ISAE-EXTENDED AND GEOMEDIA 3D
TUTORIAL

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ISAE-EXTENDED AND GEOMEDIA 3D ANALYSIS

TUTORIAL INTRODUCTION

Digital terrain models (DTMs) and digital surface models (DSMs) are a critical component of modern geospatial data processing. ImageStation Automatic Elevations-Extended (ISAE-Ext) combines the classic feature-based approach of ImageStation Automatic Elevations (ISAE) with the modern pixel-level image correlation of Semi-Global Matching (SGM) to produce DSMs in a distributed production environment. ISAE-Ext implements the SGM pixel-level correlation strategy to produce DSMs in the form of point clouds and raster files from digital stereo aerial frame source images.

TOPICS

This tutorial presents a workflow depicting the extraction of a dense point cloud surface using the Semi-Global Matching (SGM) capabilities of ISAE-Ext. After the processing is complete, we’ll show how you can ingest the surfaces into GeoMedia 3D for analysis and fly-throughs.

Topics covered in this tutorial include:

- Creating dense point cloud surfaces in LAS format with ISAE-Ext
- Opening a GeoMedia workspace
- Constructing and inserting HPC format data into GeoMedia 3D
- Navigating in the 3D map window
- Creating a fly-through with GeoMedia 3D

TUTORIAL TEXT CONVENTIONS

There are several conventions used throughout the tutorial:

- Ribbon bar items are shown as: On the **Aaa** tab, in the **Bbb** panel, click **Ccc > Ddd**.
- Dialog box names, field names, and button names are depicted using **bolded text**.
- Information to be entered, either by selecting from a list or by typing, is depicted using **italicized text**.
TUTORIAL DATA SET

The tutorial data set consists of a small portion of an ImageStation aerial photogrammetric project that was aero-triangulated using ImageStation Automatic Triangulation (ISAT), an ortho mosaic covering the same project area created with ImageStation OrthoPro (ISOP), a 50 meter mesh surface in geotiff format, and a set of full resolution LAS format files created with ISAE-Ext. Unzip the tutorial dataset to C:\Training\ImageStation. (The resulting full path to the data set should be C:\Training\ImageStation\ISAE-X and GM3D.)

TUTORIAL PREREQUISITES

You should have the following products installed:

- GeoMedia Essentials, Advantage, or Professional
- GeoMedia 3D
- ImageStation Automatic Elevations (with an ISAE-Ext license)

SURFACE GENERATION

In this section we will use ISAE-Ext to create a set of LAS format dense point cloud surface files from stereo models using the Semi-Global Matching (SGM) capabilities of ISAE-Ext.

RUNNING ISAE-EXT

1. Start ImageStation Automatic Elevations Extended from the Windows Start menu.
2. Use the Project: browser to select C:\Training\ImageStation\ISAE-X and GM3D\project and click Open.
3. Check Blockwise Matching.
4. Check Inflate Overlap and set it to 5%.
5. Digitize a polygon in the footprint viewer over the desired model boundaries by clicking 4 points over the left strip of images and right-clicking to close the polygon as shown below. The left strip of images will highlight and fill in the Select Models list. We are selecting a subset of the images for speed purposes.
in the training class. If you are running this tutorial outside the class, you can select all the models.
6. Click the **Job Processing** tab.

7. For speed purposes in the training class, set **Largest OV to Use:** to 1/8.
   
   Note that for normal (non-classroom) use you would typically leave **Largest OV to Use** set to **Full Res** to get the most out of your data set.

8. Check the **Full Resolution:** option.
9. Check the **Generate Raster**: option.
10. Round the **Resolution**: to 2.0 meters.
11. Leave the **Output Folder**: set to `C:\Training\ImageStation\ISAE-X and GM3D\SGMOUT`.
12. Uncheck the **Add Coordinate System to Output LAS Files** option.
13. Click `<< Add Jobs` to add the job to the **Job List**.
14. Click **OK** to begin the processing and dismiss the ISAE-Ext main dialog. Progress will be reported to a command window which you can close when the processes are complete.
3D ANALYSIS

In this section we will show how point cloud data from ISAE-Ext can be exploited in GeoMedia 3D. First we will convert the LAS format files created by ISAE-Ext to Hexagon Point Cloud (HPC) format. GeoMedia 3D uses HPC format for point clouds for efficiency. Next we will run GeoMedia 3D, load the point cloud data, navigate in the 3D map window, and fly through a path in the dataset.

OPENING THE GEOMEDIA 3D WORKSPACE

1. Open Windows Explorer and double-click on C:\Training\ImageStation\ISAE-X and GM3D\Japan_3D.gws to open the GeoWorkspace in GeoMedia.
2. On the 3D tab, in the View panel, click Toggle 3D to convert MapWindow1 to a GeoMedia 3D window and enable the 3D controls.

ADDING POINT CLOUD DATA

1. On the 3D tab, in the HPC Point Clouds panel, click Construct.
2. On the Construct Hexagon Point Cloud dialog box that appears, click Add…
3. On the file browser that appears, set the file type pull-down list to right of File name field to LiDAR LAS Files (*.las).
4. Browse to C:\Training\ImageStation\ISAE-X and GM3D\SGMOUT, sort the files by name, select the 7 RGB_C*.las files, and click Open.

