Abstract

This course will give attendees the information necessary to understand the value that Insights for ArcGIS brings and, therefore, how it can be positioned for your customers.

The workshop will cover the foundational concepts of working with Insights for ArcGIS, demonstrating the drag-and-drop interface and how to perform iterative analysis of data, wherever it comes from, such as Excel spreadsheets, ArcGIS services or enterprise databases. We will then take a look at the experience, talking through the architecture to show how to get the most out of Insights with analysis workflows.
Insights for ArcGIS
Agenda

• 0900 – 1030
  - Welcome / Introductions
  - Getting started with Insights
  - Demonstration
  - Behind the scenes
  - How to get Insights
• 1030 – 1045 - Coffee Break
• 1045 - 1200
  - Insights as a capability of ArcGIS
  - The value of analysis with Insights
• 1215 – 1330 - Lunch

• 1330 - 1430
  - Setting up for Exercises
  - Tour of Data holdings
  - Hands On: Exercise #1
• 1430 – 1445 - Coffee Break
• 1445 - 1600
  - Recap of Exercise #1
  - Hands On: Exercise #2
  - BYOD time
  - Road map and Q & A
Getting started with Insights
Insights for ArcGIS: Explore a new world in your data

- Discover the power of exploratory analysis
  - Visual and intuitive
- Combine Analysis and Visualization on cards
  - Linked and responsive
- Drive impactful decisions
  - Learn, record, share and collaborate

Quickly Increase Decision Confidence with Insights for ArcGIS
Insights for ArcGIS

Data - Spatial and Tabular

Visualization & Analysis

Insights page in ArcGIS
Working with Data – Intelligent defaults

Fields, or attributes are defined to a role

- Insights works directly against the fields
- Dimensional model created behind the scenes
  - Geo-Dimension
  - Temporal-Dimension
  - Categorical (Strings)
  - Quantitative (Numbers)

...roles help define actions that can be taken in Insights for ArcGIS
Relationships

Create Relationships

My Data
- well_production
- well_attributes

Choose Relationship Type
Relationship type determines the way data is combined.
- Intersect
- All
- Left
- Right

Choose Fields
Choose the fields you want to base the relationship on.

API

Cancel Finish
Analysis: Interactivity
Analysis: Action Button, starts with questions
Results of Analytic Operations are expressed in Cards Visualizations
Sharing

- Workbooks, Pages, Cards, Workflow Templates
  - Insights Viewer
  - Portal Items
- Result Datasets as Feature Layers
- Insights Pages can be embedded in **Story Maps**
Demo
Behind the scenes
Insights “Stack”

- **Modern Web Browser**
  - Supports IE11/Edge, Chrome, Safari, Firefox

- **Insights and Insights Items live here**
  - Workbooks, Page, Models

- **Insights Services / Other Engines**

- **Hosted Relational Data Store**
  - Insights Schema
  - Insights Workspace
## Connections to database

Require Server with correct JDBC Drivers

<table>
<thead>
<tr>
<th>Database</th>
<th>Supported drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft SQL Server</td>
<td>Microsoft JDBC Driver for SQL Server version 4.0 and up. Install one of the following:</td>
</tr>
<tr>
<td></td>
<td>• sqljdbc4.jar</td>
</tr>
<tr>
<td></td>
<td>• sqljdbc41.jar</td>
</tr>
<tr>
<td></td>
<td>• sqljdbc42.jar</td>
</tr>
<tr>
<td>SAP HANA</td>
<td>SAP HANA JDBC Driver. Install:</td>
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<td></td>
<td>• ngdbc.jar</td>
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<tr>
<td>Terradata</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>• Extensible through Prof Svcs</td>
</tr>
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</table>
Things to think about when deploying on-premises…

- **There is no magic bullet**
  - Performance is based on the weakest link

- **System sizing and scalability**
  - Should be done properly and even more so given the data intensive nature of Insights
  - More…

- **Size of data**
  - No “little” data
How to Get Insights
Online or Enterprise

SaaS
ArcGIS Online

OR

Your Infrastructure (Physical, Virtual, or Cloud)
ArcGIS Enterprise
Enterprise

- ArcGIS Enterprise 10.5.1 or 10.6
- Base Deployment
  - Portal, GIS Server, Data Store, Web Adaptors
- Recommend minimum 32 GB of RAM
- Download Insights from MyEsri & install

Your Infrastructure
(Physical, Virtual, or Cloud)

ArcGIS Enterprise
Licensing (Enterprise and Online)

- The portal admin must assign licenses
Licensing

- **Insights for ArcGIS Online**
  - Includes 1,000 credits / license
  - Yearly (term) license

- **Insights for ArcGIS Enterprise**
  - Yearly (term) license OR or perpetual (up front fee for indefinite time)

- **EAs (enterprise agreements)** often include Insights licenses, based EA size. See your account manager for details.

