

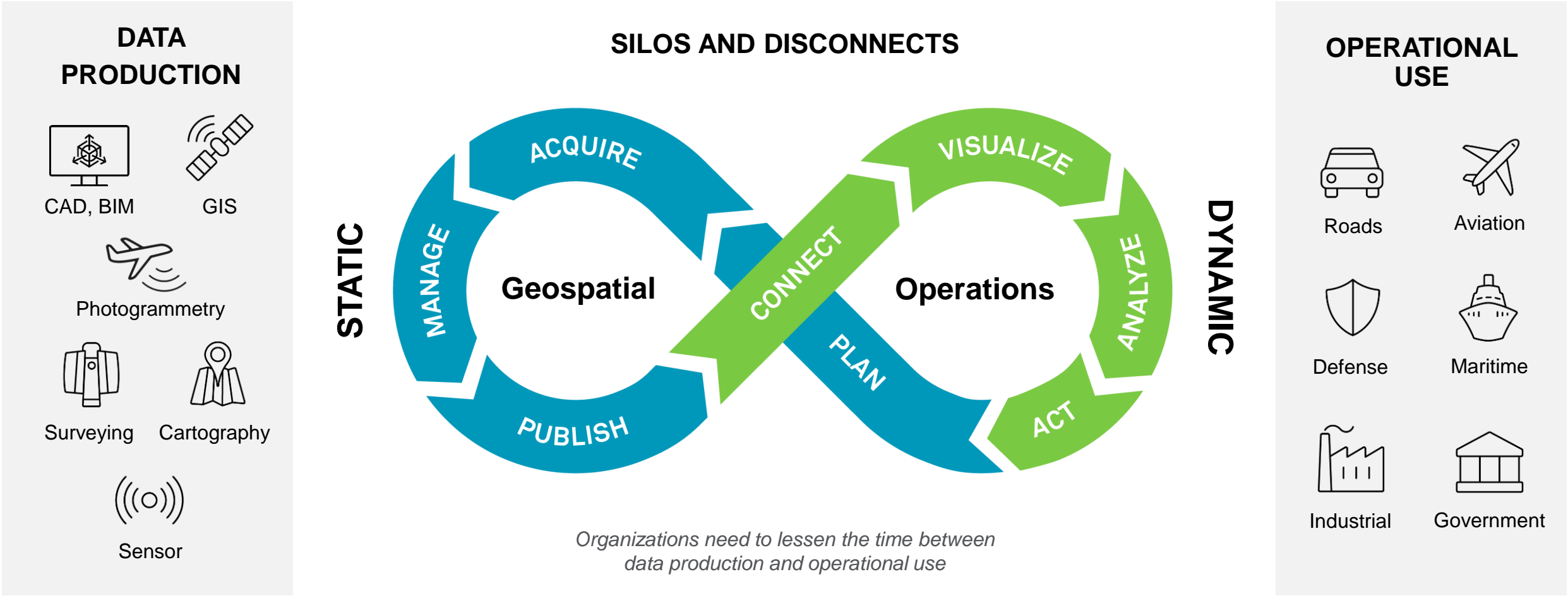


**HEXAGON**

## **Remote Sensing Update**

Pacific GIS & Remote Sensing Conference

# The Geo-Ops challenge



# Remote Sensing Challenges in Different Domains

Imagery analysts have an overabundance of data to analyze due to the use of more and more sensors. Their challenge is not better data but getting better intelligence from data... fast.

Land and urban planners need to have an economical, extremely accurate and fast assessment of land and development.

Agriculture agencies and farmers needs to increase agricultural productivity and sustainability.

Data producers, capturing satellite, aerial or UAV images need to increase data processing productivity.





**IN JUST 5 YEARS, THERE MAY BE A  
MILLION TIMES MORE GEOSPATIAL  
DATA...**

**YES, A MILLION TIMES AND  
8 MILLION ANALYSTS  
REQUIRED**

*Robert Cardillo, Director NGA*



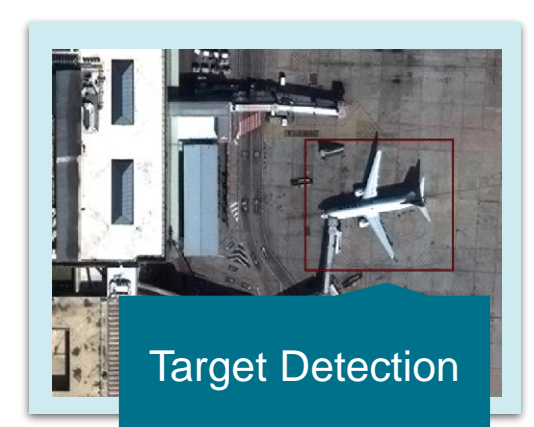
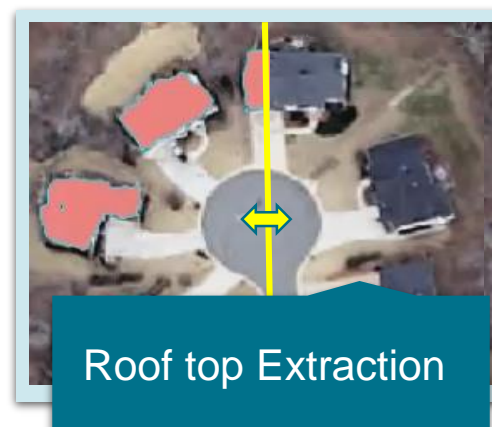
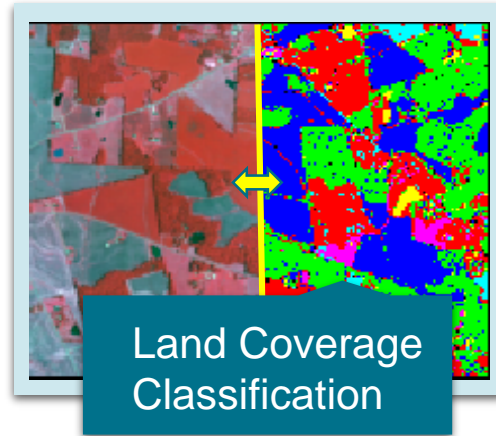
# Creating Efficiency through Artificial Intelligence

## Machine learning for geospatial datasets

- Pattern, shape, size, site, tone, and texture
- Keys a human impression while performing image analysis
- Artificial Intelligence has the computer perform these tasks
- No two areas are exactly the same, parameters are constantly updated
- Machine learning yields predictive results as more and more data is analyzed

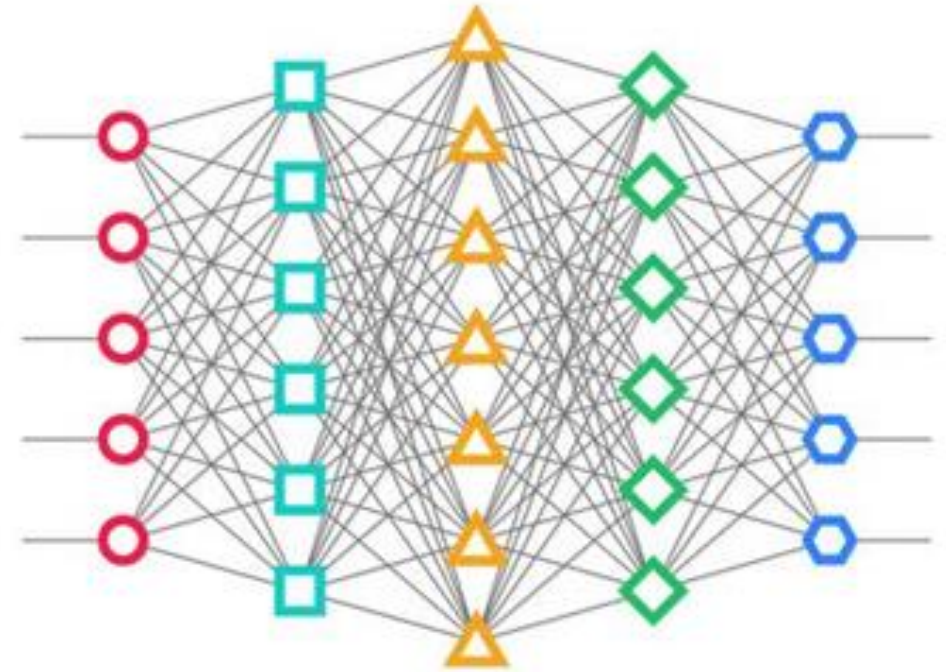


# Applying Machine Learning to the Geospatial Industry



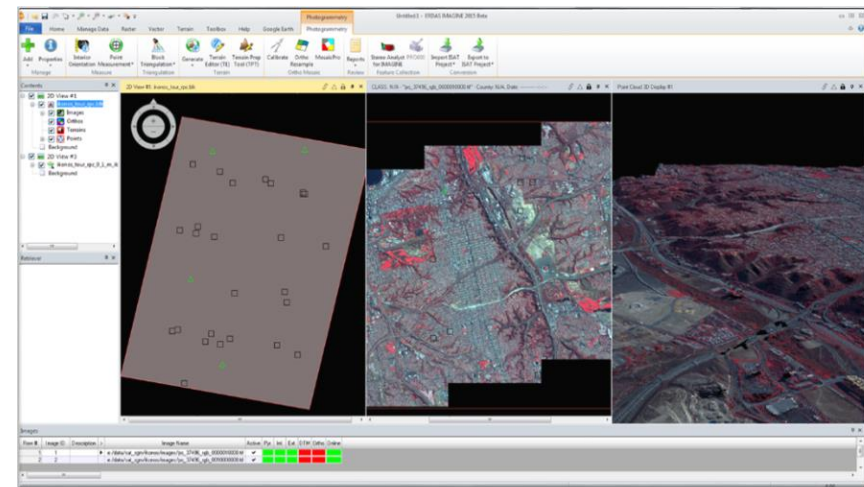
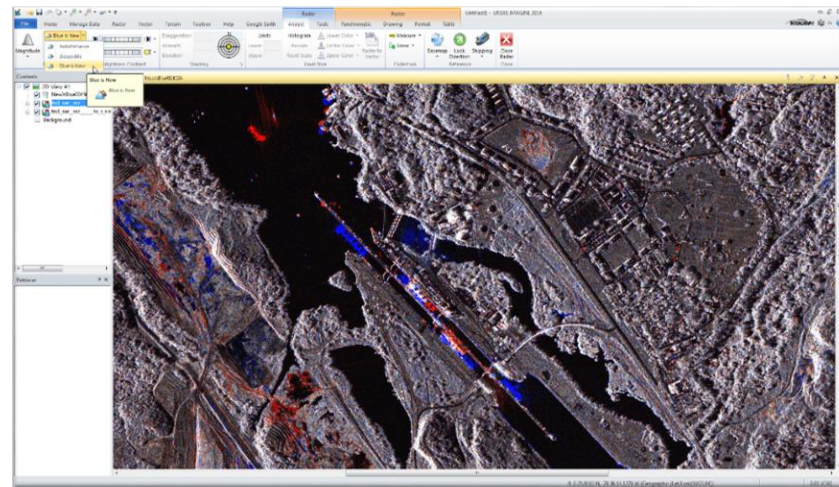
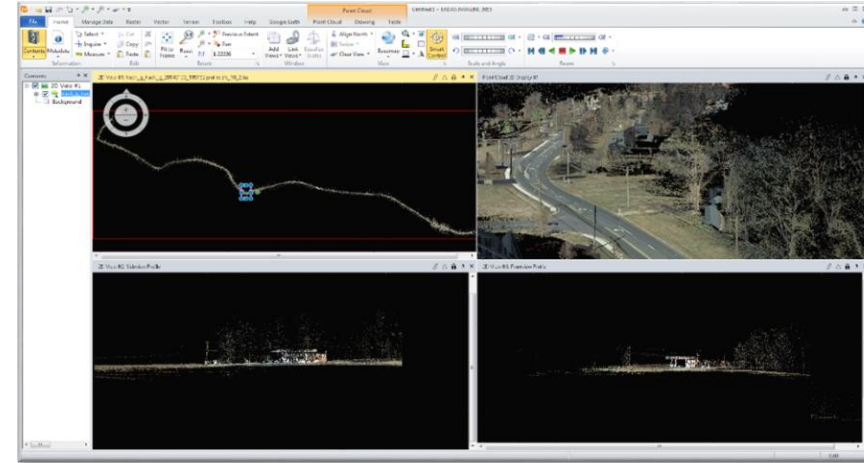
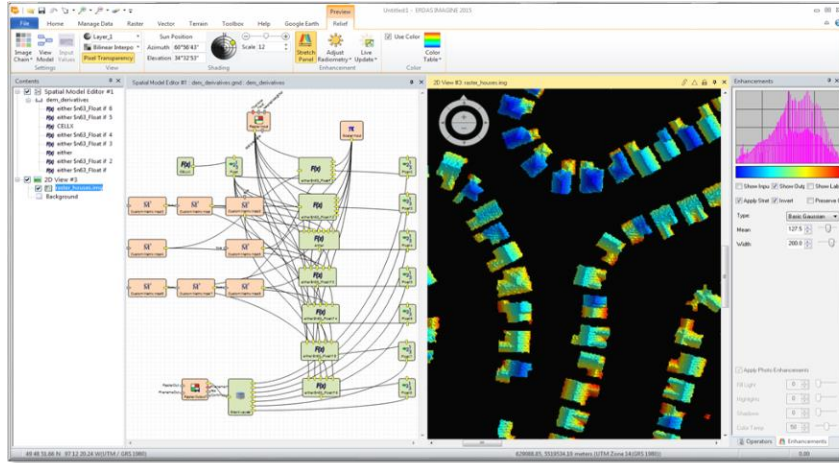
# Deep Learning

