IRSA Software Training Guide

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1.IRSA introduction

1.1 introduction

IRSA software is developed by lab of remote sensing image processing in Institute of Remote Sensing and Digital Earth (RADI), CAS. The platform for IRSA is PC. It can process multiple data and has the common functions for image processing. It also provides special functions for initial image data processing and professional functions.

The platform for IRSA is PC. It can process multiple data and other supplementary data and has the common functions for image processing. It also provides special functions for initial image data processing and professional functions.

1.2 Main Interface

The main interface of IRSA is comprised by 7 main modules: Viewer, Process, Recovery, Rectify, Mosaic, Fusion and Classification.

1.3 IRSA Modules Introduction

Viewer: Viewer module is used for displaying image and related information. It can process all supported file formats. It can view huge mass RS image(over 4GB) fast with few RAM.

Processing: Execute geometric transformation, enhancement, filter and basic image transformation from file to file. These are the effective tools for image data processing and analysis.

Recovery: Rectify images to remove the image regression caused by imaging or exterior conditions. This module includes: Strip Noise Removal, Motion Blur Recovery, Haze Removal, MTF correction and radiometric correction.

Geocorrect: It is the process to project image to plane surface to make it in accordance with geographic projection system and add cartographic coordinates system.

Mosaic: This module provides auto-mosaic based on geo-information with friendly interface and easy operation. The well designed algorithm ensures the high efficiency. It contains auto-mosaic and manual match mosaic.

Fusion: Spatially match the images of the same place from different sensors and use some algorithm to combine all information of different images to generate new image.

Classification: Divide pixels of image into different classes according to their characteristics.

2.Viewer

Viewer module is used for displaying image and related information. It can process all supported file formats. It can view huge mass RS image(over 4GB) fast with few RAM. Besides, it supports the overlapping display of several images with

geo-reference and raster with vector. All geo-information can be displayed and distance or area can be measured directly.
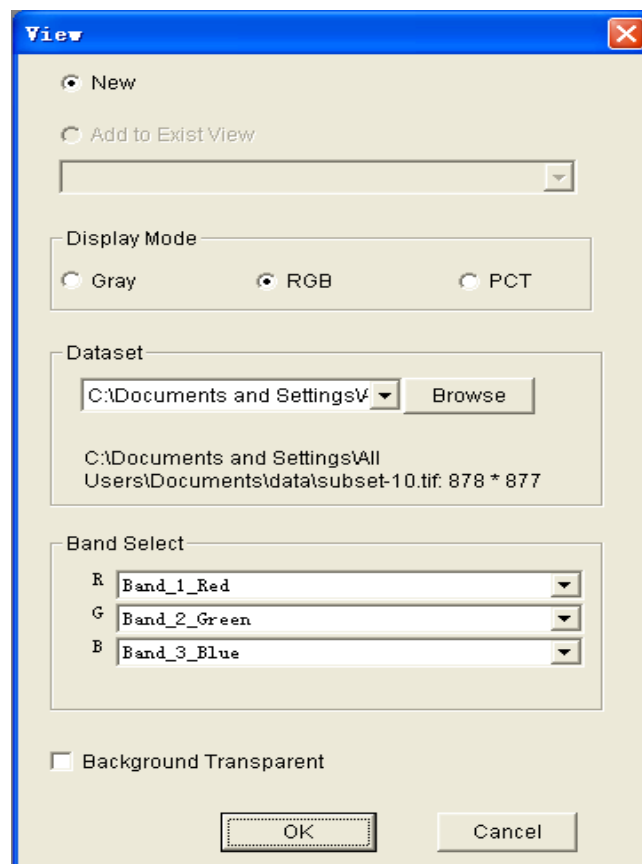

2.1 Open Raster Image File

The follows are the File bar and tool bar.
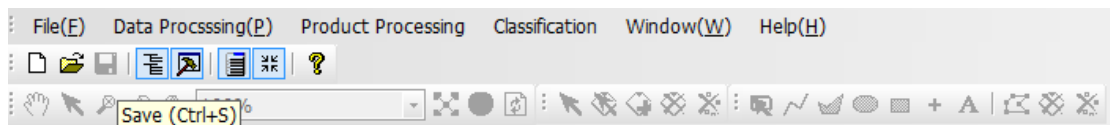
Select "File"→ "Open（O）" or click to open file selection window. After selection, click OK. If it is the supported file format of IRSA , View Creation dialog pops up:

The definition of each part is introduced below:

(1) **New**

When selected this button, a new View will open to load image.

(2) **Add to existing View**

When selected this button, the opening image will load to the existing View as a layer. Select the existing Views from the list box.

(3) **Display Mode**

There are 3 display modes: Gray Image, RGB True Color, Pseudo Color. Gray image displays one band of image; RGB image select 3 bands as the R, G and B band to select; pseudo image displays one band, the pixel value maps to a color table to make the image colorful.

(4) **Dataset**

Select the image dataset to display. Generally, one dataset stands for one image and there is one dataset in one image, there is also one file containing several datasets, like HDF file of Modis images. Once user opens a file, the dataset generates. For the management of dataset, please go to section 2.2. Select the open dataset from the combo box.

(5) **Band Selection**

Select the band in dataset that want to display. For gray mode or pseudo mode, only need select one band; for RGB mode, three bands need select. All bands are displayed in combo box for selection.

2.2 Catalog

One dataset stands for one image and there is one dataset in one image, there is also one file containing several datasets, like HDF file of Modis images. The open datasets are managed by file manager. Click "View" -> "File Manager" and the interface is shown below:
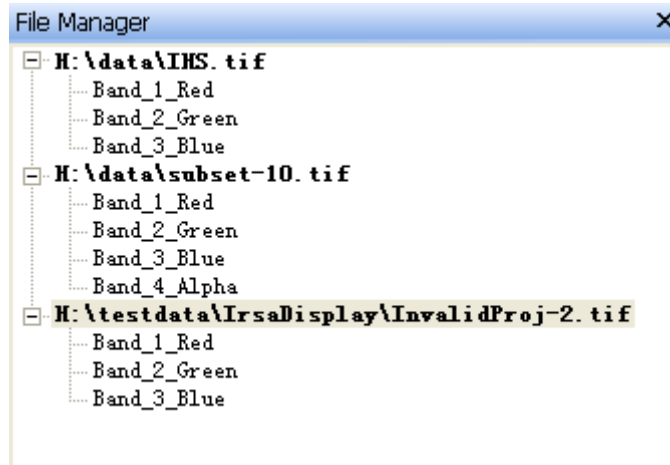
The data in file manager is organized in tree construction, the root for the tree is the name of the dataset, commonly same with file name; the sub-node is the bands containing in the dataset.