- **All Esri Partners** have Insights licenses.
Licensing

- Level 2 user + Insights license
  - Level 1 user = Read only with shared items

• For the ability to create and edit workbooks, Insights requires a level 2 named user plus an Insights license.
• For viewing only, it is available to named ArcGIS users, including Level 1.
*Be sure to share data that the page or model needs.
*Today, public sharing is only available with Enterprise (not Online).
*Must be owner of a workbook to open it within Insights and modify it
*Shared pages and workbooks support interactions of the read-only viewer

**Anonymous access**
- View embedded shared page within: story map, The Hub, web page
- Access through iframe only

**Public**

**Level 1 user, any role**
- View shared page within the Insights viewer (read only)
- Can not open shared workbook nor shared model

**Viewer**

**Level 2, publisher role, + Insights license**
- View shared page or workbook within the Insights viewer (read only)
- Open shared model within Insights
  - Add data, and re-run analysis
  - Understand documented workflow

**Analyst**
15 Minutes
Insights as a capability within ArcGIS
- Self-service analysis
- Explore both spatial and non-spatial data
- Find answers, drive impactful decisions

*Now in ArcGIS Online*
Putting Insights to Work

Retail
Analyze patterns in sales performance based on proximity to store and area demographics.

Banking
Conduct deposit, branch performance, and investment analysis by location.

Law Enforcement
Identify crime patterns and manage operational accountability processes.

Petroleum
Perform acreage analysis and manage the portfolio to improve exploration and production.

Health and Human Services
Analyze access to care, model what-if scenarios, and meet community health needs.

Local Government
Look at budget and human resource allocation to identify issues and find efficiencies across different regions.

Electric and Gas
Monitor system and asset performance and mine data from real-time sensors.

Insurance
Perform portfolio and claims analysis and understand spatial patterns over time.
ArcGIS – Common Patterns of Use

- **Mapping & Visualization**
  - Understand locations and relationships with maps and visual representations

- **Data Management**
  - Collect, organize, and maintain accurate locations and details about assets and resources

- **Field Mobility**
  - Manage and enable a mobile workforce to collect and access information in the field

- **Monitoring**
  - Track, manage, and monitor assets and resources in real-time

- **Analytics**
  - Discover, quantify, and predict trends and patterns to improve outcomes

- **Design & Planning**
  - Evaluate alternative solutions and create optimal designs

- **Decision Support**
  - Gain situational awareness, and enable information-driven decision making

- **Consortium Engagement**
  - Communicate and collaborate with citizens and external communities of interest

- **Sharing & Collaboration**
  - Empower everyone to easily discover, use, make, and share geographic information
## ArcGIS – Common Patterns of Use

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Evaluate alternative solutions and create optimal designs

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**Constituent Engagement**
Communicate and collaborate with citizens and external communities of interest

**Sharing & Collaboration**
Empower everyone to easily discover, use, make, and share geographic information
Access Data Anywhere

ArcGIS Insights

Tabular
Spatial
Database
Cloud
Big Data
Access Data Anywhere & Follow Your Workflow

ArcGIS Insights

- Data preparation
- GeoEnablement
- Visualization
- Statistical analysis
- Spatial analysis
- Share results
- Share processes

Tabular
Spatial
Database
Cloud
Big Data
Analytic Workflows, With Deeper Insight

Visualization
- Interactive data views
- Charts, graphs, tables, and maps
- Dynamic selection & cross filtering
- Context of the largest digital atlas in world

Statistical Analysis
- Descriptive stats
- Link analysis
- Regression

Spatial Analysis
- How is it distributed?
- How is it related?
- What’s nearby?
- How has it changed?

GeoEnablement
- Geocode address
- Convert X,Y
- Join to boundaries
- Join to demographic variables

Data Preparation
- Format fields
- Calculate new fields

Record & Repeat Analysis
- Share model to analysts
- Document best practices
- Re-run with new data

Share Results
- Share with executives
- Tell your story
- Share with public

Empowering the Analyst and Scientist
When should I use Insights?

