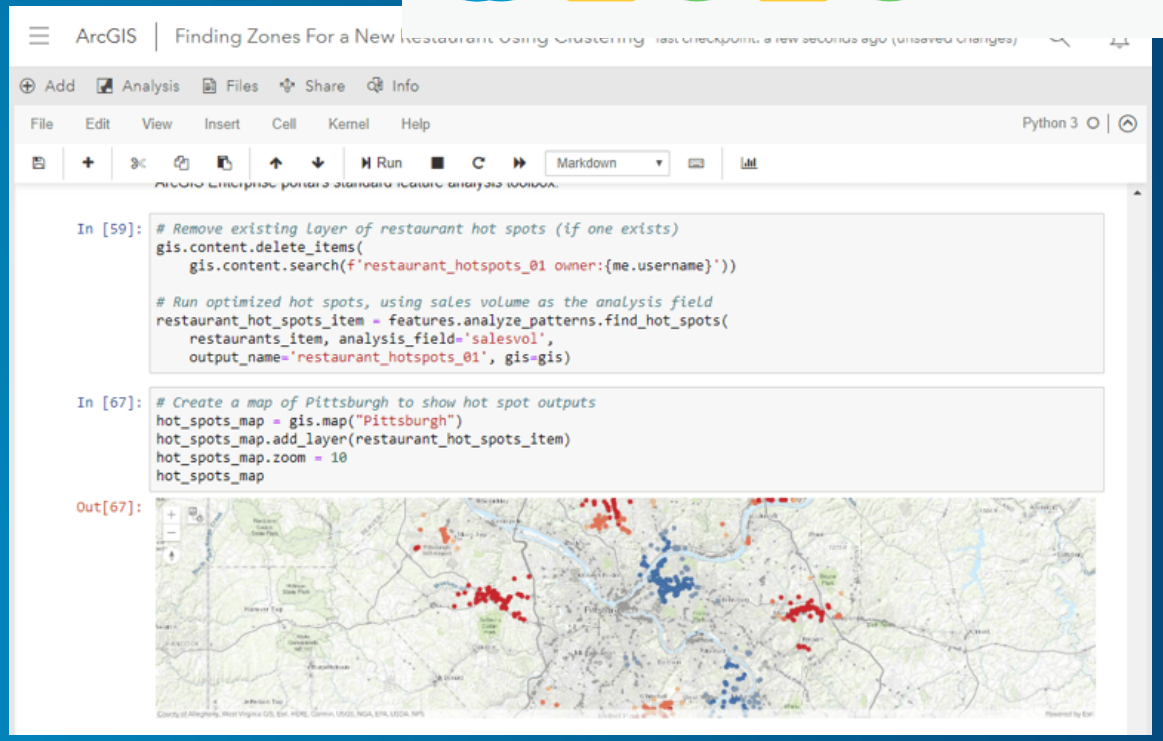
Automate and extend functionality

ModelBuilder, ArcPy & ArcGIS Notebooks

- Use ModelBuilder or Python to automate geoprocessing workflows or extend functionality
- ArcGIS Pro has ArcMap equivalency and many new capabilities
- ArcGIS Notebooks combine ArcGIS spatial algorithms (ArcPy, ArcGIS API for Python) with open-source Python libraries