(1) Open & Close Dataset

Once a file is opened, a new dataset is added into file manager. The new View can be displayed from these datasets. When View closed, datasets still open and can load in new View again. Close datasets following these steps:

Step 1: Move the mouse to the node of the dataset that want to close;

Step 2: Right click mouse to open context menu:
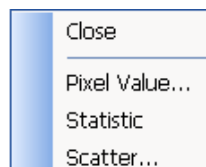
Step 3: Click Close. The selected dataset is closed. If there are View layers from this dataset, a window will pop up to ask whether close the corresponding layer in View. Select OK to delete the layer in View and close the dataset.

(2) View Data Attributes

Click "View" -> "File Attribute" or to pop up attribute window, shown below:

Property		×
☐ **File Info**		
File Path	H:\testdata\IrsaDisplay\InvalidProj-2.tif	
File Format	GeoTIFF	
Band Number	3	
Width	1459	
Height	1380	
☐ **Band Info**		
☐ **Band_1_Red**		
Width	1459	
Height	1380	
Block Width	1459	
Block Height	5	
Data Type	Byte	
Min Value	7.000000	
Max Value	255.000000	
☐ **Band_2_Green**		
Width	1459	
Height	1380	
Block Width	1459	
Block Height	5	
Data Type	Byte	
Min Value	3.000000	
Max Value	255.000000	
☐ **Band_3_Blue**		
Width	1459	
Height	1380	
Block Width	1459	
Block Height	5	
Data Type	Byte	
Min Value	0.000000	
Max Value	255.000000	
☐ **GeoCS**		
☐ **UL**		
x	1072934.000000	
y	2062386.000000	
☐ **BR**		
x	1084606.000000	
y	2051346.000000	
☐ **Resolution**		
x	8.000000	
y	-8.000000	

In this window ,the attributes of selected dataset are displayed, including file information, band information, projection information, geographic information.

(3) View Pixel Value

View the pixel values in all bands. Right click mouse on dataset to open context menu, click "View Pixel Value" and the dialog shown below pop up:
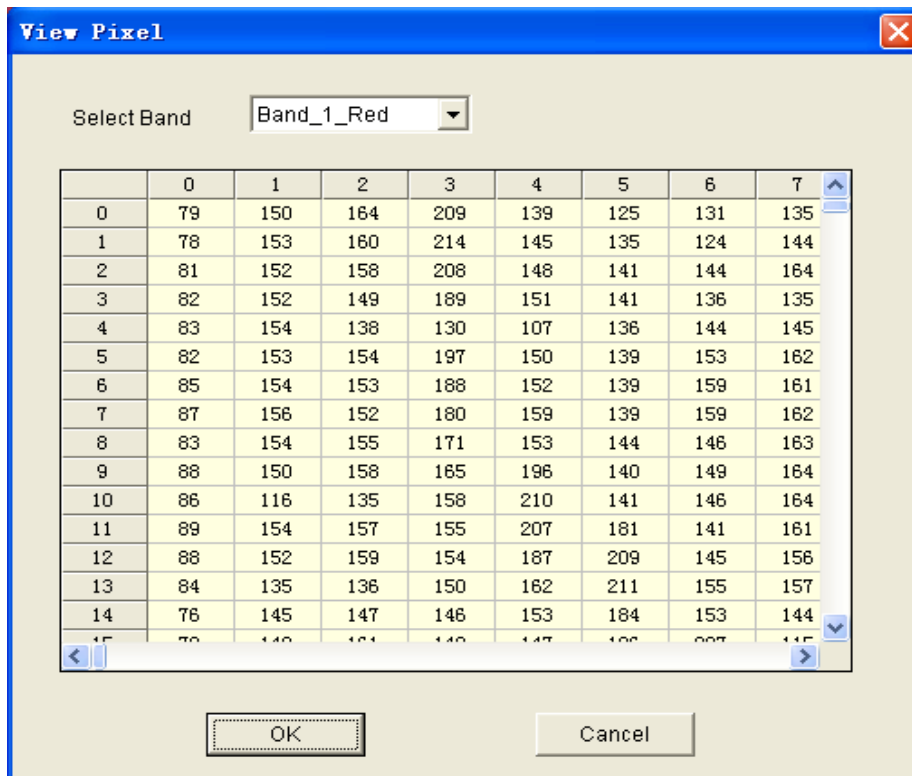
The number in first row and column of the table start both from 0, showing the row and column number of upper left corner of image, and other units display the corresponding pixel values; the band selection combo box contains all bands list, select the band and the table will update to the selected band value.

2.3 Layer Management

Multi-images can be displayed in one View, and each image is called a layer. The is a overlapping sequence from top to bottom in the direction vertical to screen, called Z order. The upper layer will cover the lower layer. The sequence can be changed by adjusting Z order. Layer Create, Layer Delete and Z Order Adjustment can all be operated in layer manager, shown below:
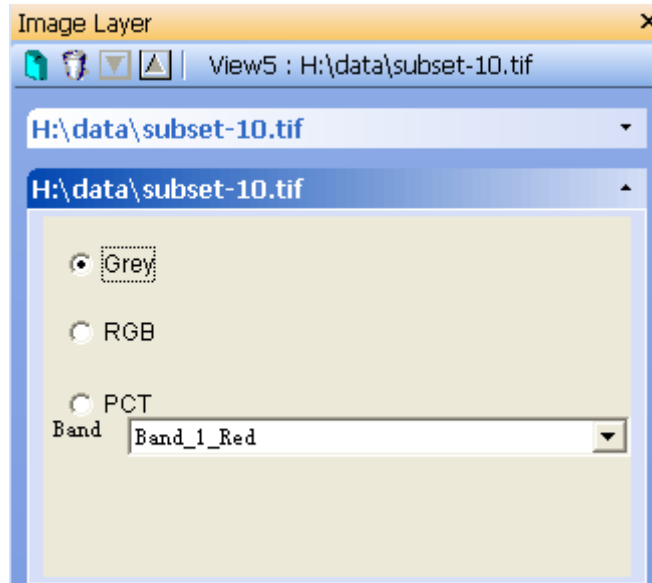
In the middle of layer manager, there are several bar, each of witch matches with one layer, piling follow the Z order; the title of bar is the name of the layer; click title and the layer is selected and the bar will unfold just like the first layer shown in the picture above, here the color mode and band combination can be set;

2.4 Image View

(1) View Toolbar

After image loading, use the tools on tool bar to operate the image, the bar is shown below:
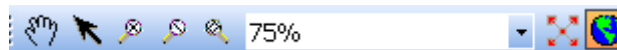
(2) Use Overview to Explore

Use Overview to navigate. Click or select "View"→ "Overview" to open Overview window shown below:

The red rectangle in Overview stands for the range displaying in View. Move the image, and the red rectangle changes correspondingly.

