Image Analysis, Interpretation, and Geoprocessing in ArcGIS

Cody Benkelman
Steve Kopp
OUTLINE

- Introduction
- Content on ArcGIS.com
- Image Management & Dissemination
  - Mosaic Dataset
- Image Interpretation & Analysis
- Examples
Geospatial Information, Integrated & Accessible

- Geospatial workflows
- Actionable information & knowledge

Imagery is Core to GIS
Users of Imagery

Image Managers

- Manage
- Disseminate

Image Users

- Analyze
- Visualize
ArcGIS – Maximizing the Value of Imagery

• Providing Image Accessibility:
  - Timely
  - Quickly
  - Accurately
  - Collectively
  - Simply

• Exploiting Rich Information Content:
  - Resolution
  - Temporal change
  - Spectral range
  - Dynamic range
Elements of a Complete GIS

• Content
  - Base data provided by ESRI

• Management
  - Storing, Organizing and Structuring

• Dissemination
  - Accessibility to data, information and knowledge

• Visualization
  - Interpretability and human understanding

• Analysis
  - Gain knowledge to make informed decisions
Content

ArcGIS Online (www.ArcGIS.com)
World Imagery Updates at 10

- Worldwide Imagery at 15m Resolution
- United States Imagery 1m or better
  - Updates to over 50% of United States
  - New Sub-meter Imagery in Metro Areas
    - Formerly available by subscription only
- International
  - GeoEye IKONOS Imagery for Major Metro Areas
  - Expanded Imagery for other Countries
    - Great Britain, Belgium, France,
      Germany, Czech Republic,
      Luxembourg, Netherlands, Portugal
- Community Map Program
- World Elevation coming…
World Landsat Imagery

To be added to ArcGIS.com

- NaturalVue (from MDA)
  Color Balanced, Orthorectified,
  Cloud-free worldwide mosaic

- Global Landsat GLS
  Image Services
    - 8band, Color 321, False Color 432, PseudoColor 742, NDVI
Managing & Disseminating Image Data
Mosaic Dataset

Optimum Model for Image Data Management

- Author with ArcGIS Desktop (Editor/Info)
- Quickly Catalog
  - All raster datasets
  - Imagery from different sensors
- Define – In Geodatabase
  - Metadata
  - Processing to be applied
  - Default viewing rules
- Access – Any ArcGIS application or as service
  - As Image
    - Dynamic Mosaic, Processed on the fly
  - As Catalog
    - Footprints, Detailed metadata
On-the-fly Processing & Dynamic Mosaicking

Resolves Traditional Image Management and Processing Issues

- **Processing Time**: Reduces processing
- **Overlapping Imagery**: Maintain information
- **Disparate Datasets**: Large NoData areas
- **Image Quality**: Reduces resampling

- **Storage**: Reduces storage by removing redundancy
- **Multi-resolution Data**: No need to sample up or down
- **Maintenance**: Add imagery as required
- **Maintain Metadata**: Retain valuable information
Image Accessibility

*Providing Image Accessibility*

- Direct Access
  - Raster
  - Mosaic Dataset
Image Accessibility

Providing Image Accessibility

- Direct Access
  - Raster
  - Mosaic Dataset

- Static Web Services
  - Map Cache
Image Accessibility

Providing Image Accessibility

- Direct Access
  - Raster
  - Mosaic Dataset

- Static Web Services
  - Map Cache

- Dynamic Image Services
  - Server based processing
  - Image Services, WMS, WCS, KML
  - SOAP, REST interfaces

ArcGIS provides image accessibility
Image Interpretation, Analysis, and Geoprocessing
Primary modes of usage

Mode 1: Visualization

Mode 2: Authored analysis (Repetitive Application)

Mode 3: Unique and/or site-specific analysis
Optimizing services according to usage mode

- Rasters
- Author (ArcGIS 10)
- Mosaic Dataset
- ArcGIS Users
Optimizing services according to usage mode
Optimizing services according to usage mode