New
ArcGIS Notebooks



R-ArcGIS Bridge

Combine ArcGIS mapping and spatial data processing with R statistical computing

Pass data between ArcGIS Pro and R dynamically

Now supports hosted GIS data and remote services including Living Atlas

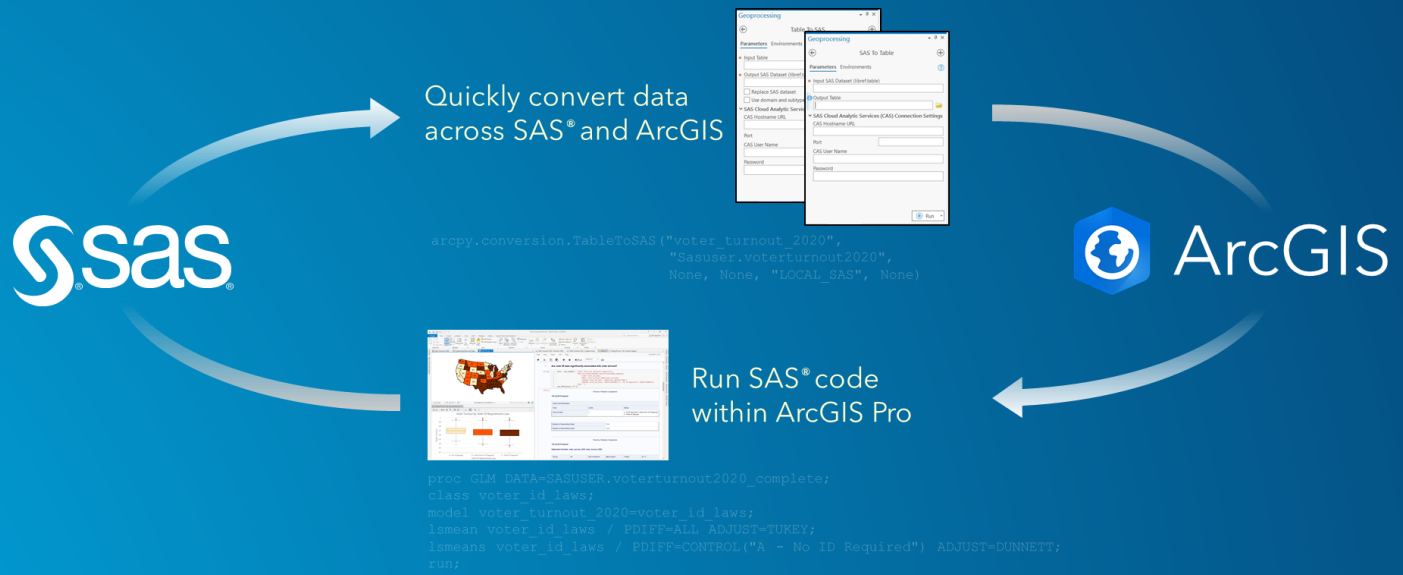
Integrate R scripts into ArcGIS Geoprocessing tools and run ArcPy geoprocessing tools from R