- Deep learning is a type of Machine Learning but differs in the way how they are trained and perform classification
- Deep learning uses Convolution Neural Networks (CNNs) to train itself on the classification
- Deep learning removes the manual identification of features in data and, instead, discovers the designated patterns in the training data by itself
- When you build the Deep Learning model, you will pass representative image chips into the algorithm and it will do all the work



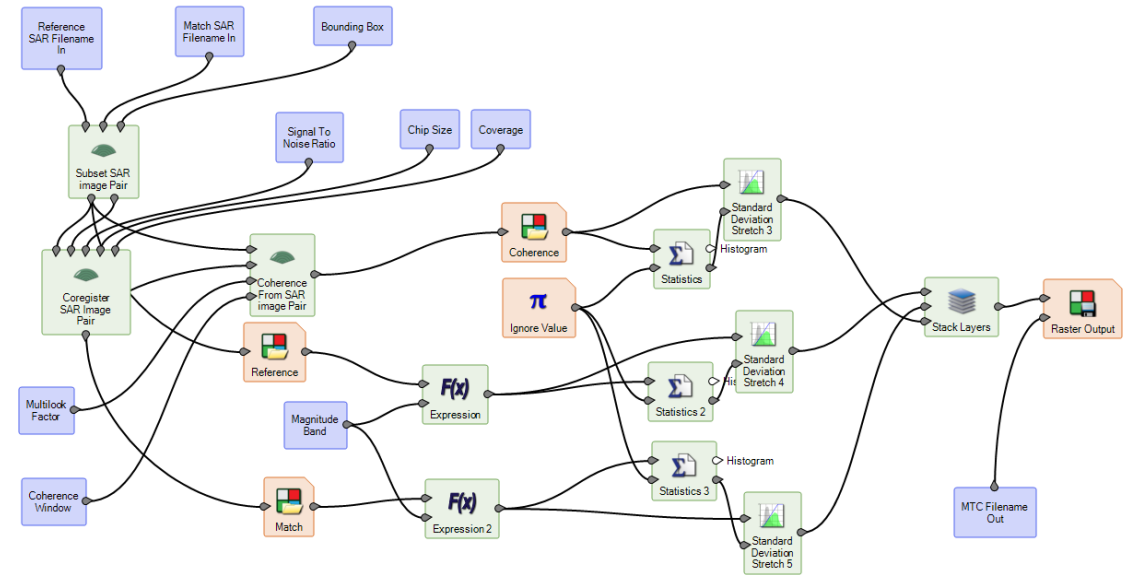
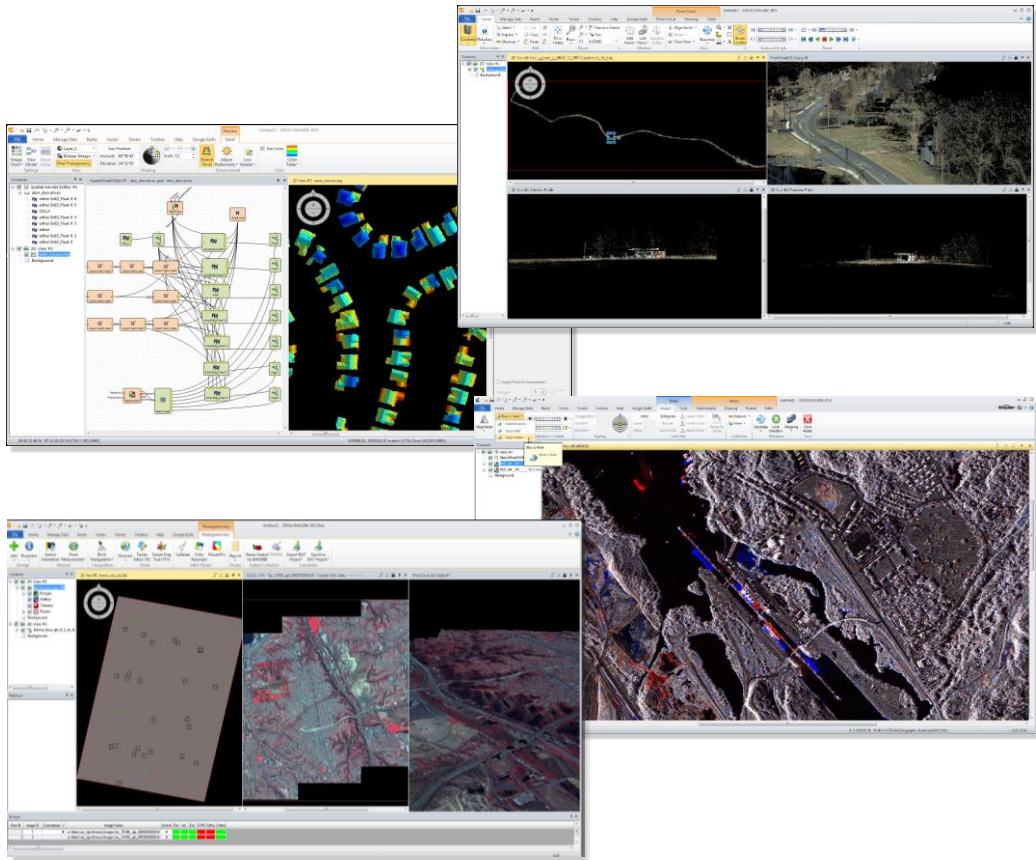


# From Desktop Remote Sensing, Photogrammetry, Point Clouds, and Radar





# To Geospatial Services - Deployable Anywhere



# Spatial Modeler Overview



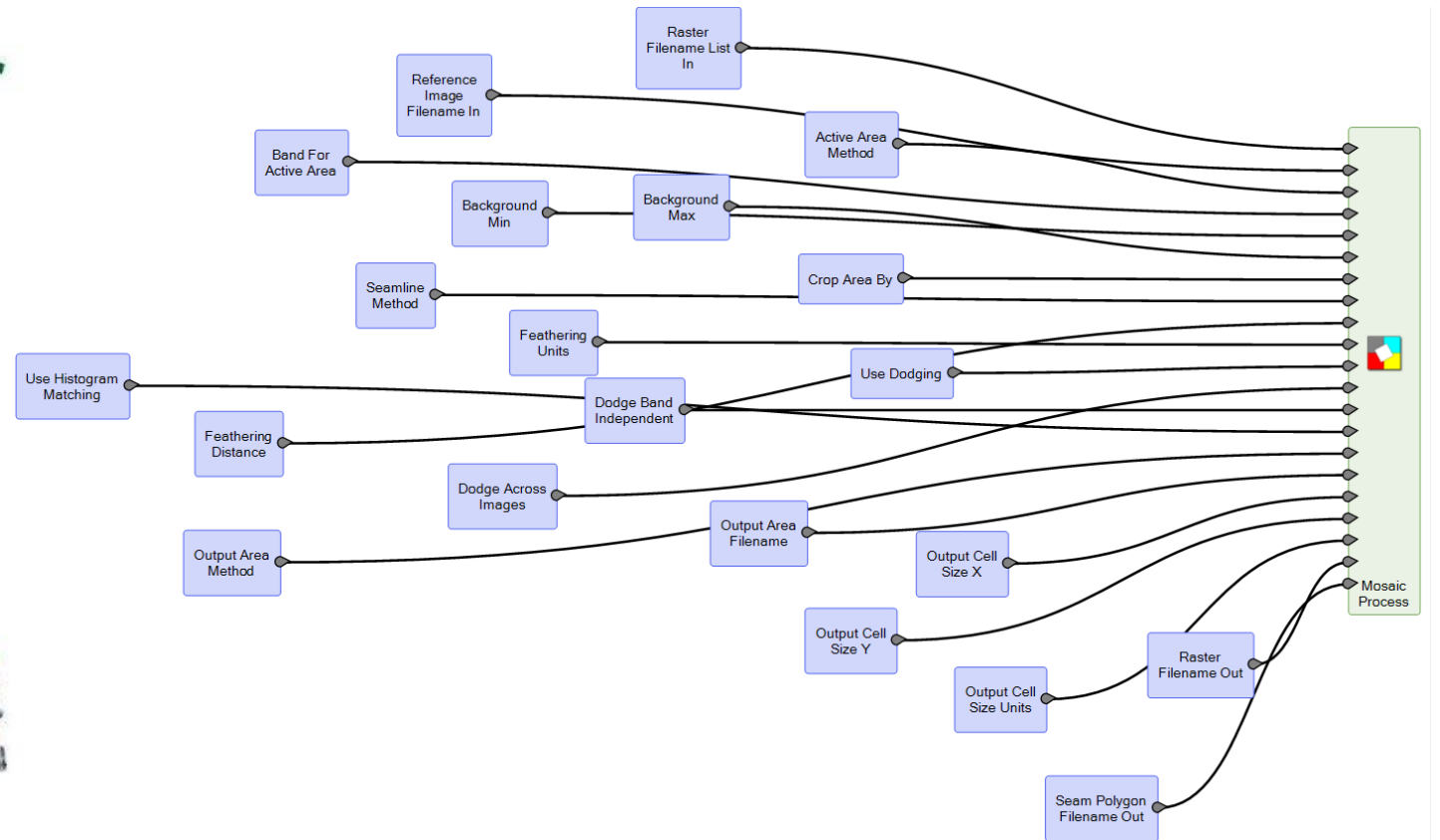
Box of Tools



Beginner Level

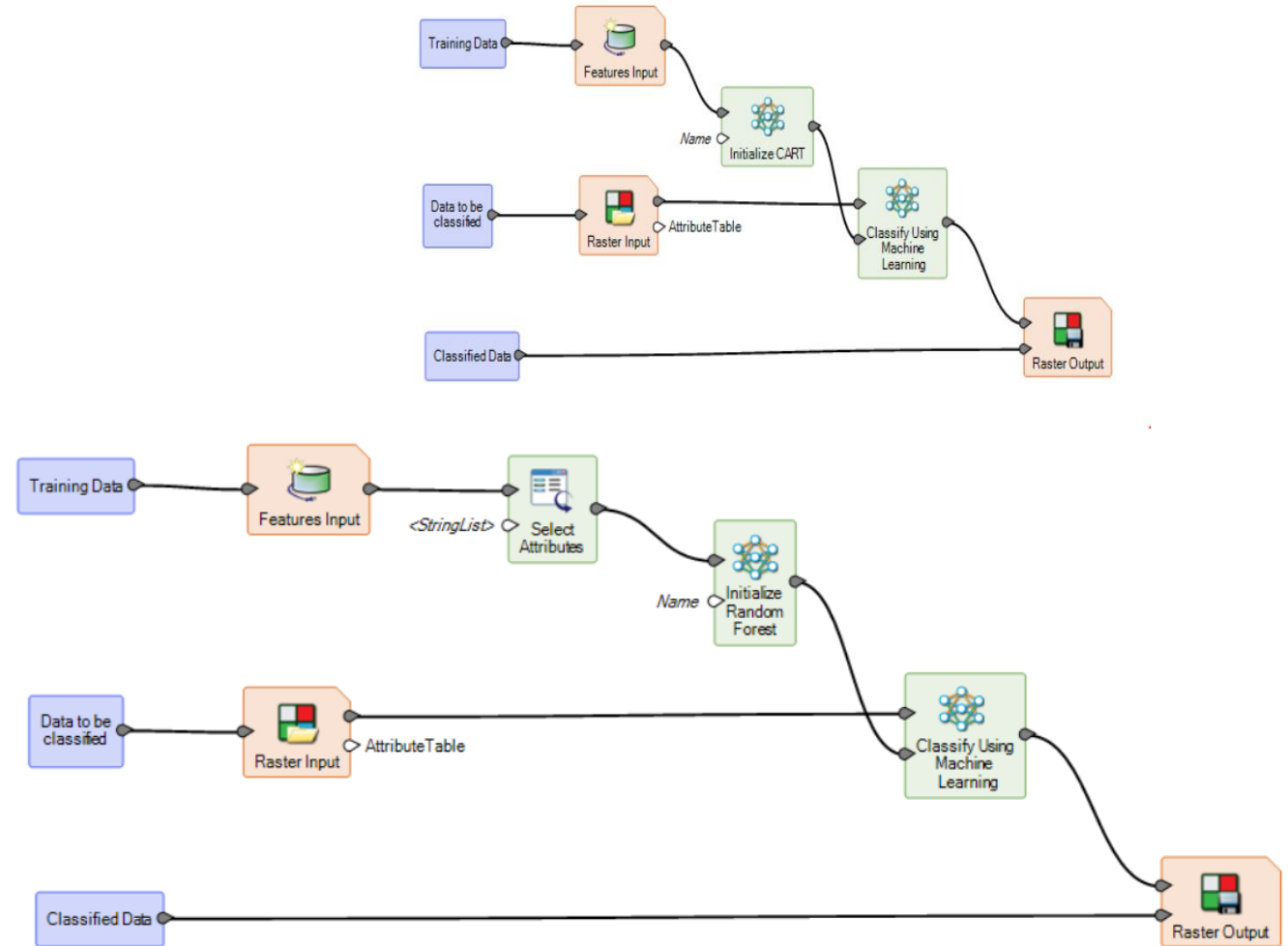


Professional Applications



# Machine Learning Classifiers in Spatial Modeler

- Machine learning algorithms support the geospatial domain
- Combine the power of Spatial Modeler with machine learning
- Apply machine learning to existing geospatial workflows
  - Feature extraction
  - Object and pixel classification or labeling
  - Learned change detection