Mode 1: View, Select, and Download

Mode 3: View
Optimizing services according to usage mode

Rasters → Mosaic Dataset → Image Service

GeoProcessing Service: Viewshed, Profile, Classification…

Mode 1: View
Mode 2: View & Export
Mode 3: View, Select, and Download
Optimizing services according to usage mode

- Mosaic Dataset
- View & Export Image Service
  - Viewshed, Profile, Classification…
  - GeoProcessing
    - View & Export
    - View, Select, and Download

- Mode 1
- Mode 2
- Mode 3

- Rasters
- New Rasters
- Author
- LAS files
- Terrain
Visualization

*Interpretability of Imagery*
Image Enhancement

Exploiting the Full Value of Imagery

- Through the Image Analysis Window
  - Ortho
  - PanSharp
  - Composite
  - Mosaic
  - …
- Applied On-The-Fly
- Stored in Layer
Image Enhancement

Exploiting the Full Value of Imagery

- Image Analysis Window buttons
- Active as a function of available data
ArcGIS Desktop - Image Analysis Window

**Better Interpretation & Understanding of Imagery**

- Single Button Access to
  - Image Enhancements
  - Image Interpretation
  - Image Processing
- Save functions in Layers
ArcGIS Desktop – Accelerated Display

Seamless Pan and Zoom

- Electronic Light Table like display performance
- Integrated geospatial imagery and vectors
- Utilizes Hardware Acceleration
- Dynamic
  - Change: Contrast, Brightness, Gamma, DRA
Visualization Demo
Analysis

Exploiting the full value of imagery
Search & Discovery

Finding the Required Imagery

• Simplified through Image Services
  - Best by default
  - User Query
  - User defined mosaic method

• Catalog Access
  - Footprints
  - Metadata

• Selections

• WebBased Query tools
Spatial Analysis

- Raster based spatial modeling and analysis
- Analyze spatial relationships
- Build spatial models
- Perform complex raster operations
  - Hydrology
  - Principle Component Analysis
  - Raster Algebra
- Supervised / Unsupervised Classification
- Post-classification cleanup and generalization tools
Image Classification Toolbar

New in Spatial Analyst 10

- Training Sample Manager
  - Supervised & Unsupervised
  - Class Probability
  - Principle Component Analysis
- Define training areas graphically
- Interactively classify and refine
Multispectral Image Analysis

- Satellite and Airborne sensors detect narrow bands of reflected and emitted electromagnetic radiation
  - Visible (Red, Green, Blue)
  - Infrared (Reflected near IR and Thermal IR)
Spectral Reflectance is the key

- Objects reflect this energy in different amounts in different parts of the spectrum
Making Landcover Data from Imagery
Geoprocessing Tools

*Unified access to all data processing and analysis tasks*

- Full range of GIS analysis tools
- Accessible through
  - Dialogs
  - Command line
  - Graphical model building
  - Scripting
- Run on Desktop and Server
- Customizable
- Sharable
Demo: World Elevation Service
Summary
ArcGIS – A Platform for Complete Imagery Solutions

Information Centric Workflows Enable Efficiency & Interoperability

- ESRI works closely with its partners
- ArcGIS provides THE platform
- Partners provide domain expertise

GeoEye
RapidEye
SPOT
Microsoft (Vexcel)
Trimble (Applanix)
DigitalGlobe
Pictometry

ITT VIS
Definiens
Clark Labs
Overwatch
BAE Systems

- Automated Feature Extraction
- Multispectral Analysis
- Hyperspectral Analysis
- Radar
- Specialized Sensor Support
- Stereo Display
- More…

PCI Geomatics
Trimble (Inpho)
LizardTech
i-cubed
MDA

DAT/EM
PurVIEW
TerraGo
Qcoherent

Service partners not listed
ArcGIS with Imagery

- Imagery is Core to GIS

- ArcGIS Enables the:
  Management, Dissemination, Visualization and Analysis of all forms of imagery

- Maximizing the Value of Imagery
- Mosaic Datasets are the optimum model of managing and serving imagery and rasters
- Platform for complete Imagery Solutions