(3) Multi-windows GeoLink View

For this function, two or more Views need open, and there is geo-overlapping area for these Views. If these two conditions satisfied, operate the following steps to GeoLink Views:

Step 1: Ensure that the linking View is under Geo-Code mode;

Step 2: Right click in one of the Views and open the context menu like this:
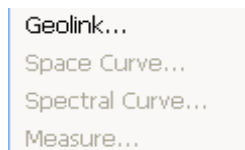
the "GeoLink" is activated, click to open the GeoLink dialog:
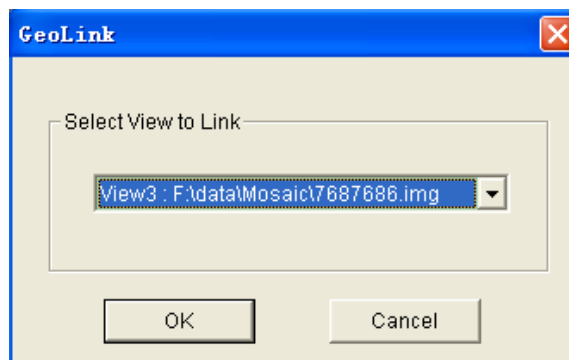
All View that can be linked with main View are listed in the combo box. Select and click OK to link.

Step 3: After linking, when explore in the main View, the linking View changes correspondingly, ensuring the same area.

Step 4: One View can link to multiple Views, just repeat the step 2.

Step 5: For canceling GeoLink, right click on main View and open menu:
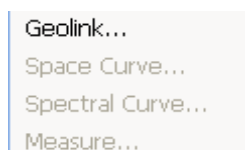
If it is in GeoLink, the "Link Cancel" is activated, click to cancel.

(4) Display Multi-Layer with Swipe and Flicker

These two special display modes can display the upper and lower layers alternating.

a.Swipe:

When there are more than 2 layers in View, select "View" -> "Swipe" to popup the following dialog:
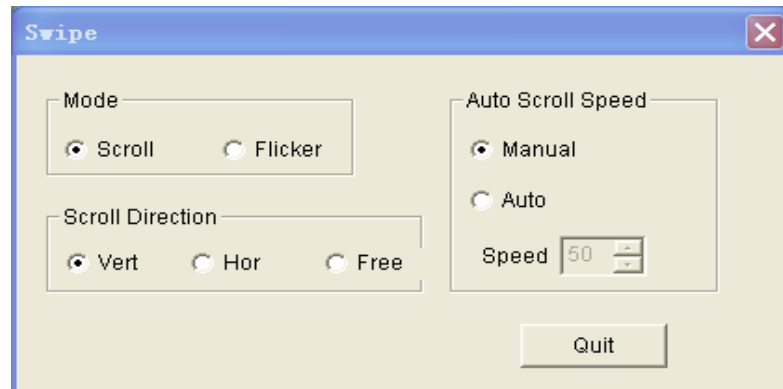
Select "Scroll" in "Swipe Mode", the "Swipe Direction" has 3 directions:

➢ Vertical(Vert.)－Swipe up-and-down to display the two layers;

➢ Horizontal(Hor.) －Swipe left-to-right to display the two layers;

➢ Free－Swipe in both directions to display;

b.Flicker:

This mode is to display two layers alternating, adaptable for look up the difference between two layers. There are manual mode and auto mode

➢ Manual: Click in the View to switch to lower layer and upper layer hides; loose mouse, lower one hides and upper one displays. Click repeat to flicker.

➢ Auto: Automatically alternating display two layers following the set speed.

2.5 AOI Tool

AOI layer includes point, polyline, polygon/rectangle, ellipse/circle and text etc. Using AOI tool can generate, edit, draw, and save these objects.

(1) Generate AOI

➢ **Point:** Select "AOI" -> "Point" or click . Then user can click on the View to add a point.

➢ **Polyline:** Select "AOI" -> "Polyline" or click . Then user can click on the View to add the first node of the ployline. Move mouse to draw the trace, and then click to add the second node. Repeat this to draw all nodes. Double click to end polyline drawing, and the new polyline is selected.

➢ **Polygon:** Select "AOI" -> "Polygon" or click . Then user can click on the View to add the first node of the polygon. Move mouse to draw the trace, and then click to add the second node. Repeat this to draw all nodes. Double click to end polygon drawing, and the new polygon is selected.

➢ **Ellipse:** Select "AOI" -> "Ellipse" or click . Then user can click on the View to add the upper left corner of circum rectangle of ellipse. Do not loose mouse and drag. Release mouse to end ellipse drawing, and the new ellipse is selected.

➢ **Rectangle:** Select "AOI" -> "Rectangle" or click . Then user can click on the View to add the upper left corner of rectangle. Do not loose mouse and drag. Release mouse to end rectangle drawing, and the new rectangle is selected.

(2) AOI Measure Tool

When there is AOI graph selected, the area, perimeter and distance of AOI can be measured. The steps are:

Step1: Draw AOI and select it. It the graph is polygon, rectangle, ellipse or polyline, the measure tool can be used.

Step 2: Select "Feature Extraction" -> "Measure" or right click on AOI to open context menu, select "Measure" to open the measuring result dialog:
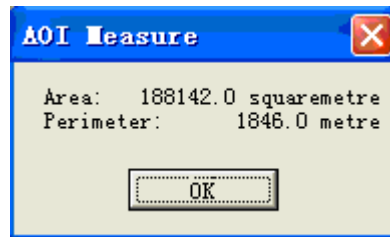
3.GeoCorrect

Function: Geometric correction is the process of projection image data into plane surface to accord it with cartographic projection system; the process is called geo-reference. Because all cartographic projection systems obey some cartographic coordinate system, geometric correction includes geo-reference.

Step:

Step 1:   Open the GeoCorrect module

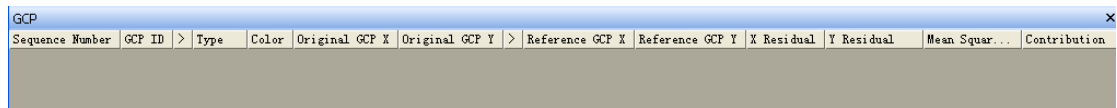
Then you can find the follows:
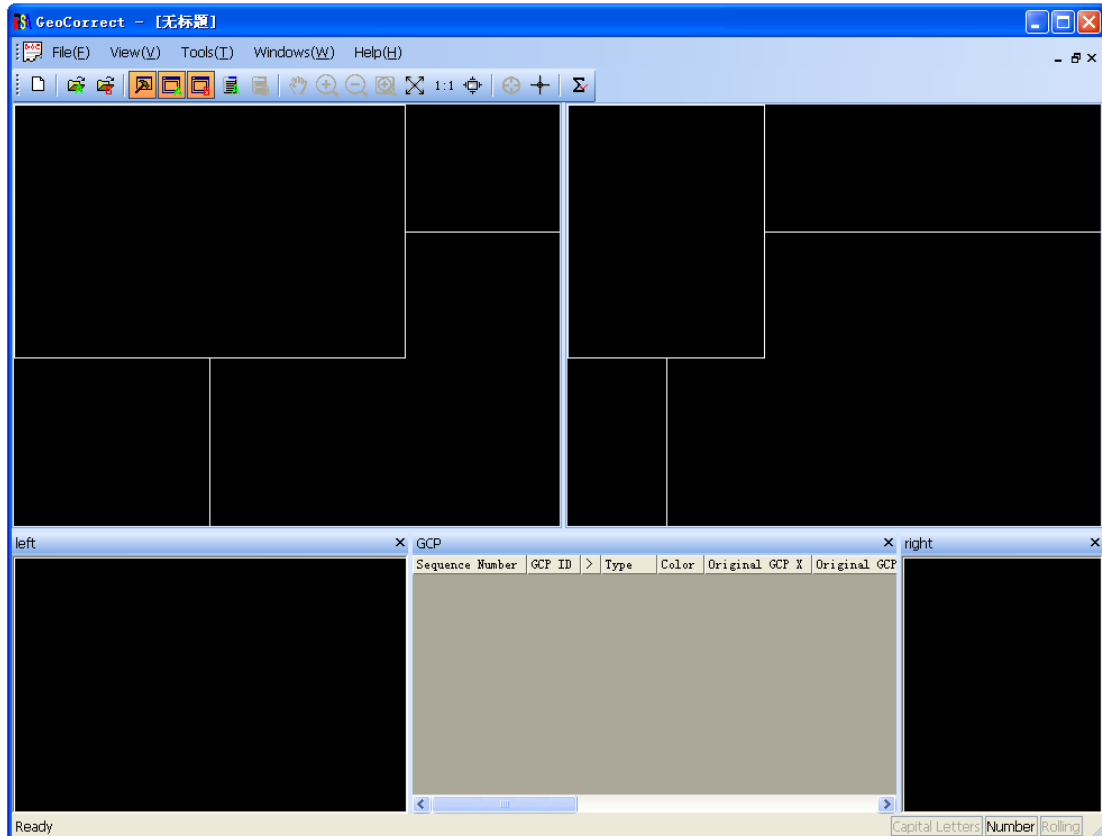
Step 2:　　Open distorted image.

File Name:　　Click Browse… to open File Open dialog to select distorted image.

Step 3:　　Open reference image.

The use is the same as the distorted image open.

Step 4:　　Open GCP list.

When the GCP values are needed, click this button to popup the following window. When enter in the main program, this window is open..

Step 5:　　GCP select.

Add GCP

The mouse changes into Add GPC status after click it, click left button in selected location to get one GCP.

Choose or Move GCPs

Compute Residuals

Click it to calculate GCPs Residuals.

GCP ID: the node for GCP。

Color : Click left button on color column to pop up color list to select one color.

 Right click on GCP list to popup "Delete GCP" menu and delete the selected GCP.

Double click on selected GCP in GCP list, orientation window will move to the location of this GCP.

Click "Move GCPs" icon on tool bar, use mouse to drag the selected point to modify its location. Or input new coordinate values in GCP list and the GCP will move the corresponding location.

Step 6:   Resample

.when you select enough GCP, you can click "Tools-Geometric Correction",you can find that.
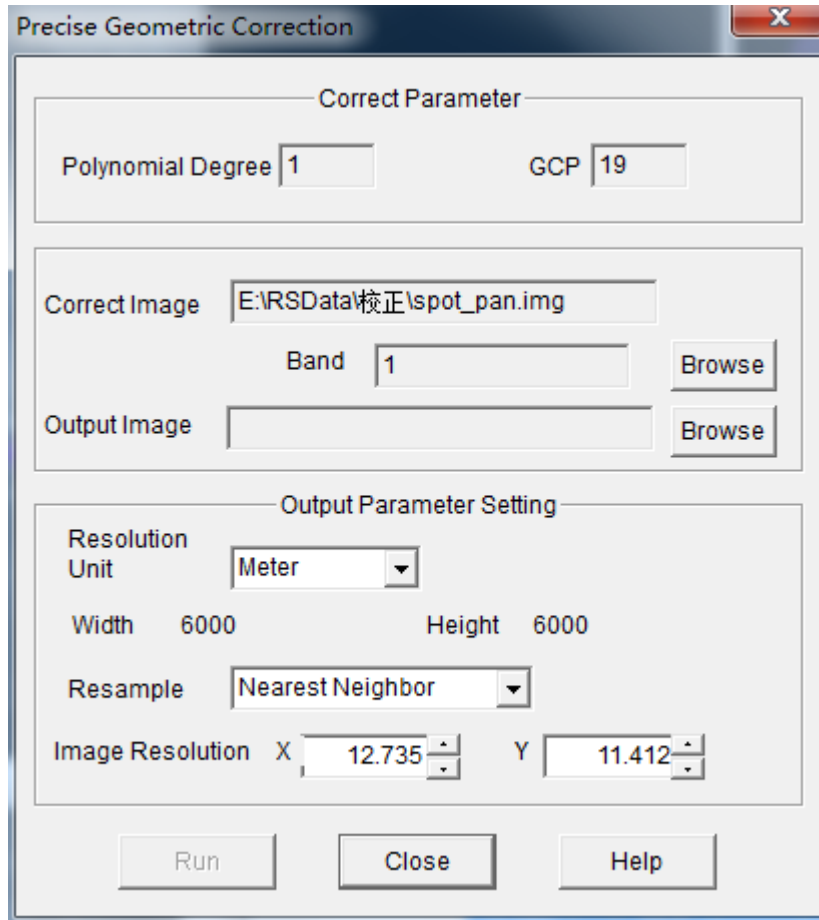
After setting the **Output Image, Resample, Image Resolution**,click "Run",you will get the result.

4.Mosaic

Functions: Mosaic two or more digital images to one united new image by the process of geometric mosaic, color adjustment and overlap exclusion.

This function acquires that images have geographic information and the projection, ellipsoid, datum level and resolution between images must keep in accordance with each other. It supports a maximum of 1024 images to mosaic at the same time.