Create interactive web maps in R notebooks

SAS-ArcGIS Bridge **new in ArcGIS Pro**

Quickly convert data across SAS and ArcGIS

Use SAS analysis procedures directly within ArcGIS Pro



New

- SAS to Table tool
- Table to SAS tool
- SAS Python API integration

Sharing and Collaboration

The power of working together

Share Analysis

Many ways to share your geoprocessing and analysis work

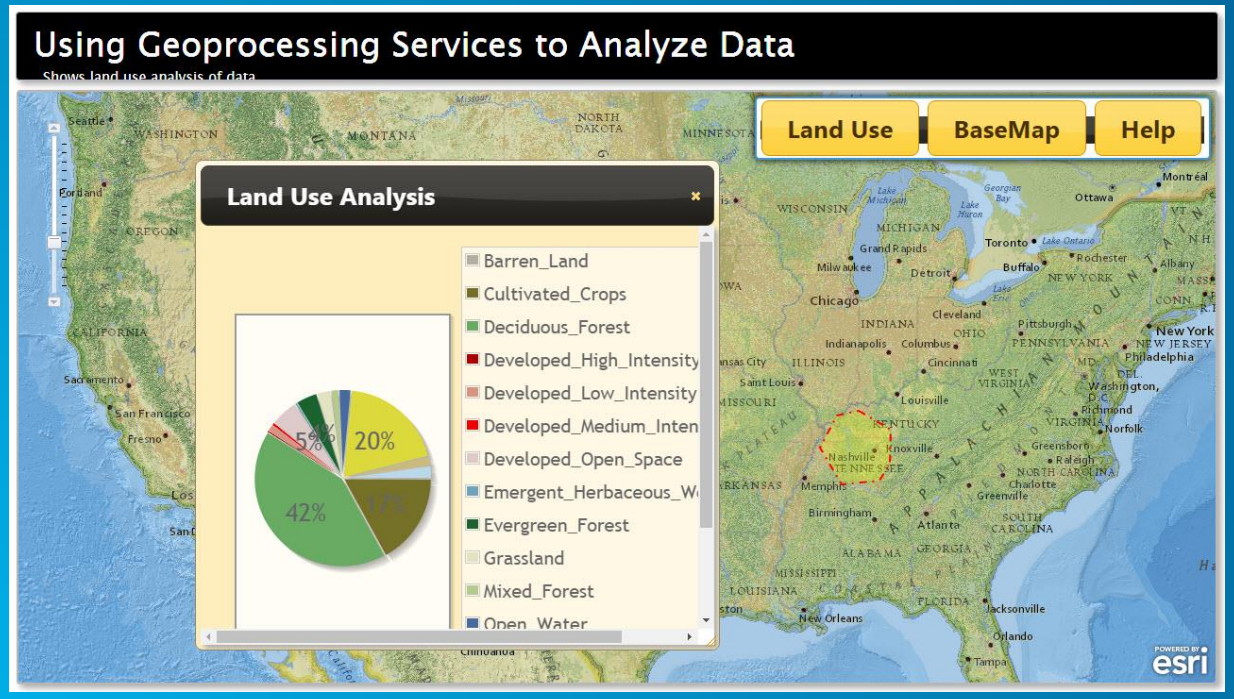
Geoprocessing Package

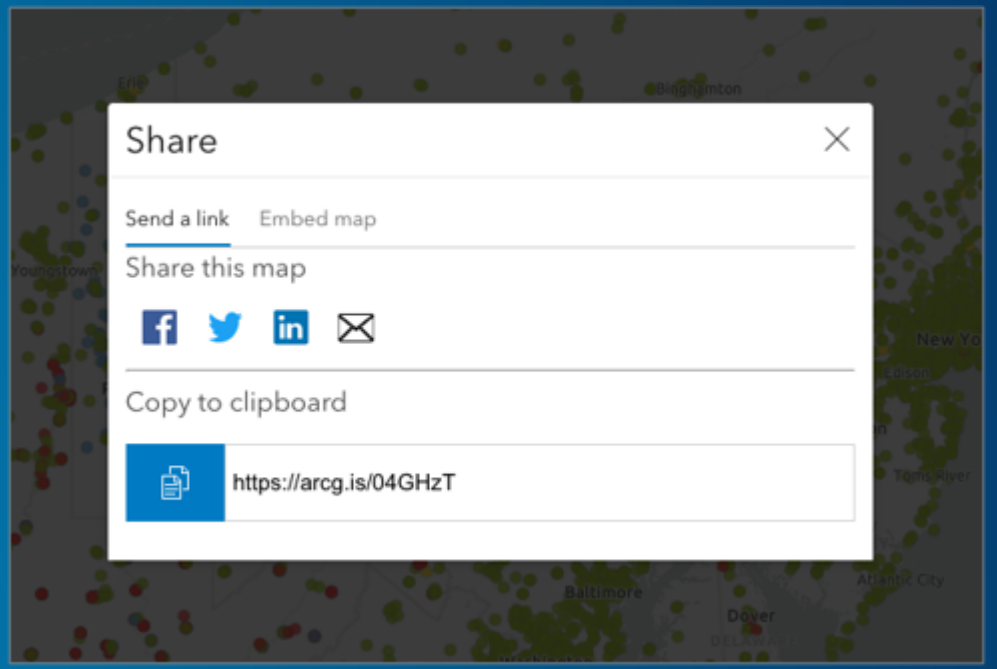
Web Tool/Geoprocessing Service

ArcGIS Notebooks

ArcGIS API for JavaScript

