Producing Ortho Imagery In ArcGIS

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Agenda

• Ortho imagery in GIS
• ArcGIS ortho mapping solution
• Workflows
  - Satellite imagery
  - Digital aerial imagery
  - Scanned imagery
  - Drone imagery
• Q/A
Ortho Imagery in GIS
What is ortho imagery?

• Varieties of remote sensing data
  - Geometric distortions

• Ortho imagery
  - Geometric distortions have been corrected

• Ortho Mapping
  - Process and technology that products ortho imagery
Ortho Imagery in GIS
Previous workflow with remote sensing imagery in GIS

• Users to purchase ortho imagery
• Users to purchase imagery software to process
Ortho Imagery in GIS
ArcGIS integrates photogrammetry into GIS system

• Reduce project cost and production cycle
• Easy to use for GIS users
ArcGIS Ortho Mapping
Capabilities

• Generate ortho products
  - Orthomosaics
  - DEM (DTM/DSM)

• Support many types of data
  - Satellite images
  - Aerial images
  - Scanned images
  - Drone images

• Advanced License
ArcGIS Pro Ortho Mapping – 3 Steps

1. Create ortho mapping workspace
2. Perform block adjustment
3. Generate ortho mapping products
1: Ortho Mapping Workspaces
A sub Pro project that manage input, output, and intermediate files for an ortho mapping session

- Manages images using mosaic dataset
- Keeps track of the processing phases
- Support operations
  - Create, add, import, copy, delete
- Create from New Workspace wizard
  - Satellite, digital aerial, scanned, drone
- Consistent workflow of adjustment and product generation
2: Adjustment
Image matching and triangulation

• Compute control points
  - Tie points
  - Ground Control Points (GCPs)
  - Check points

• Compute adjustment
  - Triangulation algorithm for frame camera model
  - Triangulation algorithm for RPC model
  - Apply transformation to each image
2: Adjustment
Editing GCPs using GCP Manager

- Import GCPs
  - Txt, csv, table
  - Import GCP photos
- Manually add GCPs from Map
- Entering one tie point
  - Auto-generate the rest
3. Generate Elevation Product using DEM Wizard
Includes generating point cloud and interpolate DEM from it.

- Three methods for point cloud generation
  - Extended Terrain Matching (ETM)
  - Semiglobal Matching (SGM)
  - Enhanced Semiglobal Matching (ESGM)

- Output elevation data
  - Digital Surface Model (DSM)
  - Digital Terrain Model (DTM)

- Use for orthorectification
3. Generate Orthomosaic Product Using Mosaic Wizard

Seamline

- Automatically generated seamlines
  - Voronoi method
  - Disparity method
  - Radiometry method
- Manually edit using Topology editing
- Seamline feather with user defined width
3. Generate Orthomosaic Product Using Mosaic Wizard

Color Balancing

- Dodging or histogram methods
  - Color grid
  - 2nd order polynomial
- Calculate color surface from images
- User provide a target surface
3. Generate Orthomosaic Product Using Mosaic Wizard
Generate Orthomosaics and other products

- Orthomosaics
- Orthorectified mosaic dataset
- Tile cache
  - Using Tile Cache tools
- Ortho image scenes
  - Use Export Mosaic Items tool
- Ortho image tiles
  - Use Split Raster tool
Workflow: Satellite Imagery

- Support many satellite data (39)
  - RPC model
- DEM is required for creating workspace
  - Local DEM dataset is recommended
- Support processing templates
  - Pan, MS, Pansharpen
Workflow: Satellite Imagery
Example: ZY3 Songshan
FWD, NAD, and BWD scenes
Generated DTM (10m)
Workflow: Satellite Imagery
Example: ZY3 Songshan

NAD and MS scenes

Pan-sharpen orthomosaics
Workflow: Digital Aerial Imagery
Camera table and frame table

- A camera table from internal orientation info
  - Focal length, pixel size, principle point
  - Image-to-film transform
- A frame table using external orientation info
  - Image perspective center
  - Omega, phi, Kappa, camera distortion parameters
- Create workspace from
  - The two tables
  - DEM data
Workspace: Digital Aerial
Example: 16 aerial images, Z/I imaging DMC II 230

- Generated orthomosaic
  - Generated DTM for orthorectification
  - Computed seamlines using disparity method
- Generated DSM for hillshade analysis
Demo

Creating Orthomosaics from satellite images

Creating DSM from aerial images
Workflow: Scanned Aerial Images

Camera and frame table

• A camera table from internal orientation info
  - Focal length, pixel size, principle point
  - Image-to-film transform

• A frame table using external orientation info
  - Image perspective center
  - Omega, phi, Kappa, camera distortion parameters

• Historical data workflow tools
  - Image footprint
  - Index map
  - Scan

• Create workspace from the 2 tables
Workflow: Scanned Aerial Images
Example: 44 photos of year 1965

- 13 GCPs manually added (NAIP as reference)
Workflow: Drones

- Images with internal GPS (EXIF)
- Images with external GPS table
- Support a library of cameras
  - User defined camera parameters
- Elevation (dataset or a constant)
Workflow: Drones
Example 1: Measuring volume for an engineering site

- Data
  - 225 images, GSD=0.016

- Processing
  - Projection error= 0.55 (pixel)
  - GCP = 0.39m z=0.14m

- Generate Orthomosaic

- Generate DSM
  - ESGM method

- Measuring volume
  - Surface Volume Geoprocessing tool
Workflow: Drones
Example 2: Mapping Crop Condition

- Data
- Adjust
- Generate orthomosaic
- Create water content map
  - with raster function (VARI)