ArcGIS Pro: Introduction to Image Analyst extension

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What is the Image Analyst extension?

• The Image Analyst extension (IA) is an application extension which extends ArcGIS Pro with advanced imagery analysis tools, workflows, and user experiences.

• IA is for Image Analysts and Geospatial Analysts who focus on:
  • visual enhancement and exploitation of imagery
  • creation of derived products from imagery
  • taking measurements from imagery
  • capturing features from stereo imagery
  • advanced analysis and image processing
  • advanced analysis of multidimensional raster datasets
  • exploitation and analysis of motion imagery (FMV)
  • extracting information from imagery using deep learning models
  • editing of imagery and raster datasets
Image Analyst extension Product Information

• Availability
  • first release was ArcGIS Pro 2.1
  • available for
   • ArcGIS Pro Basic
   • ArcGIS Pro Standard
   • ArcGIS Pro Advanced

• Pricing
  • the same as the Spatial Analyst extension

• Licensed
  • Category B (addition to Enterprise Agreements)

• ArcGIS Image Server
  • All Image Analyst capabilities which are available on the server come with Image Server, there is no additional purchase required!
Image Analyst Capabilities

**Stereo Mapping**
Visualize imagery and capture 3D feature data in a stereo viewing environment.

**Image Classification**
Perform object-based and traditional image analysis using image segmentation and classification tools and capabilities.

**Perspective Imagery**
Work with oblique imagery oriented in a natural perspective mode to facilitate effective image interpretation applications.

**Motion Imagery**
Work with geospatially enabled video data together with your GIS data to assist in timely, well-informed decision support.

**Advanced Raster Functions**
Perform real-time raster analysis and image processing on an extensive suite of remote sensing data types, and save your results if desired.

*More functions in 2.4*

**Advanced Multidimensional Analysis**
Perform advanced raster modeling with multidimensional geospatial data using geoprocessing tools, Python, Notebooks, and the ArcPy API

**Pixel Editor**
Redact sensitive areas from images, clean up raster analysis results, and edit DEMs.

**Deep Learning**
Perform image feature recognition using deep learning techniques.

*Enhancements to training workflows in 2.4*

*New in 2.4*
Image Analyst Pixel Editor

Redaction
- Redact (black out)
- Pixelate
- Blur
- Set NoData

Analysis Cleanup
- Expand
- Shrink
- Reclass
- Majority Filter
- Set NoData

DEM Editing
- Set Average
- Set Constant
- Add To
- Pixelate
- Blur
- Set NoData
- Fill Voids
- Interpolate from Vertices
- Average Filter
- Median Filter
- Constrained Filter
- Outlier Filter
- Terrain Filter

New in 2.4
Pixel Editor Demonstration
Image Analyst Advanced Multidimensional Analysis

- Geoprocessing Tools
  - Aggregate Multidimensional Raster
  - Generate Multidimensional Anomaly

- ArcPy
  - arcpy.Raster is now multidimensional
  - Map Algebra on multidimensional rasters

- ArcPy Image Analyst Module
  - arcpy.ia.Aggregate
  - arcpy.ia.Anomaly
  - arcpy.ia.Apply
  - arcpy.ia.Foreach
  - arcpy.ia.Subset

New in 2.4
arcpy.ia multidimensional API Demonstration
Stereo Mapping

Workflow

- ArcGIS can already prepare imagery for stereo capture
  - ArcGIS Pro Ortho Mapping, Drone2Map
- ArcGIS can already manage stereo collections of imagery
  - Mosaic Dataset / Image Services
- ArcGIS Pro 2.1+ and ArcGIS Image Analyst adds stereo display and capture
Image Space and Mensuration

Extracting information from imagery in non-map space

Capabilities:

• Measure distance, area, centroid – with georeferenced imagery
• Measure height – requires sensor model
• Measure height from shadow – requires sun angle
• 3D measurement support – with user configurable DEM
• Make measurements in both map and image space
• Style and annotate measurements
• Track, store, and manage measurements
• Report generation for decision makers

View and analyze imagery in its native space, free of distortions
Demo
Image Space & Mensuration
Presenter(s)
Full Motion Video (FMV)

- work with multiple archived & live stream videos
- intuitive "standard DVR" user experience
- video player and map synchronization
- spatial + temporal bookmarking
- capture features in video player
- export video clips
- pause and export current frame to georeferenced image
- MISB metadata viewer
- video multiplexer geoprocessing tool
  transforms non-MISB sources to MISB source for use in ArcGIS Pro
Demo – Motion Imagery
Presenter(s)
Raster Functions for Image Processing

ArcGIS Pro
~50 Raster Functions

- Multiband Math
  - Arithmetic
  - Band Arithmetic

- Analysis: Band Math & Indices
  - NDVI / NDVI Colorized
  - SAVI / MSAVI / TSAVI
  - GEMI
  - GVI (Landsat TM)
  - PVI
  - Tasseled Cap (Kauth-Thomas)
  - Binary Thresholding
  - Heat Index
  - Wind Chill