# Steps to Classify Images Using Machine Learning Algorithms

Prepare Training Data

Select the ML algorithm

Train the ML algorithm

Validate the training



Select the image to classify

Select the trained ML algorithm

Execute the ML algorithm

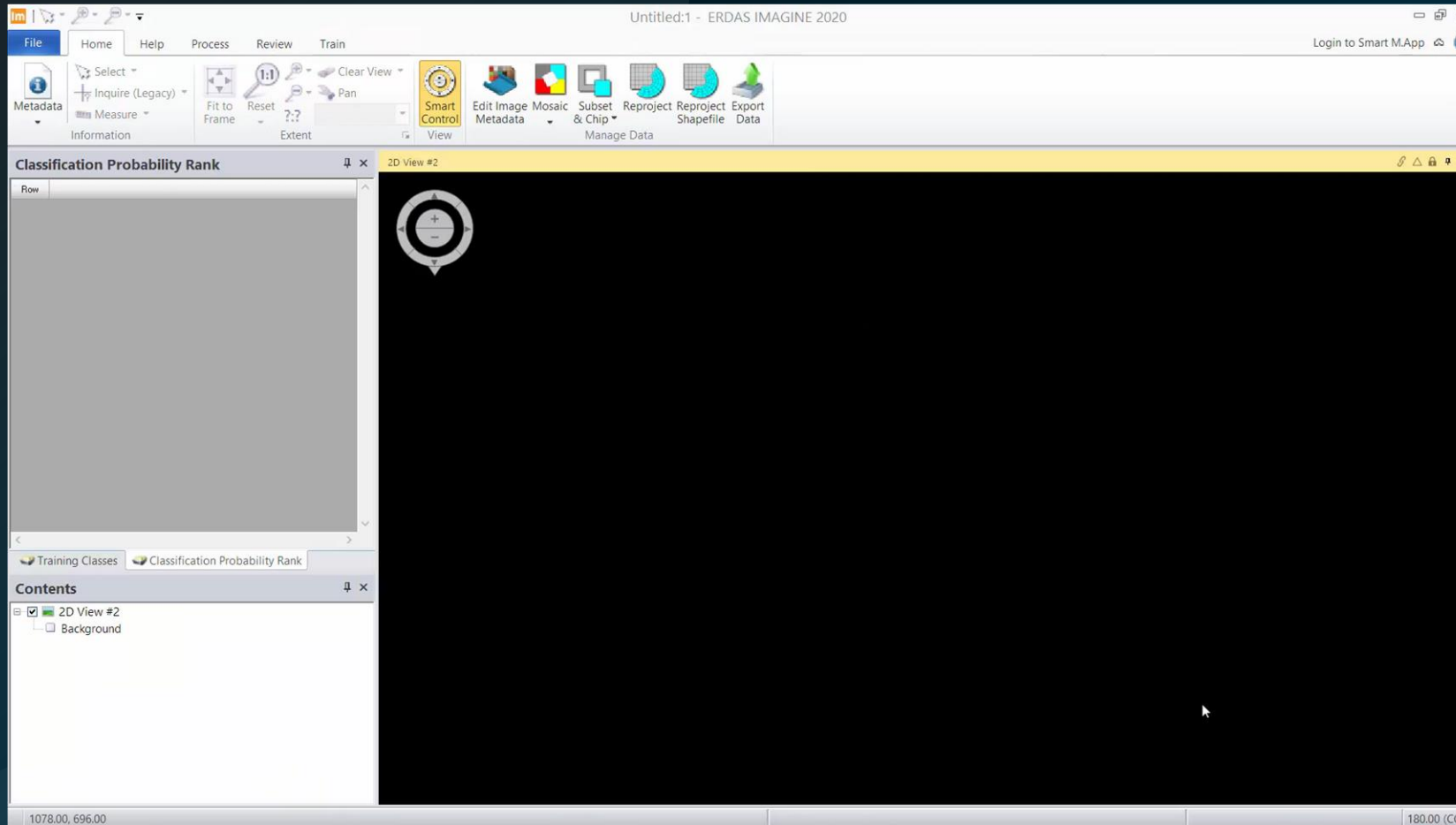
Image classified result





# Object Detection Using Deep Learning

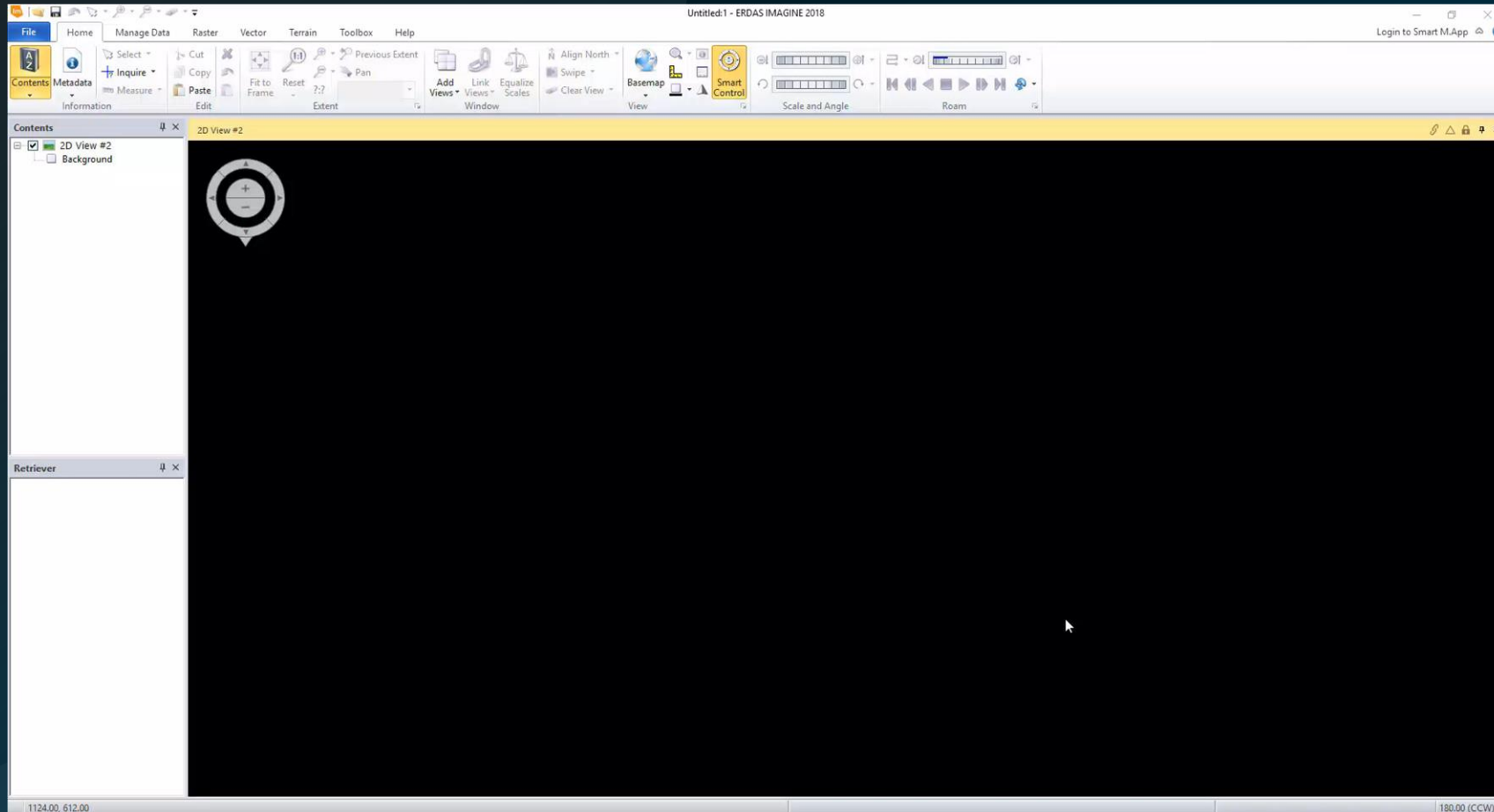
## Mapping Palm Oil Tree Locations in RGB orthophotos



- Create training footprints and chips using the machine learning layout tools
- Train (or initialize) an object detection deep learning convolution neural network using Spatial Modeler
- Use the trained object detection machine intellect to identify oil palms in other images using Spatial Modeler

# Object Detection Using Deep Learning

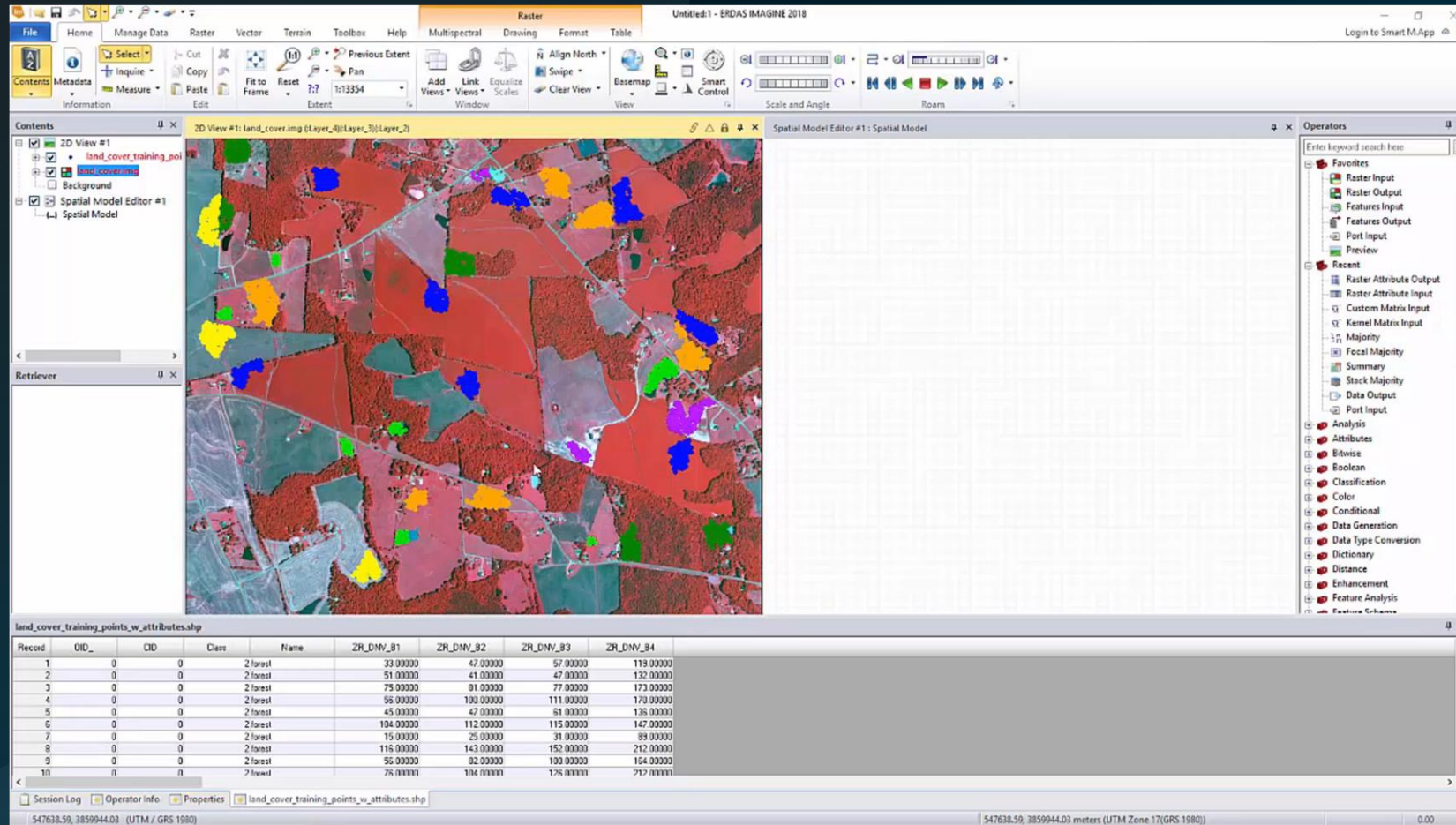
## Vessel detection in maritime domain



- Create training footprints and chips using the machine learning layout tools
- Use the trained object vessel detection machine intellect to identify all the relevant vessels in other images using Spatial Modeler