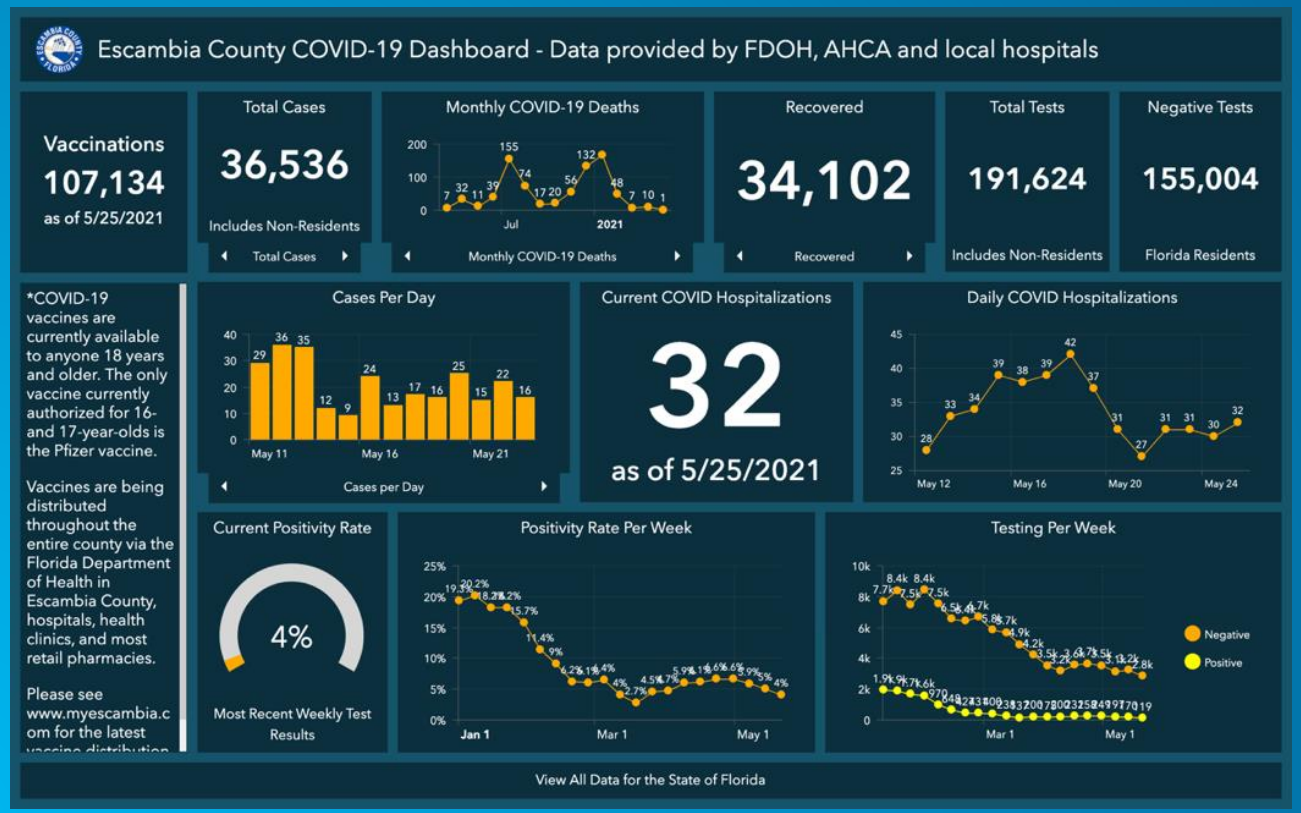
ArcGIS WebApp Builder

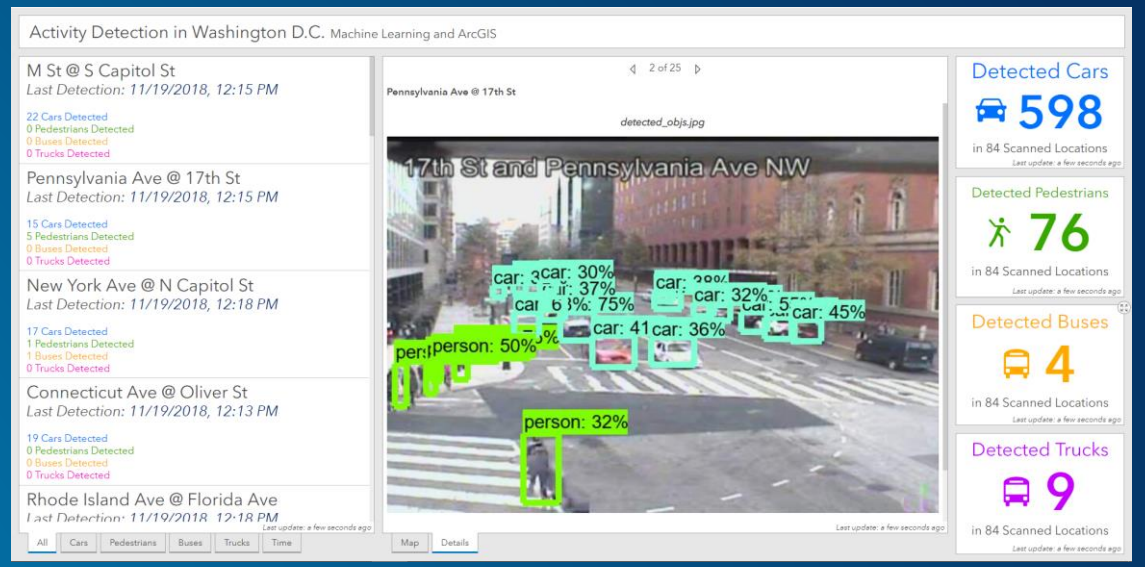


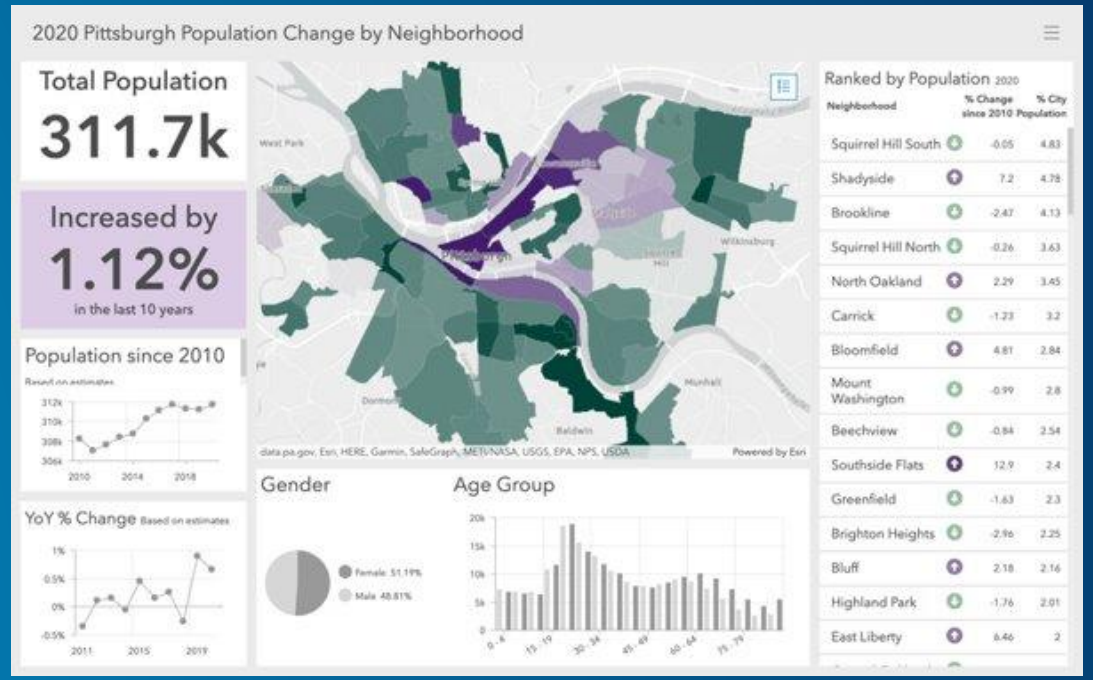


ArcGIS Dashboard

- Grabs your attention to where it's needed
- Communicates information at-a-glance
- Make it easy to spot what's most important