Note: For every stereo model processed by ISAE-Ext there will be two LAS files generated for each point cloud encoding option used. One that is based on the fullest resolution of the processing options used, and the other that has been thinned for quick viewing capability. The thinned version will have "Thinned" embedded in the output file name(s).

5. On the Construct Hexagon Point Cloud dialog box, click the Define button next to the Source field in the Coordinate systems group box.
6. On the Define dialog box that appears, click Load, select C:\Training\ImageStation\ISAE-X and GM3D\csf\project.csf, click Open, and click OK to return to the Construct Hexagon Point Cloud dialog box.
7. Leave Target set to Same as the input coordinate system.
8. In the Results group box, change the Voxel size to 0.5 m.
9. Use the File Name: Browse button to specify C:\Training\ImageStation\ISAE-X and GM3D\test.hpc for the output File name and click Save.
10. Click **OK** to cause GeoMedia 3D to copy and compress all the input LAS format files into a single HPC format file. This process will just take a few seconds on this reduced dataset used for the training class.

   Note: ImageStation DTMQue (ISDQ) can also be used to convert LAS format to HPC format.

11. When the process completes, click **Close** to dismiss the **Construct HPC Log Summary** dialog box, then click **Cancel** to dismiss the **Construct HPC Point Cloud** dialog box.

12. On the **3D** tab, in the **HPC Point Clouds** panel, click **Insert**.

13. On the **Insert Hexagon Point Cloud Footprints** dialog box that appears, click **Add**…

14. Select `C:\Training\ImageStation\ISAE-X and GM3D\Japan3D.hpc` and click **Open**.
Note: This full resolution file was created in advance from all the stereo models and converted to HPC format to save time in class.

15. Change the **Feature class:** from *Footprints* to *SGM_Data.*

16. Click **OK** to insert the data into the legend and display.

17. Click **Close** to dismiss the **Insert HPC Footprints Log Summary** dialog box.

**ADDING A SURFACE**

1. On the **3D** tab, in the **Surfaces** panel, click **Add.**
2. On the **Add Surfaces** dialog box that appears, use the **Browse** button to select the *C:\Training\ImageStation\ISAE-X and GM3D* folder then click **OK.**
3. Click the + sign next to the folder name in the **Available files** list view, click next to `50mmesh.tif` to activate the checkbox, then click the right-arrow > button to add it to the **Selected files** list.

4. Leave the **Optimize surfaces** option checked. This will provide more accurate rendering of the point cloud data in the 3D window.

5. Click **OK** to add the surface to the project and dismiss the dialog box.

6. Use your mouse to change the view dynamically:
   a. Mouse wheel forward to zoom in.
   b. Mouse wheel backward to zoom out.
   c. Press and hold mouse wheel, pull mouse to tilt view towards horizon, and push mouse to tilt view back to vertical.
   d. Press and hold mouse wheel and move mouse side to side to rotate view.
   e. When finished, return the view to vertical, north up, and use the GeoMedia **Fit All** command to reset the view.

   Note: You can also use the on-screen navigation control in the upper-right corner of the map window to zoom, pan, tilt, and rotate the 3D view.
FLY-THROUGHS

1. Click on the Route feature in the legend.
2. Select the feature by using the GeoMedia Select by Legend Entry command.
3. On the 3D tab, in the Flight Paths panel, click Fly to open the Fly Flight Path toolbar.
4. On the toolbar, click the Flight Path Options button.
5. On the **Flight Path Options** dialog box, set the **Height** to 100 m, the **Speed** to 40.0 mps, and the **Tilt** to -15 deg, then click **OK**.

6. On the control, click the **Save** button.

7. On the **Save Flight Path from Select Set** dialog box, enter a **Flight path name**, such as **Training Flight**, then click **OK**.

8. On the control, click the **Play from Waypoint 1** button to start the fly-through.

9. We hope you enjoy your flight!


**REVIEWING THE POINT CLOUD RASTER**

If you will recall, while running ISAE-Ext we checked the option to **Generate Raster**. This causes the program to create a raster rendition of the SGM point cloud data that is
in essence a form of “true ortho.” In the tutorial training folder you will find an image file of the rasterized point cloud. The models were processed at full resolution prior to the class to save time, and then the individual raster scenes were mosaicked together using OrthoPro. In this section we’ll show you how to load the raster into the GeoWorkspace for analysis.

1. On the Raster tab, in the Insert Images panel, click Georeferenced.
2. On the Insert Georeferenced Images dialog box that appears, use the Folder: browse button to locate the C:\Training\ImageStation\ISAE-X and GM3D folder and then click OK to close the Browse for Folder dialog box.
3. Use the Extensions: down arrow to set the filter to *.tif;*.btf.
4. In the Available files list, click on PointCloudRaster.tif and then click the right arrow to add the file to the Selected files list.
5. In the Image display group box, check Add new legend entry for feature class.
6. In the Insert images into group box, key in Point_Cloud_Raster for the new legend entry name under Image feature classes with matching coordinate system.
7. Click OK to insert the image into the legend and MapWindow1 display. The dialog box will be dismissed.
8. Use the GeoMedia commands to zoom in on any areas of interest, typically where there are some buildings.

9. Drag the *Ortho* legend entry to the top of the legend to put it on top of the *Point_Cloud_Raster* legend entry and note the differences between the two. Feel free to toggle back and forth between the two images by swapping them in the legend.