# Image Classification

Classification of land use based on ML algorithms applied to images



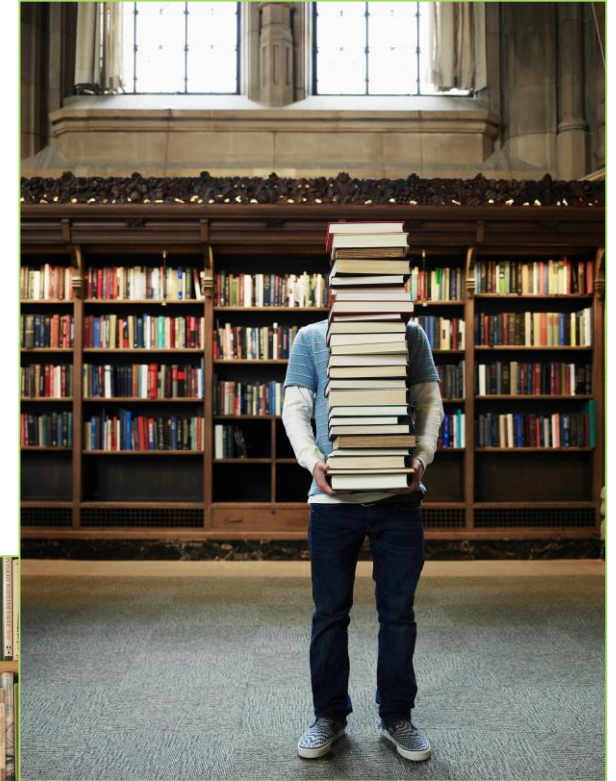
- This scenario is using information derived from the airphoto at the locations of the training polygons to train the Random Forest algorithm
- Simple example models showing the theory behind training a Random Forest machine learning network and using that network to classify other data



# What is ERDAS APOLLO?

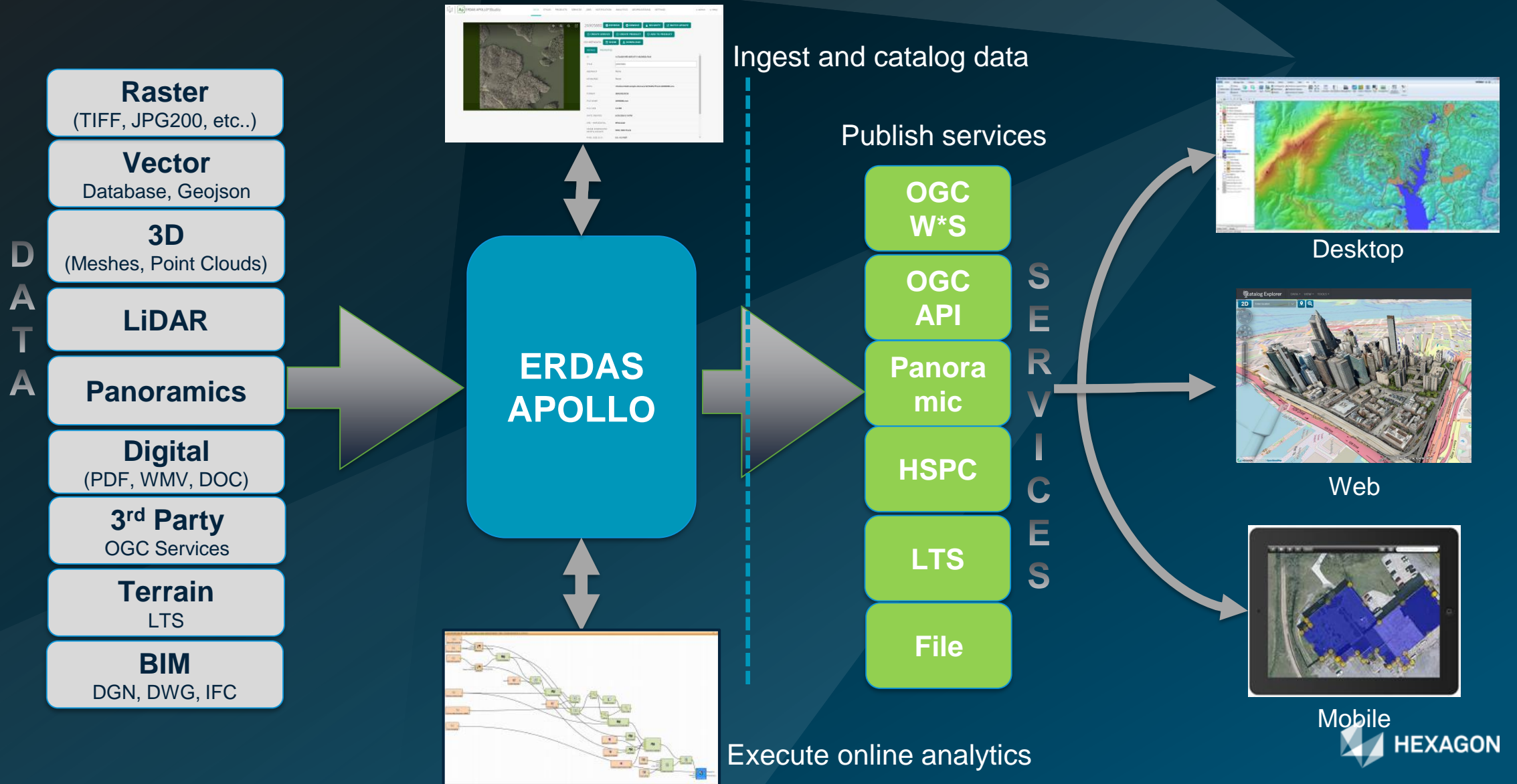
The best of both platforms

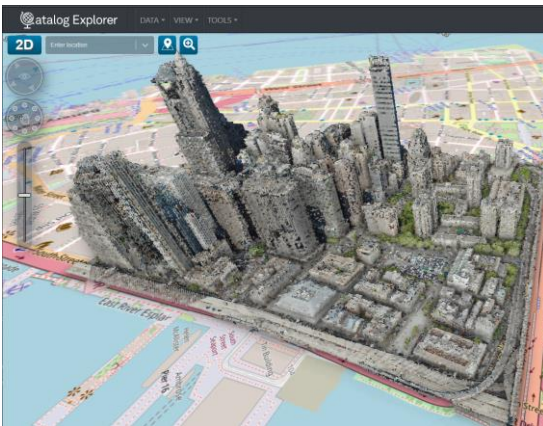
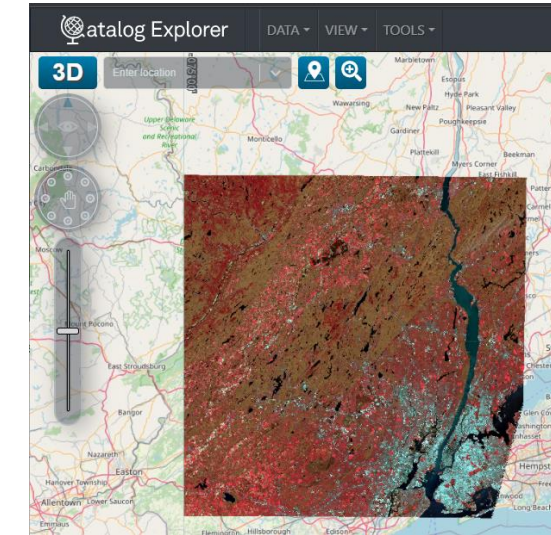
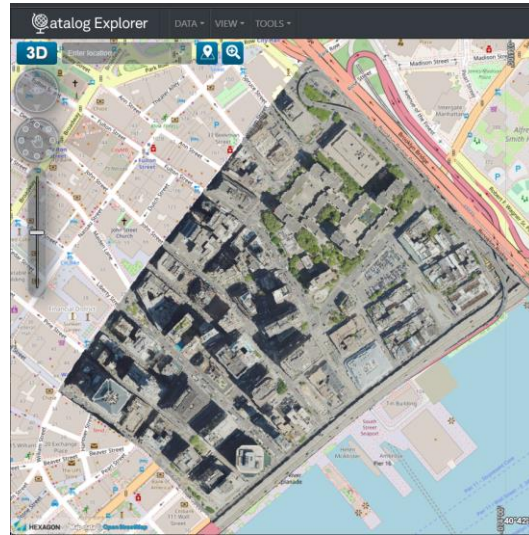
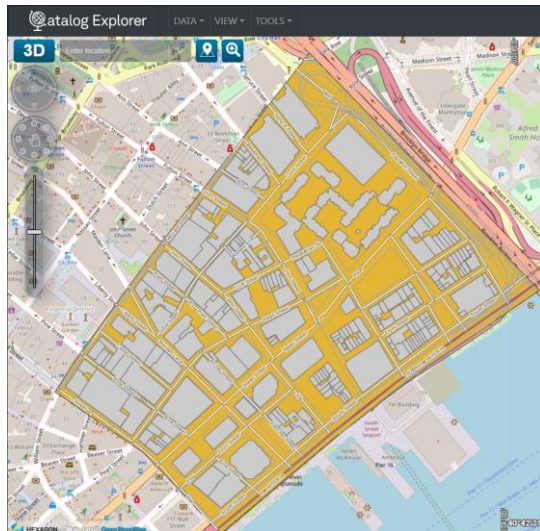
- ERDAS APOLLO provides a comprehensive data management and delivery server solution to centralize your geospatial information metadata with scheduled crawling and harvesting of regularly updated data holdings.
- It enables workflows for describing, styling, securing, cataloging and publishing geospatial and non-spatial data into a central catalog.





# ERDAS APOLLO workflow

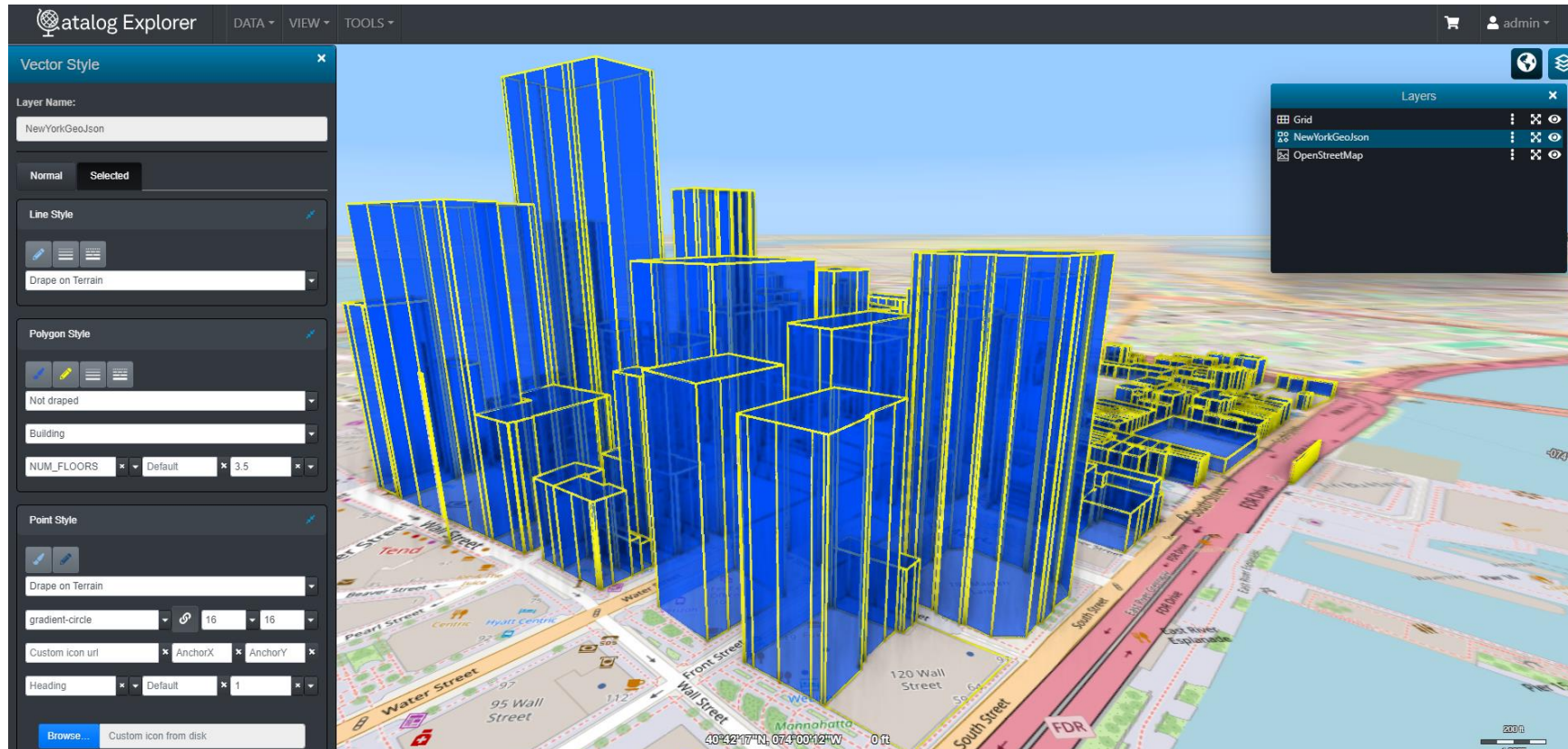




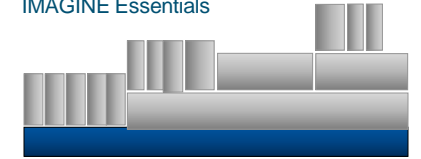


# Catalog Explorer

## Extruded shapes



- Create 3D data out of flat vector geometry
- Create buildings or truly extruded shapes



# IMAGINE Essentials

Entry-level tier offers essential tools for geospatial mapping, visualization, enhancement, and geo-correction, including enterprise-enabled access to OGC web services and relational databases such as ArcGIS for Server and Oracle Spatial.