GeoSpatial Understanding

GIS Analyst
Data Scientist
Data Analyst
Business Analyst
Knowledge Worker
When should I use Insights?

GeoSpatial Analysis Capability

ArcGIS Map Viewer

Insights for ArcGIS

ArcGIS Pro
When should I use Insights?

Apps With Purpose

GeoSpatial Understanding

GeoSpatial Analysis Capability

ArcGIS Map Viewer

ArcGIS Pro
Usable Across Roles and Skill Levels

GeoSpatial Understanding

GIS Analyst
Data Scientist
Data Analyst
Business Analyst
Knowledge Worker

Insights for ArcGIS
Enabling People to Analyze Like Never Before
Take it to the next level of understanding

GeoSpatial Understanding

- GIS Analyst
- Data Scientist
- Data Analyst
- Business Analyst
- Knowledge Worker

Insights for ArcGIS
When to Use What

Apps with a Purpose

- Data **analytics workbench**. Advanced analytics with drag-n-drop tools, minimal clicks. Visual and interactive results, share and re-run analysis.

- Specific **guided workflows** for **focused problems** (site selection, market planning, customer targeting…)

- Real-time data. **Common operating picture** for making informed decisions. **Monitor** events, activities, and situations.
Insights Within the Platform

Working Together Across ArcGIS

- Workflows may benefit from (or require) multiple apps or users
- Different skillsets and roles.

- Preprocess and format data
- Perform custom analysis before OR after using Insights
  - Pro → Insights
  - Insights → Pro

- Access organizational data that’s managed and maintained

- Share and distribute analysis results, with context and meaning.
Using Insights for Analysis
A Data Science Process

- Raw Data Collected
- Data is Processed
- Clean Dataset
- Exploratory Analysis
- Models & Algorithms
- Data Product
- Communicate Visualize Report
- Make Decisions
T-shaped professionals can more easily work in interdisciplinary teams than those with less breadth and can be more effective than those without depth.
Therefore, a data analyst gathers, arranges, processes and models data. They are able to analyze large volume of data, be it structured or unstructured.

The main objective of data analysis is to prepare and present data in the right form (graphs or tables) for decision-making and problem-solving process.
Selections and Filters

• **Attribute filters**
  - Data pane versus card
  - Remember date breakdowns

• **Spatial filters**
  - Drag and drop polygons
  - Drawing

• **Attribute selection**
  - Use the interactivity
    - Legends
    - Cards e.g. maps, charts, tables

• **Spatial selection**
  - Drag selection to new map card
Spatial Analysis Tools

- Spatial aggregation
- Create buffer / drive times
  - Fixed distance (preview mode)
  - Drive time (by mode time / distance)
- Enrich data
- Calculate density
- Find Nearest

Overlapping / dissolved
Result layers

- New temporary result layers are created:
  - When the data takes a new form e.g. summary table, bar chart or spatial selection - fewer features with attributes
  - Analysis tool has been run
- Result layers can be shared back to the portal
- Insights can use data with multiple shape fields e.g. find nearest
Analysis view and models

• Analysis is recorded
  - Steps can be seen in the analysis view
  - Models can be shared and input data updated
Map Types

CHOICE MATTERS
Map types

- Analysis and, therefore, **thematic** mapping
  - Light / dark gray basemaps
- Vector only (to date)
  - Points, lines and polygons
Map symbol types
- Quantitative and qualitative options
  - Types (Unique symbols)
  - Locations (single symbol)
  - Original symbol
  - Counts and amounts (size)
  - Counts and amounts (color)
Choropleths

- Quantitative data – rates, ratios or percentages

⚠️ Choropleth maps should show normalized values not counts collected over unequal areas or populations
  - Using normalization (in GIS terminology) we can take into account the differences between the areas (e.g. size of area, population size etc)
  -Normalization transforms measures of magnitude (counts or weights) into measures of intensity
Classification

- Quantitative data

- Classification is the method of grouping numeric data into ranges

- Classification methods include:
  - Natural Breaks *
  - Equal Interval
  - Quantile
  - Standard Deviation
  - Unclassed
  - Manual

⚠️ Classification is important

* Default
Chart types
WHAT TO USE WHEN

![Chart showing Radon exposure over years 1981 to 1985 with data points for each year, illustrating the number of total miners and exposure levels.](chart.png)
Bar graphs

• Qualitative data *

• Compare information, revealing highs and lows, trends

• A bar graph uses either horizontal or vertical bars to show comparisons among categories
  - Horizontal can be clearer if labels are long

• Along one axis the categories are plotted, and the other axis represents a numerical value

• They are useful for identifying broad differences between categories at a glance

⚠️ Not effective with a large number of categories
Grouped or Stacked Bar Graphs

- Grouped Bar Graphs: Two or more data series are plotted side-by-side and grouped together under categories, all on the same axis.
  