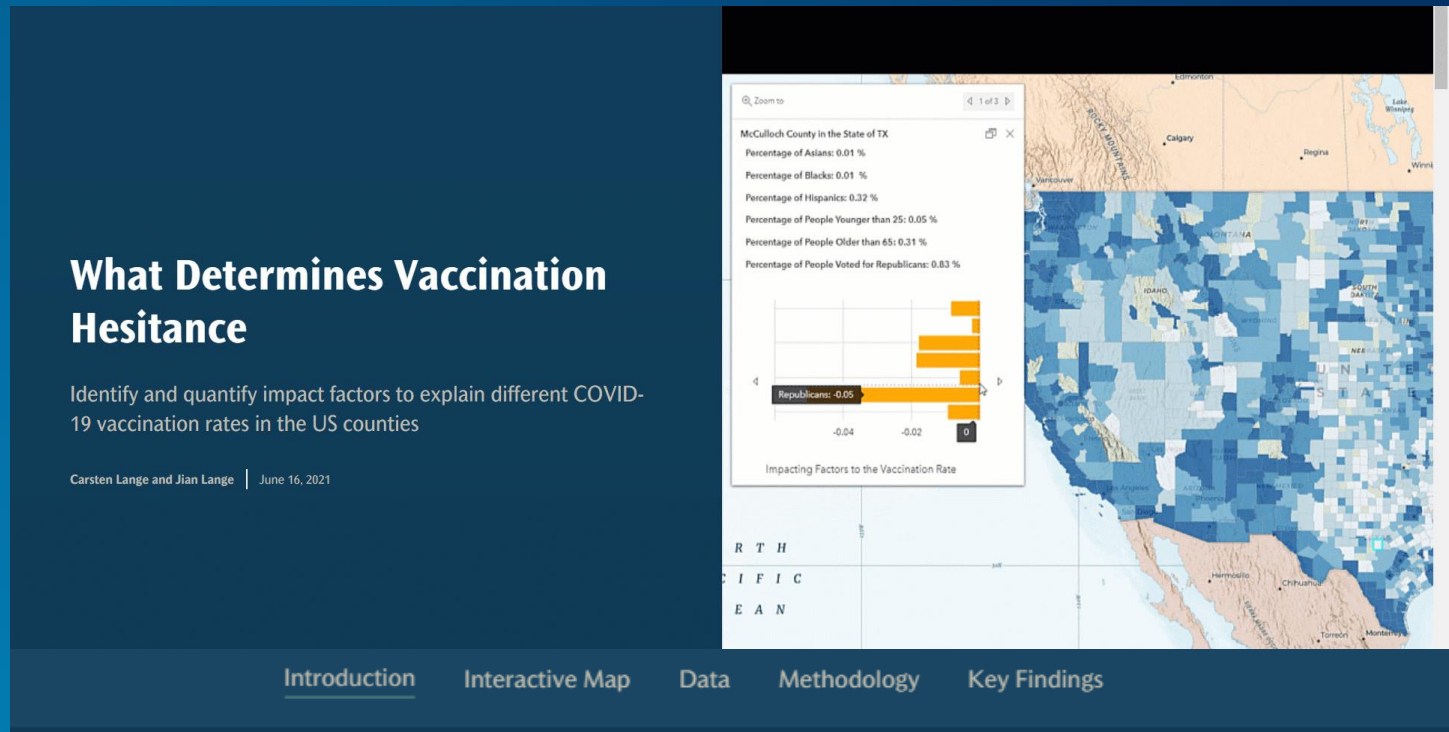






Storytelling

- Turn sophisticated analysis into compelling stories
- Combine interactive maps and multimedia content and text
- Share your narratives with colleagues, clients, and the public.



Introduction

After almost a year of COVID-19 pandemic, the U.S. Food and Drug Administration (FDA) authorized three COVID-19 vaccines. Since the beginning of this year, the US government has started an aggressive vaccination campaign. As of June 2021, 175 million of Americans older than age 12 are vaccinated. The US is finally at a better position to protect its people against the coronavirus.

While the vaccination rates are increasing steadily in the country, not all subgroups in the US population are enthusiastic about the COVID-19 vaccine. Vaccine hesitancy is not a new phenomenon in the US and it had been suggested that age, political affiliation, income etc. may all play a role. In addition, racial and income disparities had also been observed in the uptake of COVID-19 vaccines in the US. In order to assist the policy makers to develop better strategies to

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