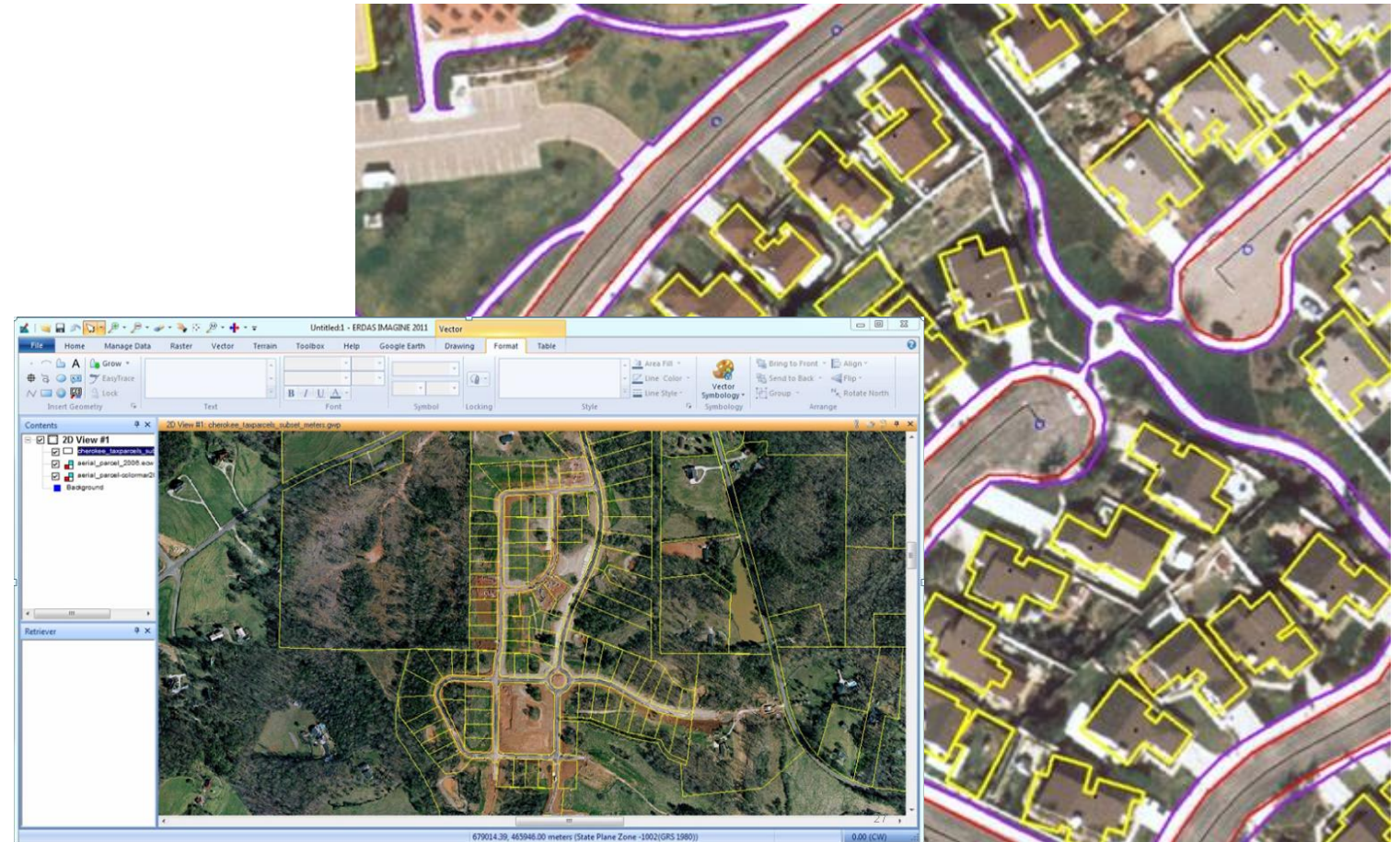
- Use over 100 data types in their native formats without conversion
- Import/export to hundreds of satellite, GIS, point data, and image file formats
- Always live Raster support (New sensors: DiMAP v2 (automatic RPC association), EXIF and XMP tag support, Pleiades Neo, ICEYE, Capella, PRISMA, 12-bit YCbCr TIFF, PlanetScope Level3, HDF, Esri \*.asc, improvements in NITF)
- Intuitive ribbon user interface with context-sensitive menus
- Extensive use of context-sensitive galleries for styling, template selection, and image enhancement
- Spatially linked multi-view data display environment
- Construct and print map compositions and reports
- Run existing spatial models
- Add-ons: MrSID, Stereo Analyst for ERDAS IMAGINE, IMAGINE Terrain Editor, Defense Productivity Module





# Vector ingestion and update

- File Geodatabase connection
- GeoMedia warehouse connection
- Reprojection
- Vector styling
- Change detection
- Object-based change detection
- Heads-up digitizing
- Semi-automated feature collection
- Classification
- Attribute editing



# Present and publish

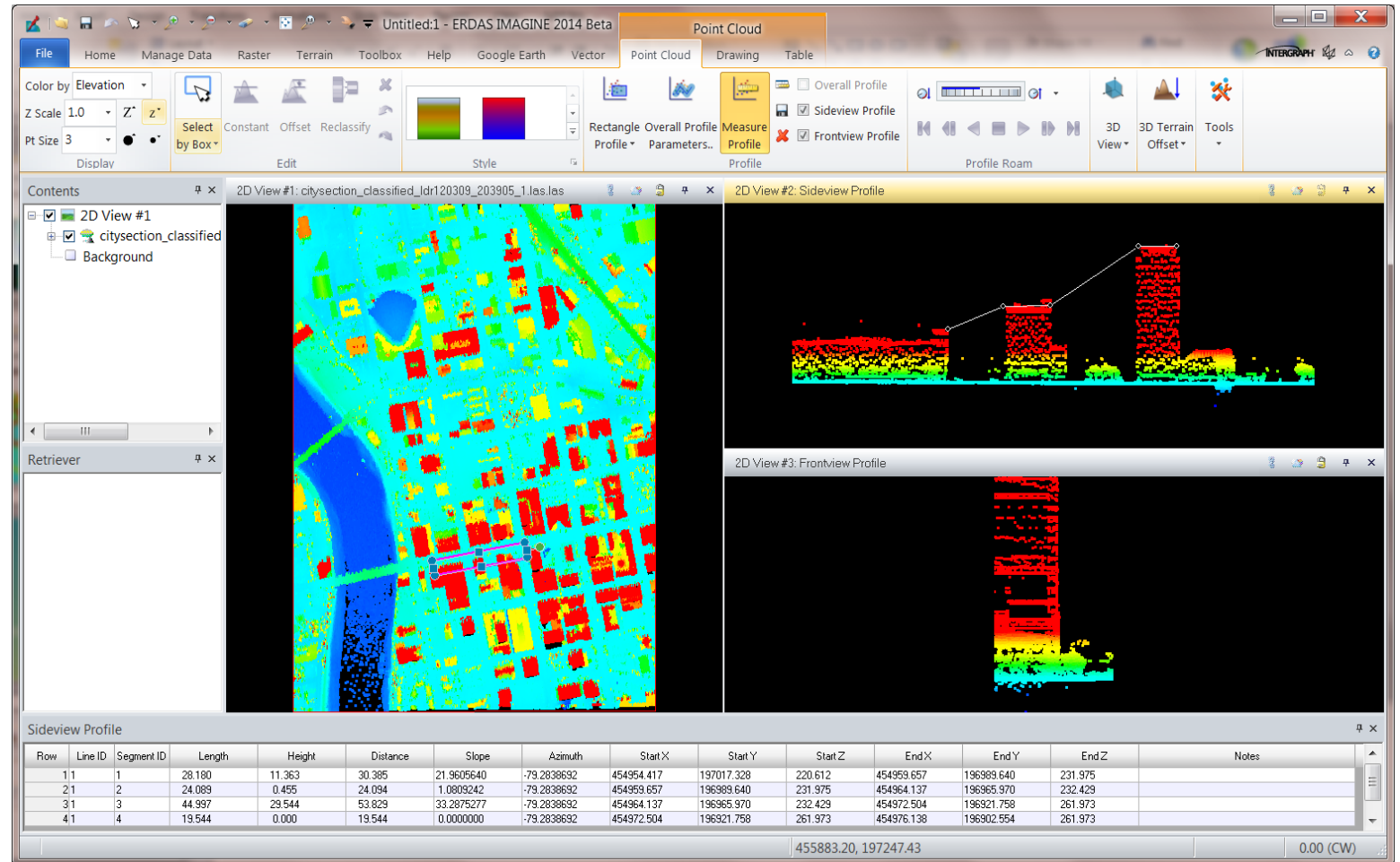
- Publish and share processes to the enterprise (WPS)
- Custom map compositions and reports
- USGS map series
- Custom international map series
- HTML maps
- Geospatial PDF
- Perspective views
- 3D fly-through
- Present and share with Microsoft Office





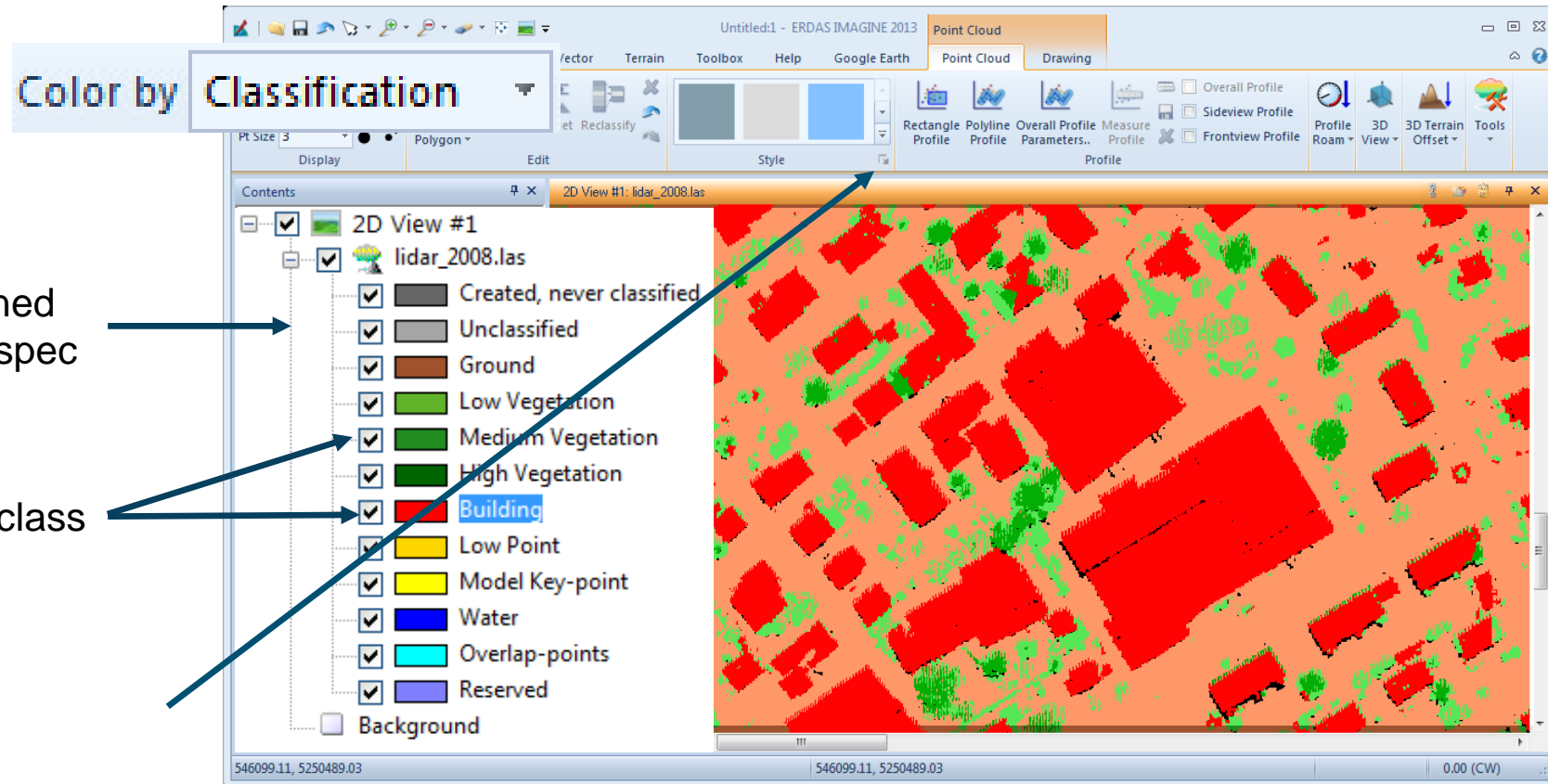
# Point clouds and LiDAR visualization

- 2D visualization
- 3D visualization
- Profile visualization
- Direct measurement
- LiDAR editing