- Statistics
  - ArgStatistics

- Visualization & Appearance
  - Contrast and Brightness
  - Convolution
  - Pansharpening
  - Resample
  - Statistics and Histogram
  - Stretch

- Correction
  - Apparent Reflectance
  - Geometric Correction
  - Speckle Filtering (Lee, Frost, Kuan)
  - Thermal noise
  - Radiometric Calibration

- Interpolation
  - Interpolate Irregular Data
  - Nearest Neighbor
  - IDW
  - EBK
  - Swath

- Data Management & Conversion
  - Raster to Vector
  - Vector to Raster
  - Colormap
  - Colormap to RGB
  - Complex
  - Grayscale
  - Remap / Reclass
  - Spectral Conversion
  - Unit Conversion
  - Vector Field
  - LAS to Raster
  - LAS Dataset to Raster
  - Clip
  - Composite
  - Extract Bands
  - Mask
  - Mosaic Rasters
  - Rasterize Features
  - Reproject
  - Region Group *
  - Lookup *

- Surface Generation & Analysis
  - Aspect
  - Curvature
  - Elevation Void Fill
  - Hillshade
  - Shaded Relief
  - Slope
  - Contour

- Python
  - Custom Algorithms

Image Analyst
~60 additional Raster Functions

Analysis: Image Segmentation & Classification
- Segmentation (Mean Shift)
- Training (ISO, SVM, ML, Random trees)
- Supervised Classification

Analysis: Overlay
- Weighted Sum

Statistics:
- Zonal Statistics
- Cell Statistics
- Focal Statistics

Math
- Round Down
- Round Up
- TanH
- Greater Than
- Con
- Equal

Calculator
- Square
- Square Root
- Set Null
- Is Null

Abs
- Bitwise
- Less Than

Divide
- And
- Less Than

Exp
- Shift
- Not

Exp10
- Not Equal

Exp2
- ACos
- Or

Float
- ACosH
- Right Shift

Int
- Xor
- Boolean

Ln, Log10
- ATan
- And

Log2
- ATanH
- Not

Minus
- Cos
- Or

Mod
- SinH
- Xor

Negate
- Equal To

Plus
- Sin
- Greater Than

Power
- Tan

Spatial Analyst
~15 additional Raster Functions

Analysis: Distance & Density
- Euclidean Distance
- Cost Distance
- Least Cost Path
- Kernel Density
- Path Allocation
- Path Distance
- Corridor
- Path Distance Backlink
- Euclidean Back Direction *

Analysis: Hydrology
- Fill
- Flow Accumulation
- Flow Direction
- Flow Distance
- Flow Length *
- Stream Link
- Watershed
- Snap Pour Point *
- Stream Order *

Analysis: Overlay
- Weighted Overlay

Surface Generation & Analysis
- Viewshed

Data Management
- Nibble

* Released in Pro 2.4
Deep Learning with Imagery in ArcGIS

Arcgis supports end-to-end deep learning workflows

- **Tools for:**
  - Labeling training samples
  - Preparing data to train models
  - Training Models
  - Running Inferencing

- **Supports all 4 imagery deep learning categories**

- **Clients**
  - ArcGIS Pro
  - Map Viewer
  - Notebook Server

*Part of ArcGIS Image Analyst, Runs distributed on ArcGIS Image Server*
4 categories of Deep Learning to Imagery in ArcGIS

- **Pixel Classification**
  - Eg: Impervious Surface Classification

- **Object Detection**
  - Eg: Palm Tree Detection

- **Instance Segmentation**
  - Eg: Building Footprint Extraction

- **Image Classification**
  - Eg: Damaged House Classification
ArcGIS – Deep Learning Workflow
End-to-end deep learning workflow

Tools to generate training samples
- Image Analyst in ArcGIS Pro
- Image Server on ArcGIS Enterprise

Model Training
- using ArcGIS Notebooks

Inferencing
- Image Analyst in ArcGIS Pro
- Image Server on ArcGIS Enterprise
ArcGIS – Deep Learning Workflow

Using deep learning models

Inferencing
- ArcGIS Image Analyst
- ArcGIS Image Server
Deep Learning Clients in ArcGIS

ArcGIS Pro
Maps Viewer
Notebook

Wide range of experiences using deep learning
Demo – Hurricane Michael Damage Assessment
-Instance segmentation
-Image classification
Presenter(s)
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Understand why quality plays a key role in every organization that uses GIS data. Learn how to use ArcGIS Data Reviewer to improve data quality and reduce costs associated with poor quality. This session will focus on using ArcGIS Data Reviewer for quality assurance.