Steps:

Step 1：Click File->Open Image in menu or click on toolbar，pop up the Add

Images window;
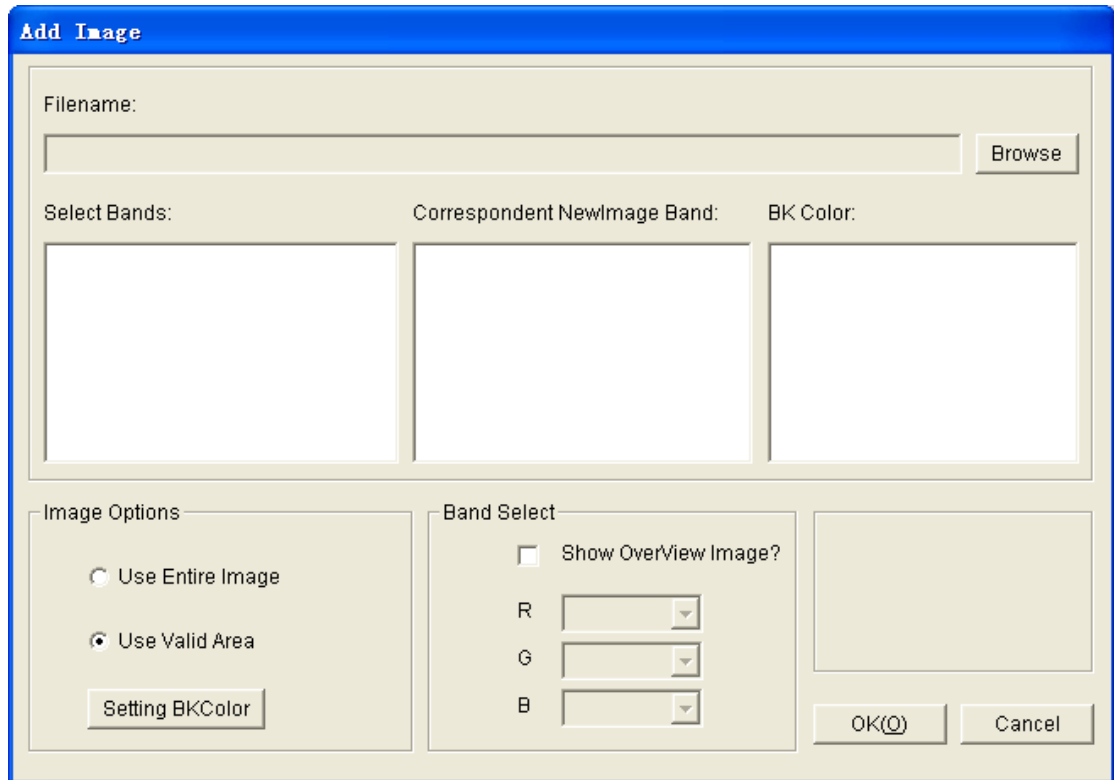
Step2: Click Browse to open the appointed image;

Step3: Click OK to finish image adding;

Notices:

(1)The bands order can be reset in the Correspondent NewImage Band list, then

click OK

(2) Redo step 1 to 3 to continue adding images

(3) Select show OverView Image? Can read the contents of images and show them in the main program.
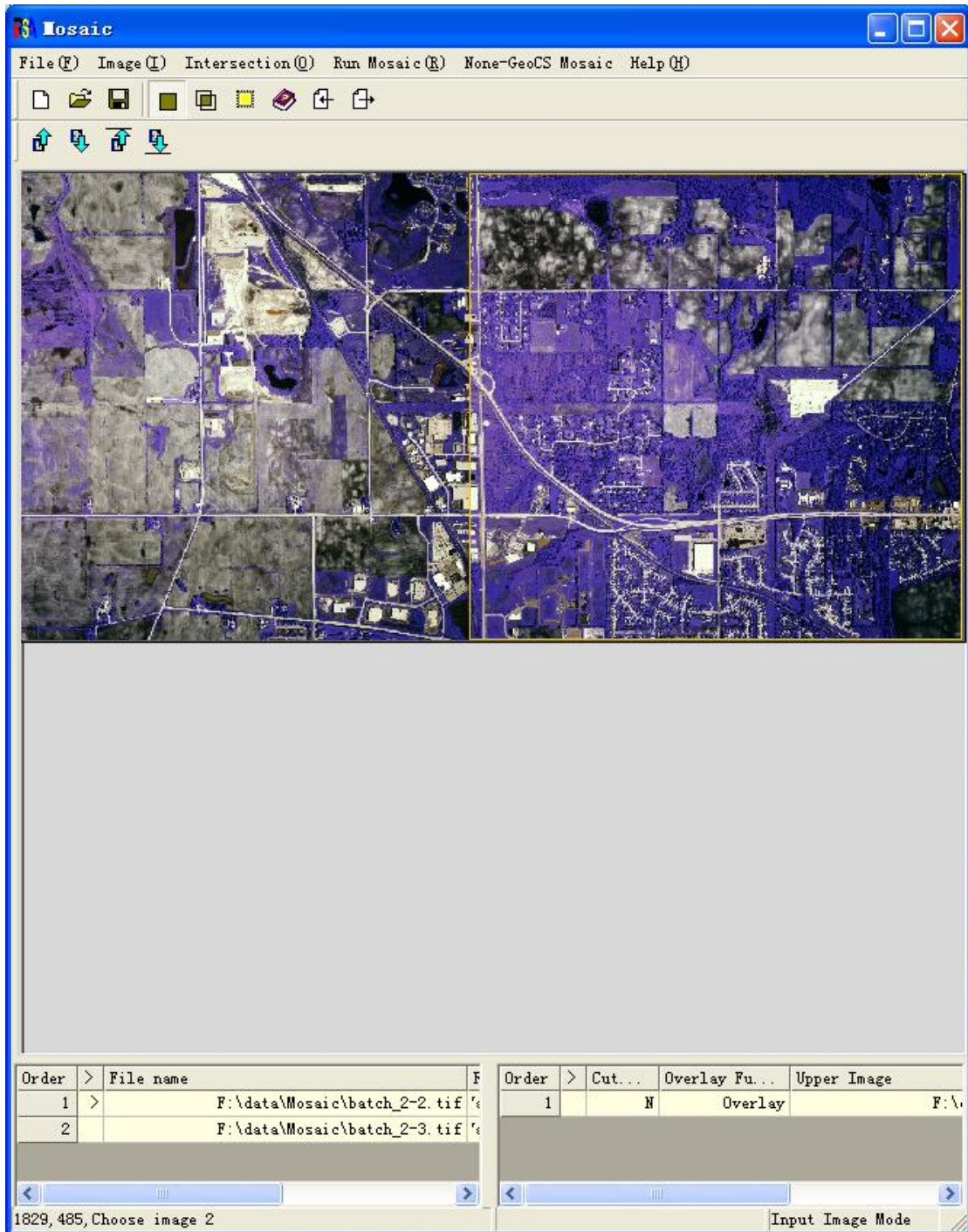
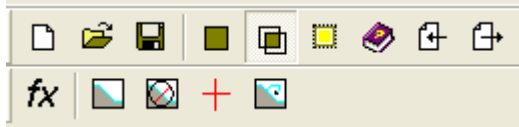Step 4: Click ▣ in toolbar to switch to image mode
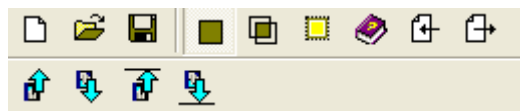
Step 5: Select the image to edit in Image Mosaic window by mouse, click ⬆ on

toolbar to move image to upper layer, while click ⬇ to move it to

lower layer, click ⬆ to move the image to top layer，while click ⬇

to bottom layer。

Step 6: Click to switch to intersection mode and than the intersection area of images can be edited.