# Viewing by classification

Point clouds can be classified based on the features they represent



Categories defined by the LAS 1.3 spec

Display or hide class

Colours are customizable

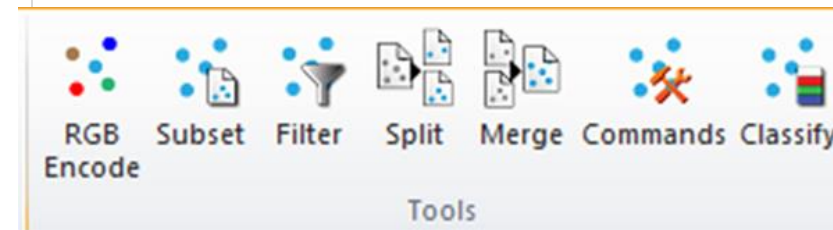
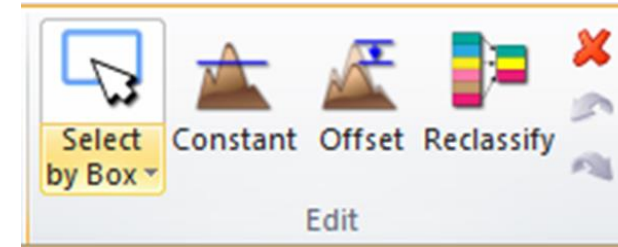
# Point clouds and LiDAR processing

## Interactive processing

- Point selection box/polygon and AOI
- Setting constant Z
- Adding an offset
- Reclass (recode) classes
- Delete points

## Offline processing

- Tiling
- RGB encode
- Subset
- Split/merge
- Filtering
- Reprojection
- Classify





File Home Manage Data Raster Vector Terrain Toolbox Help Google Earth Point Cloud Drawing Table Untitled:1 - ERDAS IMAGINE 2018 Login to Smart M.App

Color by Elevation Z Scale 1.0 Pt Size 3

Adjust Radiometry Select by Box Constant Offset Reclassify Edit

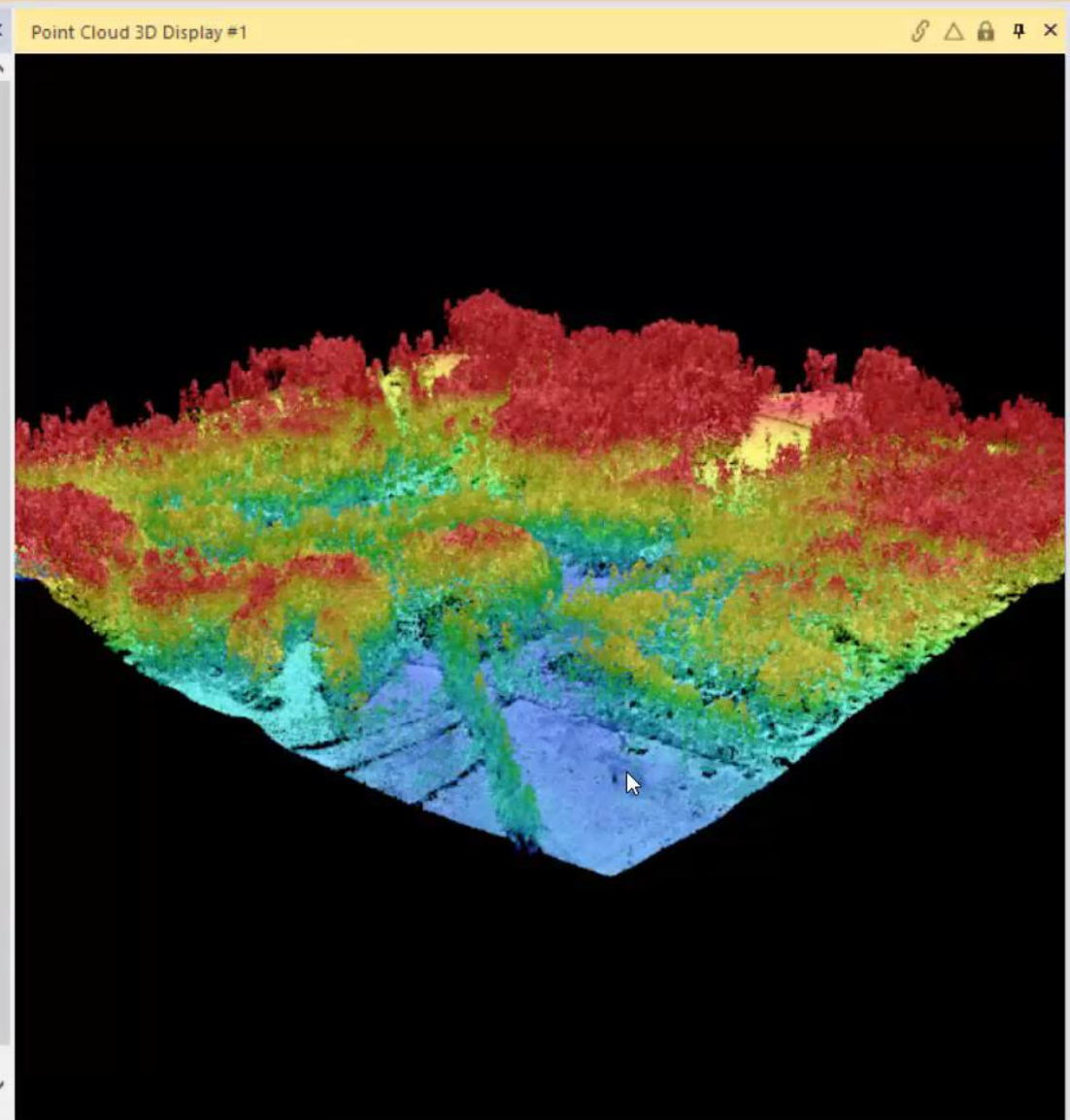
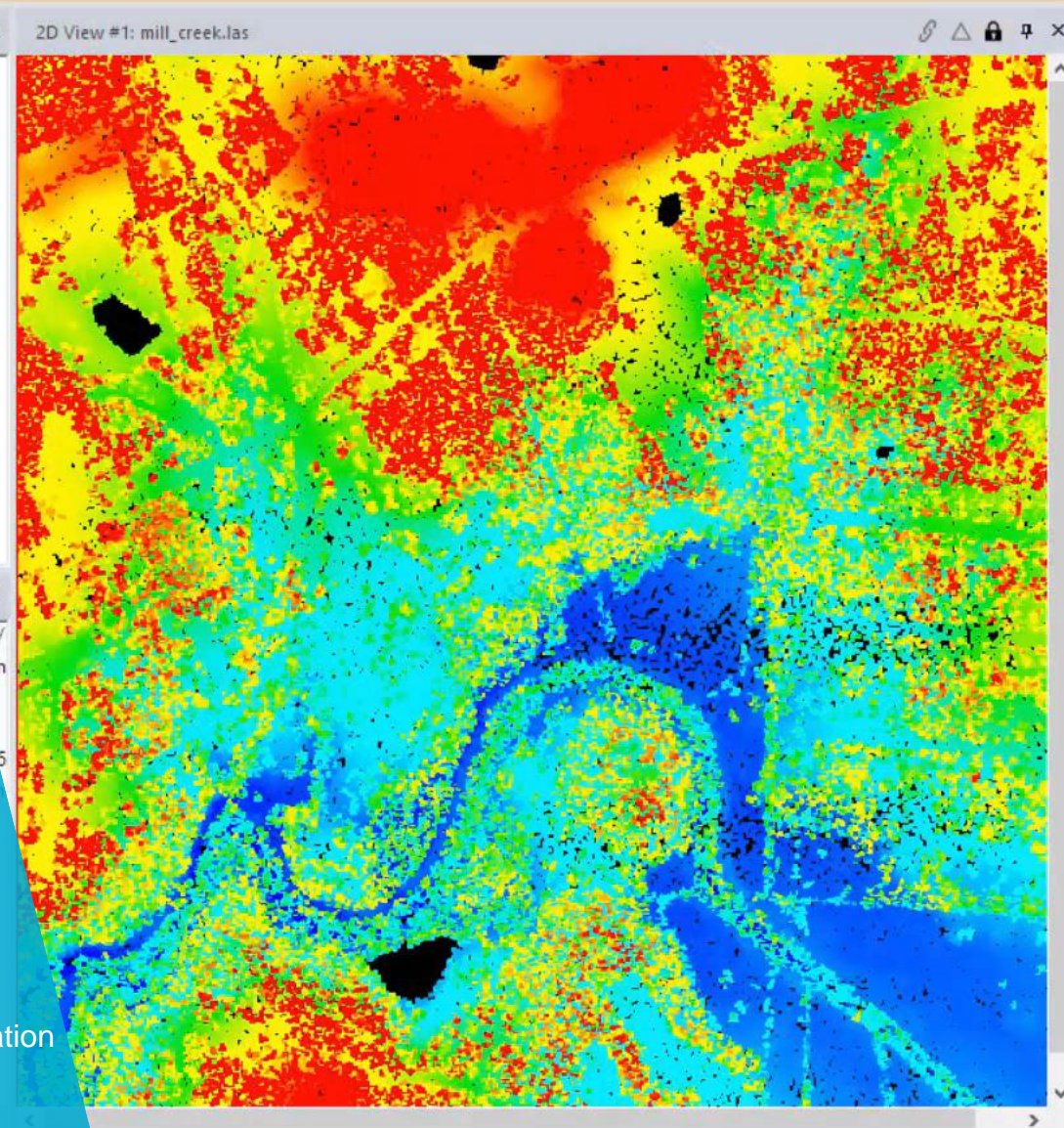
Style Overall Profile Measure Profile Profile Room Volumetric Analysis 3D View 3D Measure 3D Terrain Offset Tools

Contents

- 2D View #1
- mill\_creek.las
- Background

Retriever

- ShoeBox: cherokee\_county.ixp (c:/
- lc80190362014046lgn00-mil.im
- buildings\_wgs84.shp
- w085n34\_wgs84.img
- 10nov19165131-m2as\_r11c2-05
- cherokee\_cherokee\_streams.shp
- mill\_creek\_ortho.tif



