Geo-Imaging Accelerator (GXL) System: PanSharp XL GXL Workflow

PANSHARP XL - ACCELERATED PAN SHARPENING GXL WORKFLOW

PanSharp XL allows you to pansharpen an input directory containing orthorectified, multispectral scenes using their associated orthorectified panchromatic scenes. All input scenes must have been previously processed by the Ortho XL GXL Workflow, but PanSharp XL also supports the ability to pansharpen raw panchromatic and multi-spectral scene pairs that have been imported from the GXL Data Ingest Module. Support for pansharpening raw panchromatic-multispectral scene pairs is limited to sensors and data products which support this functionality, as described below.

GXL WORKFLOW PREREQUISITES

This is an add-on GXL Workflow that is used within the Geo-Imaging Accelerator (GXL) System. Prerequisite processing modules include Data Ingest (included in the GXL Base-System) and OrthoXL (depending on the sensor used). If the MS and PAN datasets are properly co-registered, then Ortho XL may not be necessary prior to pansharpening.

GXL WORKFLOW OPERATORS

PanSharp XL consists of a set of two automated jobs. The master job scans the input folder, validates compatible datasets, and then generates the child job. All jobs are put in a queue and executed based on their priority and availability of computer resource.

The job processor for Pansharpening (GXLMasterPansharp) has the following operators used for job submission:

Job identifiers
- **User**: name of the user submitting the job
- **Priority**: priority of the job
- **Comment**: comment to distinguish the job

Start
- **On Server**: select the processing server to run the job
- **When**: select when the job is to be started

Input Parameter
- **Predefined configurations**: The user can define and select an XML configuration file which automatically sets all parameters for the project. This is useful for when you need to repeat projects.

Workflow values
- **InputFolder**: Directory containing scenes to process.
- **OutputFolder**: Directory where results will be placed.
- **SearchMask**: List of file masks to find a source files.
- **OverwriteResult**: What to do if output file already exists.
- **MsChannels**: List of channels in the multispectral images which will be pansharpened (comma separated list). Empty designates all channels.
- **ReferenceChannels**: List of channels in the multispectral images which will be used as a reference (comma separated list). Empty designates all channels.
- **MsNoDataValue**: no data value for the multispectral image (optional).
- **PanNoDataValue**: no data value for the panchromatic (optional).

Once the job is submitted, the process will traverse the defined directory tree and

spawn an associated child job for each panchromatic-multispectral pair found.

GPU ENABLED PAN SHARPENING

PanSharp XL utilizes the PCI MP/GPU program. This is an independent executable which can automatically recognise if an appropriate graphical processing unit or video card that has been installed on the processing server is available. If the video card is detected, then the GXL system will utilize the card for processing. Otherwise, the GXL system will use all of the available CPU cores to split the job to parallel threads.

PAN SHARPENING ALGORITHM

The pan sharpening algorithm applies an automatic image fusion that increases the spatial resolution of multispectral imagery by using a high-resolution panchromatic image. Pansharp allows you to easily fuse images acquired simultaneously by the same sensor.

The pan sharpening algorithm uses a least squares approach to approximate gray-value relationships between the original multispectral image, panchromatic image, and fused image. Using the pansharpening algorithm, you can:

- Solve color-distortion and operator- and data-dependency problems
- Achieve the best color representation
- Preserve the mean, standard deviation, and histogram shape for each channel
- Fuse all spectral bands of a satellite image with the corresponding panchromatic band at once
- Minimize color distortion, maximize feature detail, and naturally integrate color and spatial features

GXL WORKFLOW INPUT IMAGES

PanSharp XL requires the following input images:

Multispectral Image Layers:

- Spectral layers to be fused with a high-resolution panchromatic layer

Reference Multispectral Image Layers:

- Aid in the pan-sharpening process
- Span the same frequency range as the panchromatic image layer
- Vary from sensor to sensor

Panchromatic Image Layer:

- High-resolution panchromatic layer

SUPPORTED SATELLITE FORMATS

The Satellite Pan Sharpening Suite supports a wide range of high and low-resolution optical satellite sensors.

Supported Sensors

- IKONOS GEO:
  - GeoTIFF or HDF GEO product
  - 1-2m accuracy with 10 or more ground control points (GCPs)
- IKONOS GEO Ortho Kit:
  - Satellite Orbital Math model can be used without RF coefficients
- QUICKBIRD (Basic and Ortho-Ready):
  - GeoTIFF or NITF with support files (ATT, EPH, GEO, IMD, RPB, TIL)
- SPOT 5: 1A and 1B Products
- SPOT 5 (TIFF): Level 1A Dimap format

FOR BEST RESULTS

- Use multispectral image channels whose wavelengths lie within the frequency range of the panchromatic image channels
- Do not exceed a MS:Pan resolution ratio of more than 5:1
- Co-register the multi-spectral channels with the panchromatic one using the OrthoXL GXL Workflow if they are misaligned.

The Pan Sharpening algorithm was developed by Professor Yun Zhang, and is licensed from the University of New Brunswick.

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