 ⚠️ With many bars in any group, they quickly become hard to read

- Stacked Bar Graphs: place the bars of multiple categories on top of each other to show how a larger category is divided into smaller categories and what the relationship of each part has on the total amount.

⚠️ Comparing segments to each other is problematic since they are not aligned.
Treemaps

- Show hierarchical data as a proportion of a whole and the structure of data
- The proportion of categories can easily be compared by their size
⚠️ Not effective for revealing small differences
Bubble charts

- **Qualitative data or quantitative data**

- Represent numerical values of variables by area in circles, randomly placed
- With two variables (e.g. category & count), the circles placed so they are packed together
  - Less perceptually accurate than bar charts (but allow hundreds of values to be visualized)
- If three variables are used (three numeric) then the circles are placed using Cartesian coordinates
  - Hard to read with too many categories
**Donut chart**

- Qualitative data

- Are used to show relative proportions or percentages of categories
- Ideally, donut charts should have at least three categories and no more than eight

⚠️ The donut represents the whole so the data must constitute the whole
• Visualizes the inter-relationships between categories
• Allows comparison of similarities within a dataset or between different groups of data
⚠️ With too many connections over-cluttering becomes a problem
A heat chart shows total frequency in a matrix. Values in each cell of the rectangular grid are symbolized into classes.

⚠️ Data is classified so if data ranges are wide, local variations will be hidden.
Data clock

- Qualitative data

- A Data clock creates a circular chart of temporal data (stored as a qualitative variable)
- Commonly used to see the number of events at different periods of time

⚠️ Remember data is classified; Can be hard to read with too many categories
Histograms

• Single quantitative field *

• Show the distribution of your data e.g. mean and median
• The numeric values are classified / binned
• The bar represents the range of the class bin, and the bar height represents the number of data points in the class bin
  - Statistics are reported: mean, median, standard deviation, skewness, kurtosis
  - The statistics are approximations (calculated on the classified data)
  - The normal distribution can be overlaid
• A dataset of the aggregated data is created
Box plot

- Shows the distribution of a set of data, within one box with:
  - the median, upper and lower quartiles, minimum and maximum values, and any outliers
  - Useful for comparing distributions between many groups

- Data can be broken down by a category
  - side-by-side box plots are created, with each box plot representing the spread of data in each category
Scatterplots

- Allows you to look at relationships between two numeric variables (both scales and quantitative)
  - Independent / known on horizontal, dependent / modeled on vertical
  - Points can also be color-coded to increase the number of displayed variables to three
- If the data contain a large range of values, one or both axes can be converted to a log scale (log-normal and log-log)
  
⚠️ Should be a logical reason for expecting a relationship
Scatterplot: Correlation

- Level of correlation can be quantified comparisons of two paired sets of measures to determine
  - Linear: as one set goes up the other set goes either up or down, equally.
  - Exponential: data values that rise or fall at constantly increasing rates. Data cannot contain zero or negative values.
  - Polynomial (2-4): when data fluctuates. The order of the polynomial is determined by the number of fluctuations.

1. **Strength**
2. **Direction**
3. **Type**

No correlation

Good correlation

Positive
Time series/Line graph

- **Temporal data**

- Visualize a sequence of numeric values, primarily for trends over time

- A line graph displays the relationship between two types of information by connecting individual numeric data points, showing the sequence of values

- Good to highlight overall trends of values and change from one value to the next

⚠️ They should only be used with continuous variables
Summary Tables

- Qualitative and/or quantitative data

- For analyzing data
  - Or exact values are important
- Additional statistics can be calculated on numeric fields
  - sum, average, min, max
  - Information can be sorted
  - Selections can be inverted or just show selected
- Can summarize data by up to two categories and \( n \) numeric fields
- Data management with new result created
  - Can be joined to create new datasets
Data Table

- Attribute table

- Access to see all the data in the dataset
- Fields can be sorted ascending or descending
- Switch selections or just show selected
- Add and calculate fields
  - Functions can be accessed using the \( \text{fx} \) button
  - Four types are available: string (10), numeric (10), date (4), and logical (3)
  - Creates a join to the original data
**Measure**: ascertain the size, amount, or degree of (something)

- A bar graph uses either horizontal or vertical bars to show comparisons among categories. They are valuable to identify broad differences between categories at a glance.
- A tree map shows both the hierarchical data as a proportion of a whole and, the structure of data. The proportion of categories can easily be compared by their size.
- Bubble charts represent numerical values of variables by area. With two variables (category and numeric), the circles placed so they are packed together.
- A heat chart shows total frequency in a matrix. Values in each cell of the rectangular grid are symbolized into classes.