**LiDAR**  
Processing and visualization





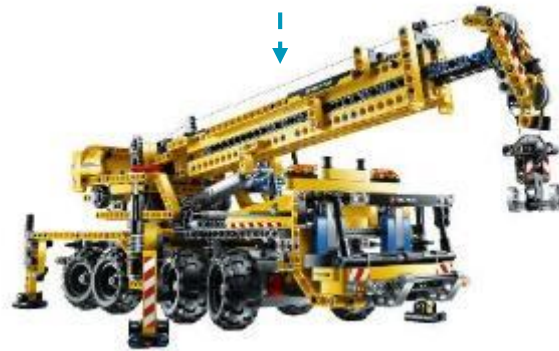
# Spatial Modeler overview



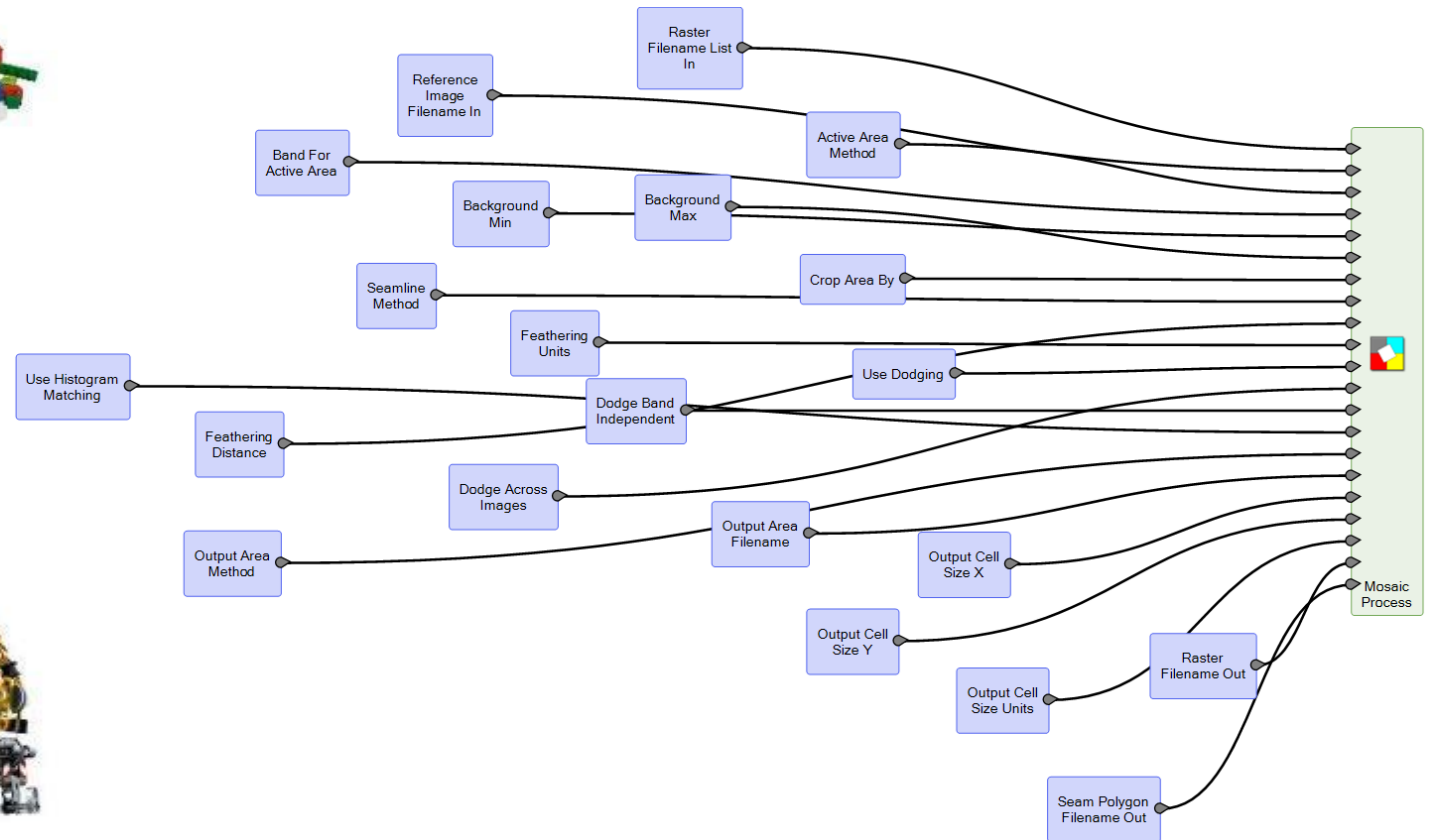
Box of tools



Beginner level



Professional applications





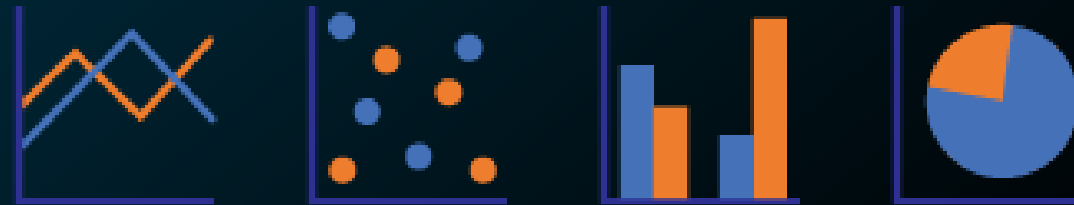
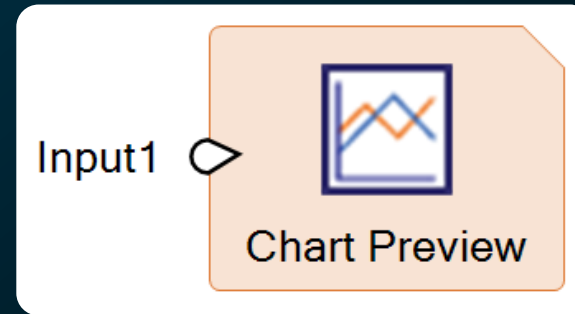
**HEXAGON**

**What's new in ERDAS  
IMAGINE 2023**

# Chart Preview operator

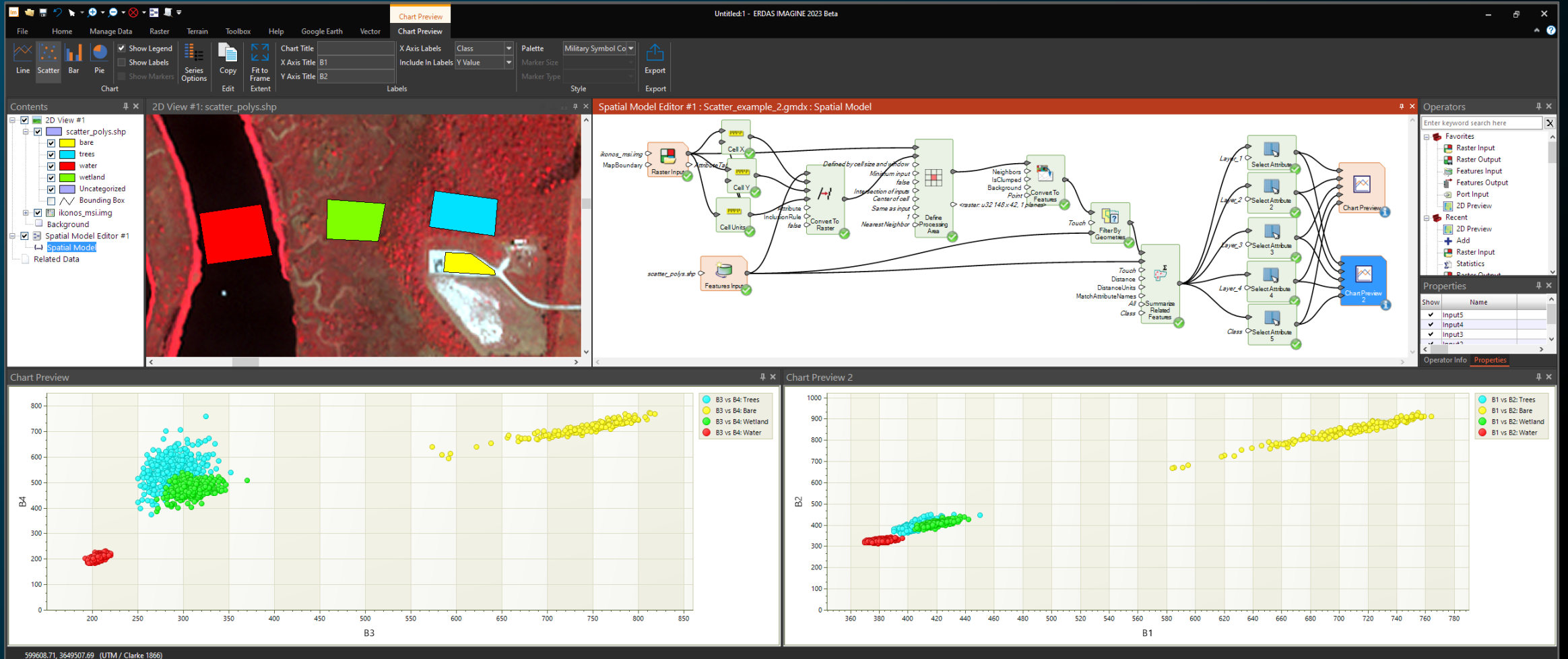
View tabular data on the fly in a charting application

- Previews are Spatial Model Editor tools for interactively exploring and analyzing derived data
- Chart Preview inputs
  - Numeric Tables
  - String Tables (as labels)
- Charting types
  - Line
  - Scatter graph
  - Bar
  - Pie

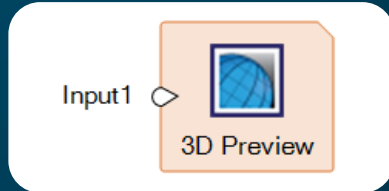




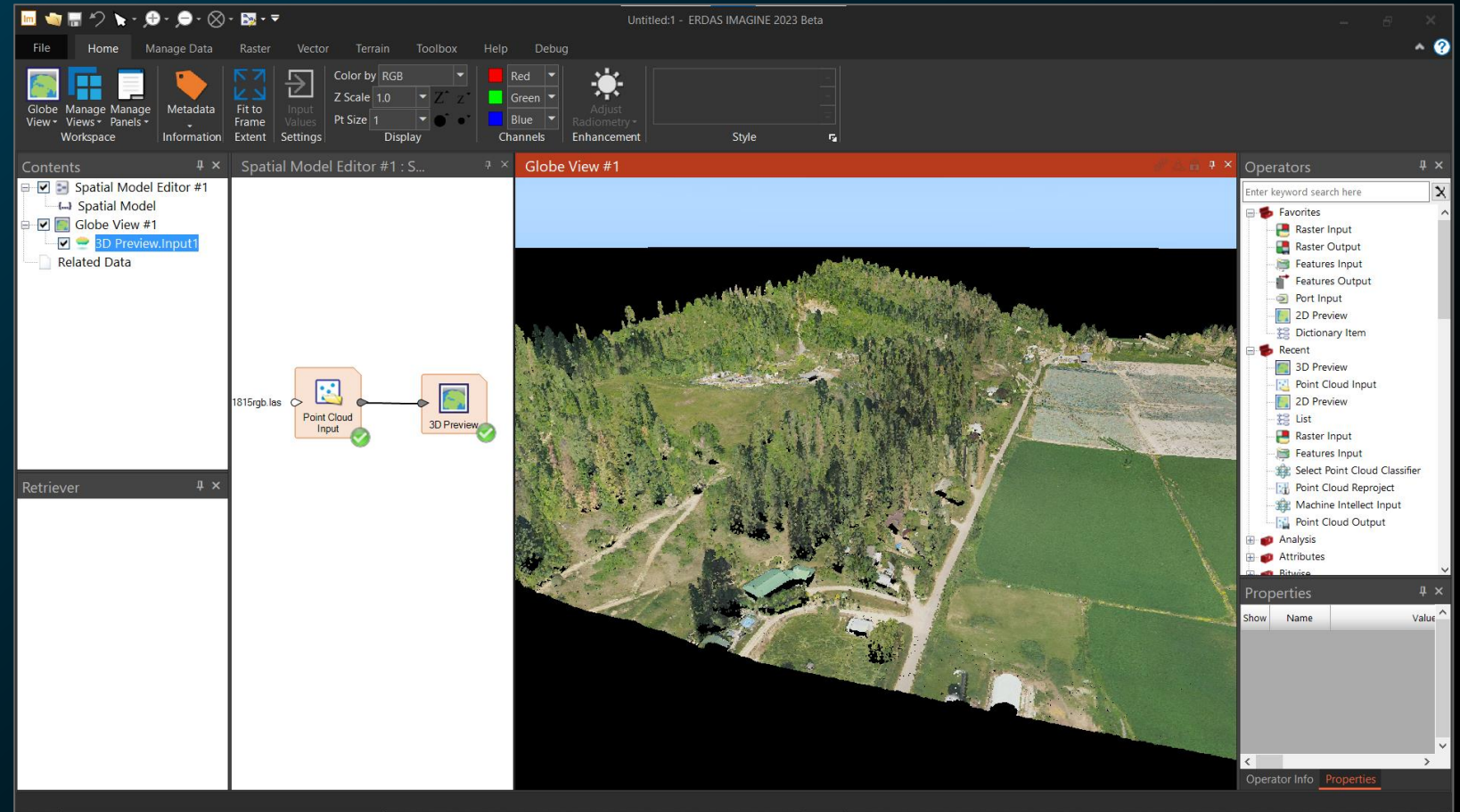
# Scatter plot example: Training area cluster separability



# 3D Preview

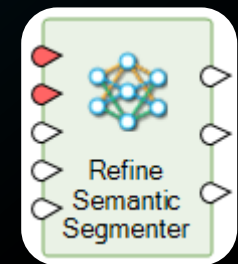
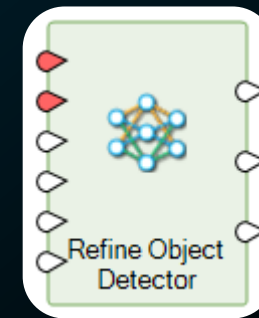
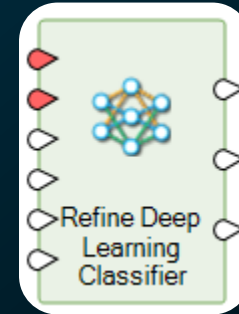


- View point cloud data in the new Globe View with the same styling capabilities as the 2D Preview
- This new Globe View will expand in future updates to include raster, terrains, base maps and more
- Based on HxDR / Luciad technology