Step 7: Click to generate a cut-line in the geometric center of the selected overlapping area.

1) Click to delete the cut-line of the selected overlapping area.

2) Click to generate all cut-lines for each overlapping area.

3) Click and the mouse changes into , users can draw one cut-line in overlapping area, double click mouse to finish.

Step 8: Click Overlap -> Set Overlap Function or click to pop up overlapping area adjustment window;

(1) When the overlap type is without cut-line, the function below can be set:
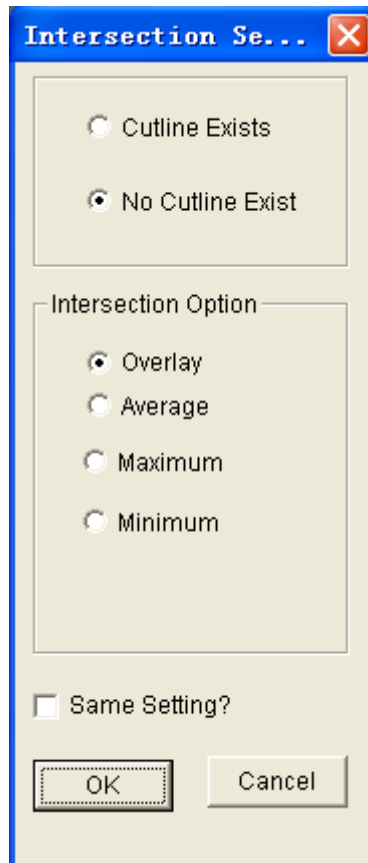
➢ **Overlap**：Use the image of lower layer to overlap the upper layer in overlapping area.

➢ **Average**：Use the average of overlapping area.

➢ **Maximum**：Use the maximum of all image layers in overlapping area.

➢ **Minimum**：Use the minimum of all image layers in overlapping area.

（2）When there is a cut-line in overlapping area, The functions can be chosen are:
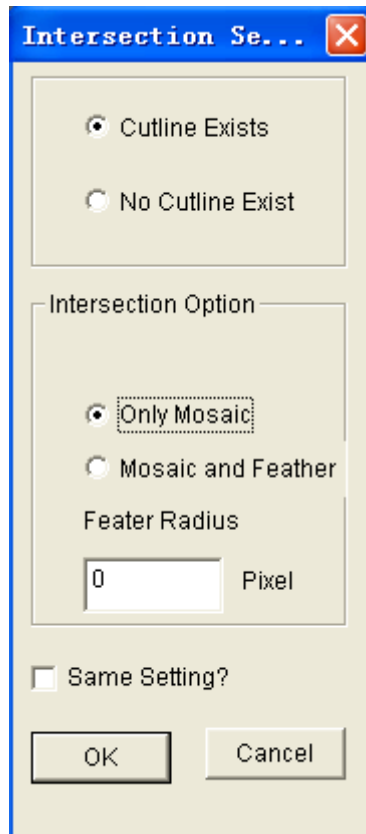
➢ **Only Mosaic**：do not feathering in overlapping area

➢ **Mosaic and Feather**：feather in overlapping area and set the feathering radius pixel in blank manually.

➢ **Same Setting:** Choose the checkbox to apply the same setting to all overlapping areas.

Step 9：Click to switch into output mode，and overlapping areas can be edited；

4) Click to define the output area with mouse in the main operation window.
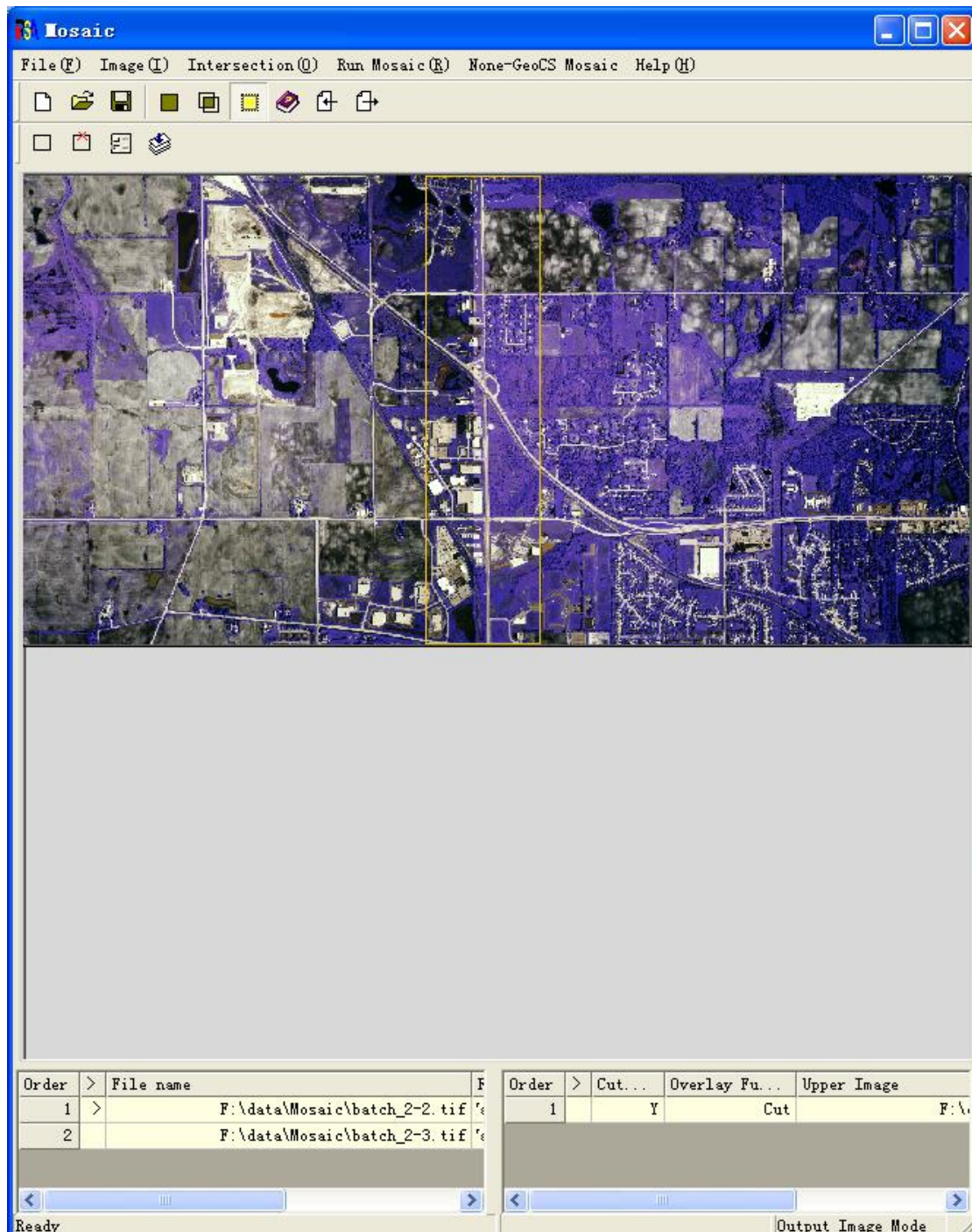
5) Click ![icon] to delete the customized output area.