**Relationship**: a connection or similarity between two or more things or, the state of being related to something else

- A choropleth map allows quantitative values to be mapped by area. They should show normalized values not counts collected over unequal areas or populations.
- A chord diagram visualizes the inter-relationships between categories and allows comparison of similarities within a dataset or, between different groups of data.
- Scatterplots allow you to look at relationships between two numeric variables with both scales showing quantitative variables. The level of correlation can also be quantified.
- Spider lines, also termed desire lines, show paths between origins and destinations. They show connections between places.

**Change**: process through which something becomes different, often over time

- A bar graph uses either horizontal or vertical bars to show comparisons among categories. They are valuable to identify broad differences between categories at a glance.
- A heat chart shows total frequency in a matrix. Using a temporal axis values, each cell of the rectangular grid are symbolized into classes over time.
- Bubble charts with three numeric variables are multivariate charts that show the relationship between two values while a third value is shown by the circle area.
- Graduated symbol maps show a quantitative difference between mapped features by varying symbol size. Data are classified with a symbol assigned to each range.
- A Density/heat map calculates spatial concentrations of events or values enabling the distribution to be visualized as a continuous surface.
- A Data clock creates a circular chart of temporal data, commonly used to see the number of events at different periods of time.
- Line graphs visualize a sequence of continuous numeric values and are used primarily for trends over time. They show overall trends and changes from one value to the next.
- A combo chart combines two graphs where they share common information on the x-axis. They allow relationships between two datasets to be shown.

**Distribution**: the arrangement of phenomena, could be numerically or spatially

- Histograms show the distribution of a numeric variable. The bar represents the range of the class bin with the height showing the number of data points in the class bin.
- A box plot displays data distribution showing the median, upper and lower quartiles, min and max values and, outliers. Distributions between many groups can be compared.
- A choropleth map allows quantitative values to be mapped by area. They should show normalized values not counts collected over unequal areas or populations.
- Graduated symbol maps show a quantitative difference between mapped features by varying symbol size. Data are classified with a symbol assigned to each range.
- A Density/heat map calculates spatial concentrations of events or values enabling the distribution to be visualized as a continuous surface.
- A unique symbol map (areas or points) allows descriptive (qualitative) information to be shown by location. Areas have different fills and points can be geometric or pictorial.

**Part-to-whole**: relative proportions or percentages of categories, showing the relationship between parts and whole

- Donut charts are used to show the proportions of categorical data, with the size of each piece representing the proportion of each category.
- A treemap shows both the hierarchical data as a proportion of a whole and, the structure of data. The proportion of categories can easily be compared by their size.
Hands-on
OPPORTUNITY TO USE INSIGHTS
Exercise #1

- [http://esriurl.com/13879](http://esriurl.com/13879)
Exercise #2

- http://esriurl.com/13878

Overview

One indicator of a region’s growth is the number of permits issued for new construction. Exploring and analyzing permit activity can help regional planners ensure that development occurs in accordance to the area’s long-term goals. One area that has recently experienced rapid growth is Montgomery County, Maryland, a suburban county near Washington, D.C. County planners want to observe spatial and temporal growth trends, find out why certain areas are growing faster than others, and communicate key information about the county’s growth to the public.

In these lessons, you’ll explore Montgomery County permit data using Insights for ArcGIS, a web-based data analytics application. First, you’ll create a new workbook and add the permit data from ArcGIS Living Atlas of the World. You’ll explore the data and become familiar with exactly what kind of information it contains. Then, you’ll analyze the data to detect patterns and find out why growth is occurring. Once you’ve gathered your findings from your exploration and analysis, you’ll share your work online.

Build skills in these areas:

- Adding data to a new workbook
- Visualizing data
- Performing aggregation and enrichment analyses
- Sharing your work
Road Ahead / Wrap Up
Almost done…

Q & A