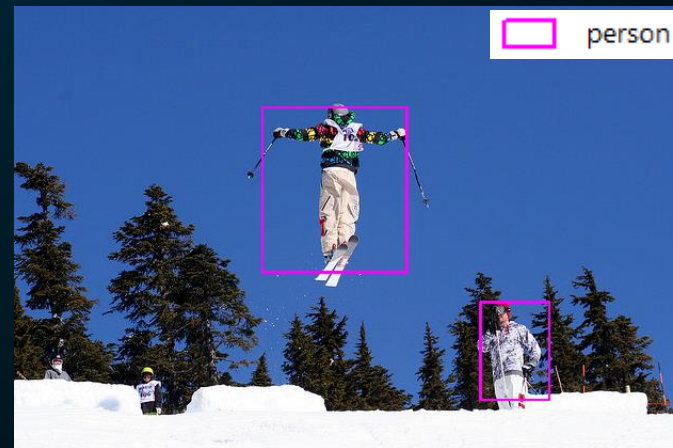
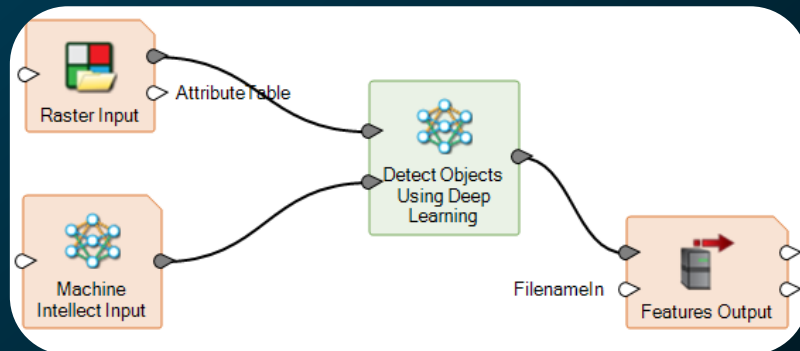
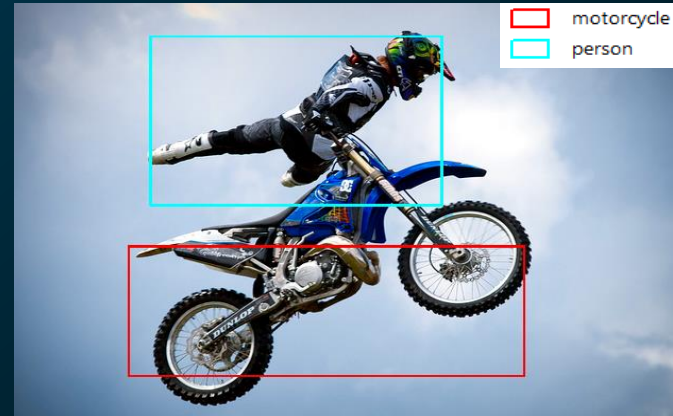
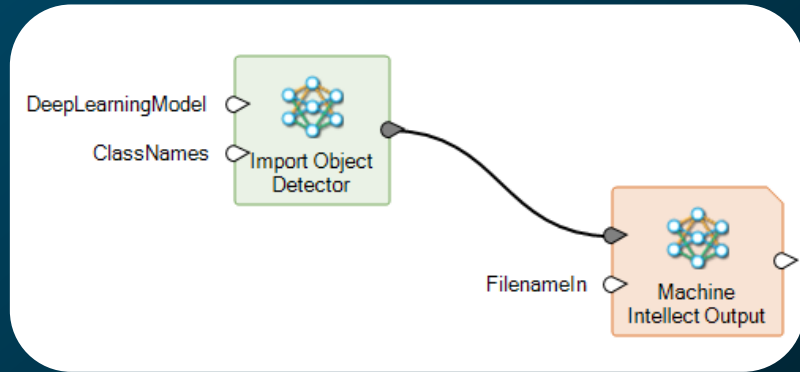
# Refine Deep Learning Machine Intellects

- Three Classes of Machine Intellects
  - Classifiers
  - Object Detectors
  - Semantic Segmenters
- We have now added the ability to refine these machine intellects with new data
- Refinement is an incremental training where an existing machine intellect is improved with new dataset
- The classes in the new training data have to match the classes in the Machine intellect

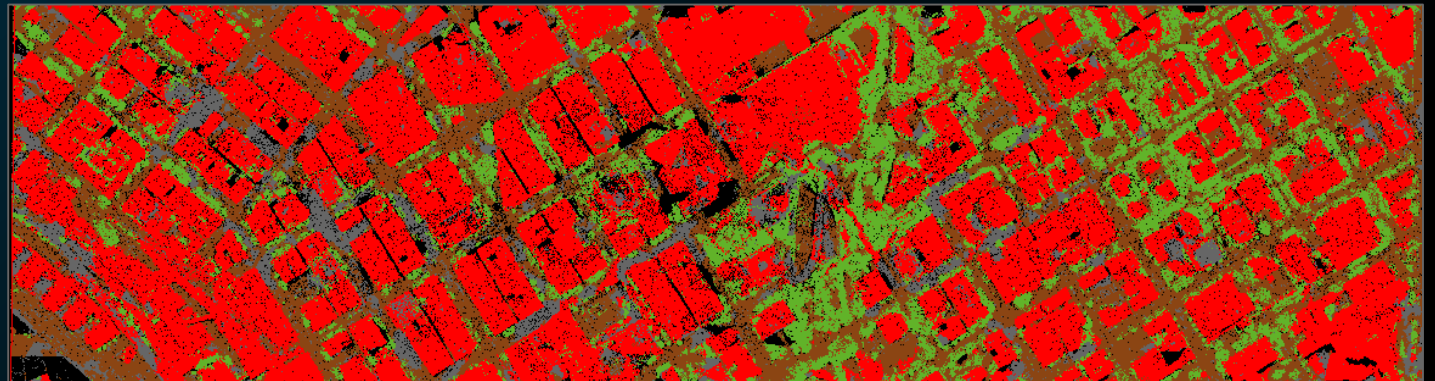
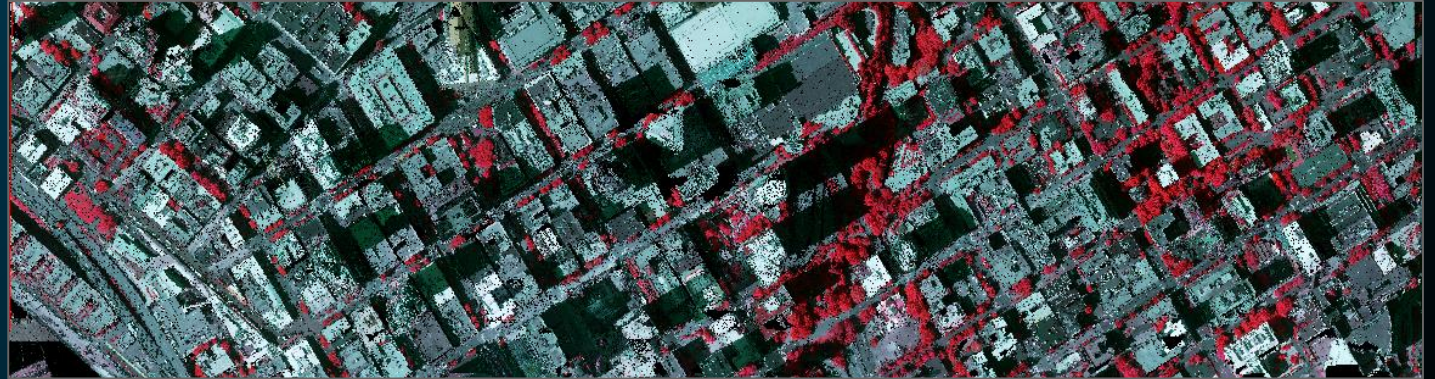
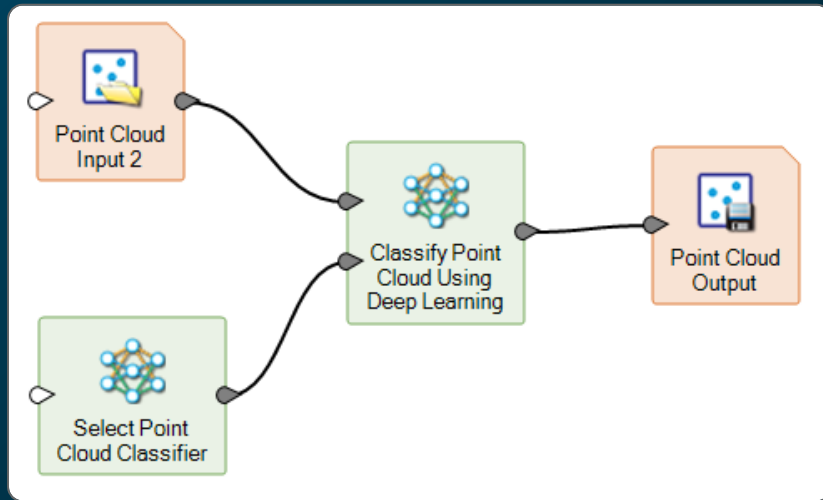




# Import Deep Learning Models



# Deep learning-based point cloud classifiers

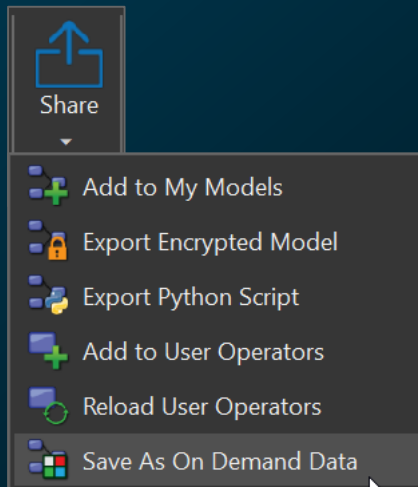




# New and improved formats

## New

- Hexagon Smart Point Cloud (HSPC)
  - “Native” point cloud format
- Meta Raster Format (MRF) and Limited Error Raster Compression (LERC) format read
- Sentinel-3 SLSTR Level 2 WST read
- On-demand data from Spatial Models (ODX)



## Improved

- Adobe Deflate compression for TIFF
- IMAGINE Image File format (IMG)
  - NoData Masks persist in IMG (no wasted DN values)
  - Compressible IMG > 2GB (disk-space savings)
  - Controllable via Preference (for compatibility)

## Original

PNEO_Isodata.ige	8/4/2022 6:49 PM	IGE File	2,567,170 KB
PNEO_Isodata.img	8/4/2022 6:50 PM	ERDAS IMAGINE ...	23 KB
PNEO_Isodata.rrd	8/4/2022 6:50 PM	RRD File	562,458 KB

## Improved




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PNEO_BigImage.rrd	2/15/2023 3:38 PM	RRD File	562,779 KB





# IMAGINE Image File format

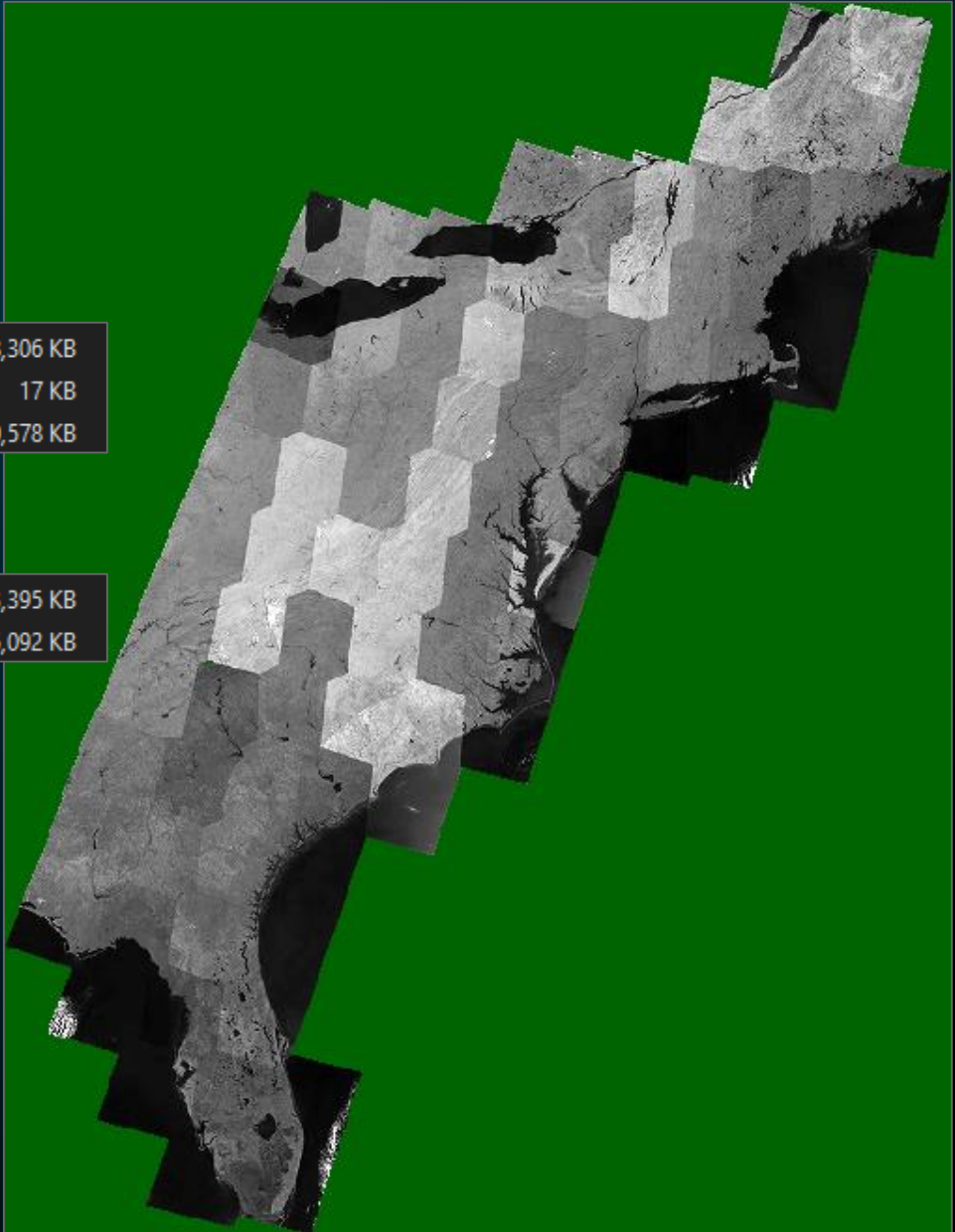
Numerically lossless compression

## Original

 east_coast.ige	2/10/2006 11:42 PM	IGE File	24,108,306 KB
 east_coast.img	6/14/2022 3:03 PM	ERDAS IMAGINE D...	17 KB
 east_coast.rrd	11/13/2019 3:47 PM	RRD File	2,020,578 KB

## Improved

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 east_coast_big_image.img.pyrx	3/10/2023 3:41 PM	PYRX File	145,092 KB



**Thank you!**