6) Click ![icon] to set output parameters.
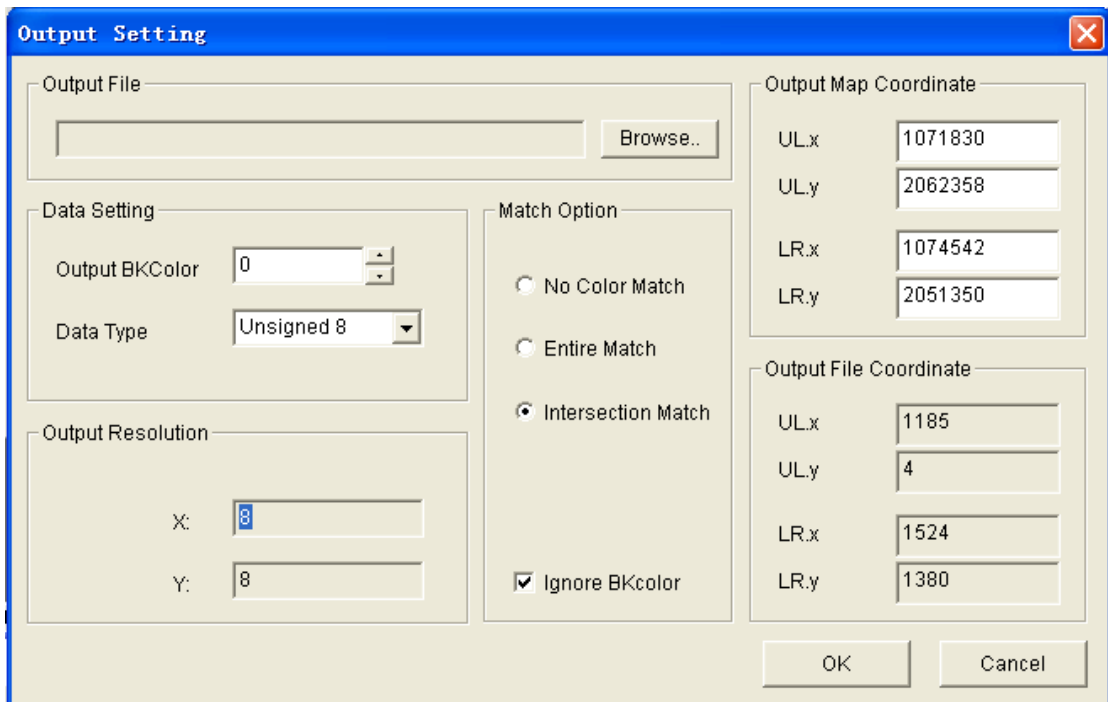
Click Browse… to set the output file name.

Output Background Color：User can set the background color of invalid output area.

Data Type：User can set the output data type.

Output Resolution：User can modify the resolution of the output image.

Match Options：

➢ No Color Match：Do not operate light balance adjustment to image

➢ Entire Match：Match the whole image

➢ Intersection Match：Match in overlapping areas.

Ignore Background Color：Pick up this option to ignore the invalid area

Output Map Coordinate：User can identify the final mosaic area with keyboard input

Click OK to finish and close the Output Option window.

Step 10：Click ![icon] or **Mosaic>run…** in menu to run mosai**c.**

5. Fusion

Fusion module function: fuse the images of the same place from different sensors

to enhance image, the processed image have the multi-spectrum information and better spatial resolution
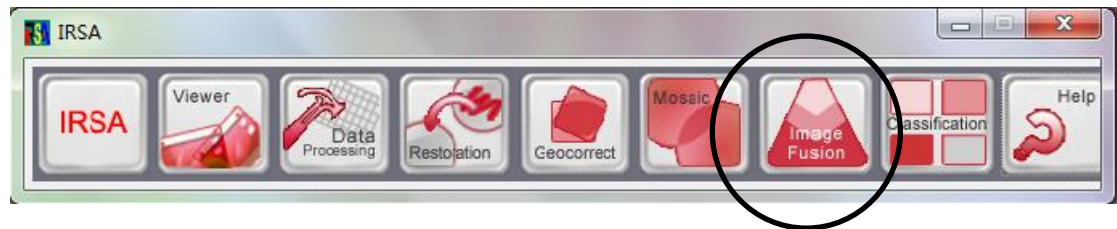

5.1 Fusion based on RGB-HIS transformation

Function: In colorimetry, three base color comprise of the color information，it can also be described by intensity and chroma. The intensity is the feeling of brightness of human's eyes that caused by light, and it is the direct proportion to object reflection ratio, while chroma can be divided into hue and saturation. Hue is the main spectrum wavelength or average wavelength, saturation is the light or dark extent of color. IHS model of color information is quite suitable for image processing of apperceiving color characteristics with human visual system.

Notice: IHS transformation fusion replaces component I of high resolution and Multispectral images after IHS transformation and than process IHS inverse transformation to acquire the fusion image. Compared to original image, the spatial resolution has improved. This fusion mode is often used for images of feature enhancement and obvious feature difference to improve the special resolution of Multispectral image, but it may cause the spectrum distortion of the result.
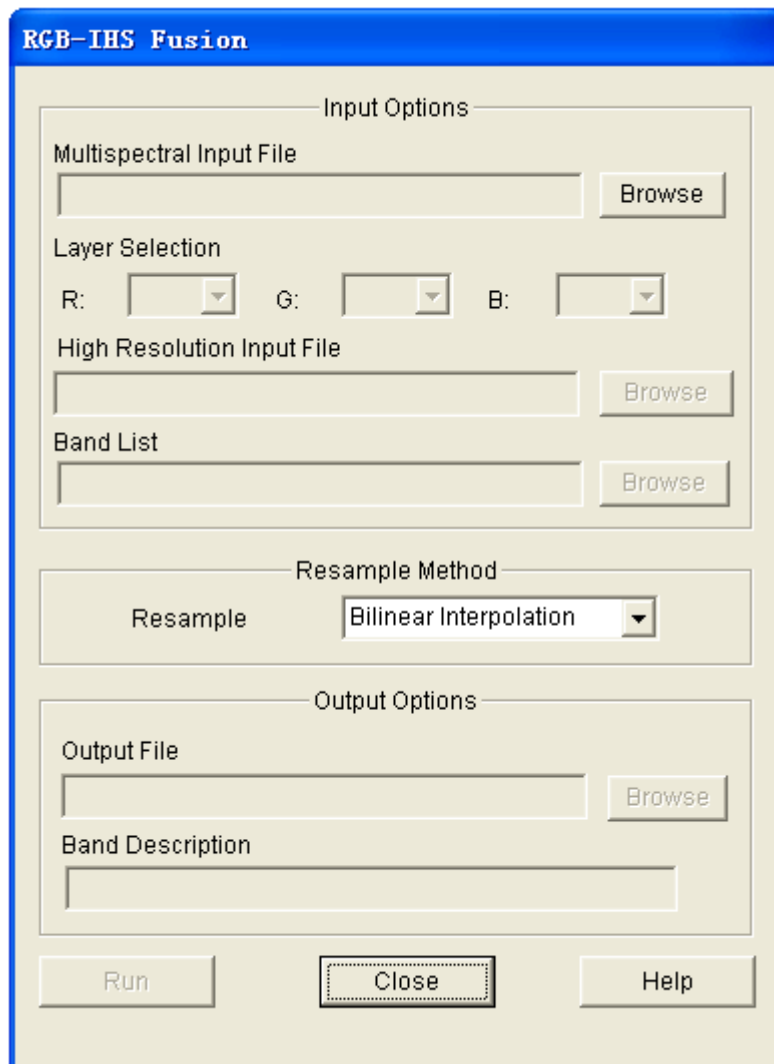
Steps:

Step 1: Click the button Browse… of Multispectral image input to open file;

Step 2: The default processing bands are the first three bands of image, user can click the band list to set the bands;

Step 3: Click the button Browse…. Of high resolution image input to open file;

Step 4: The default band is the first band of image, it can also be changed by clicking band list button;

Step 5: Choose the resample method, the default is bilinear interpolation;

Step 6: Click Browse button of output image to choose the path and set the file name and file type;

Step 7: Band Description: this edit box is editable and receives the default value. It can also add extra image information; the description will be shown in the

notice of new paths;

Step 8: Click Run, the main interface disappear and pop up the progress bar. When the program finish, the main interface will recover and pop up the dialog of success.

5.2 Fusion based on PCA

Function: PCA is also called principal component analysis or K-L transformation, which is the multi-dimension orthogonal linear transformation base on statistics. The purpose for PCA transformation is not decreasing the affection of random noise or compressing data but keeping the statistics independent of each band of Multispectral image, then process each band to implement pixel-level fusion, which is convenient for data more than three bands.

   Notice:

   PCA transformation fusion replaces the first component of Multispectral image after PCA transformation with high resolution image, then process the PCA inverse transformation to acquire fusion image. This fusion mode is often used for the dynamic analysis of images from different sensors or multi-temporal images. This transformation can remove noise and add special information of high resolution image. But it may not keep the original spectrum components well and distort color information.

   Steps:

Step 1: Click Browse… of Multispectral image input to open file;

Step 2:   The default bands for process is all bands, the band list can be changed by choosing with band list button, the number of chosen bands must be more than 1;

Step 3: Click **Browse…**of high resolution image input to open file;

Step 4: The default band is the first one, it can be changed by click band list button;

Step 5: Choose resample method, the default is bilinear interpolation;

Step 6:   Click Browse… of image output to set the output path, file name and type;
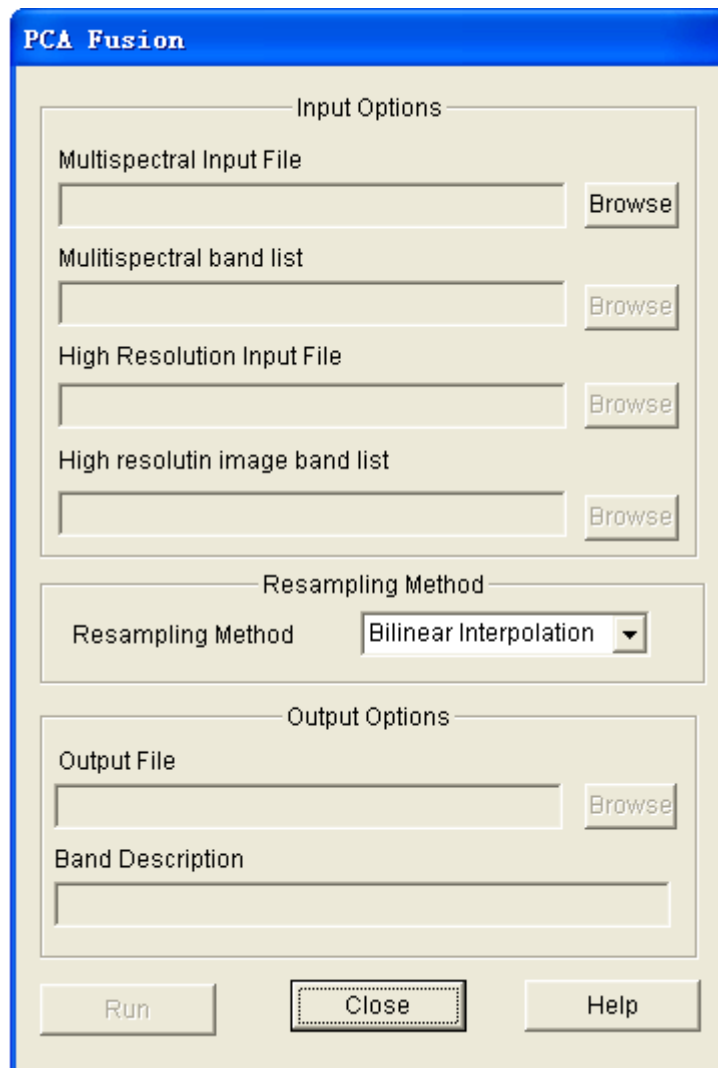
Step 7: **Band Description:** this edit box is editable and receives the default value. It can also add extra image information; the description will be shown in the notice of new bands;

Step 8: Click Run, the main interface disappear and pop up the progress bar. When the program finish, the main interface will recover and pop up the dialog of success.