

Geog 580: Digital Remote Sensing

Lab Assignment 2: Image Statistics

The purpose of this lab assignment is to let students to get familiar with image statistics extraction, univariate and multivariate statistics, histogram, and band-substitution image fusion.

1. Select the area of interest (AOI) for your exercise.

- 1) Point your browser to <http://geobrain.laits.gmu.edu/OnAS/> and click Enter. Then follow the instruction given in assignment 1 to select AOI and access the data through GeOnAs portal.
- 2) Please use either Landsat TM or ETM data available in GMU_LAITS CSW catalog for your assignment.
- 3) You can still use Washington DC as your AOI, but you can freely select any AOI for your assignment.
- 4) Please select Green, Red, NIR, and Pan bands.
- 5) When the following pop-up window pops up for each selected band, set "Res. on X axis" to 0.000167 and "Res. on Y axis" to 0.000131, which is roughly the half the default value for band Green, Red, and Nir bands in DC, and almost the same as the default value for the Pan band. Make sure you key in the same resolution for all band.

Raster Dataset: Selection

You have chosen to get coverage "Band 1: Blue-Green (0.45-0.52 micrometer)" of granule "ECHO_ProviderD[USGS_EROS]_Collection[Landsat 7 Enhanced Thematic Mapper Plus (ETM+) V1]_Granule[G179361333-USGS_EROS] [ProductionDateTime=1999-07-28 15:39:19.000][QACloudCover=3.44%][TwoDCoordinateSystem=WRS-2:15,15 33,33]" through advanced service. Please specify the following parameters.

Projection: "EPSG:4326"

Northern: 38.99511

Western: -77.1199 Eastern: -76.909395

Southern: 38.791513

Bounding Box:
 Dataset Bounding Box
 Project Bounding Box
 Intersection of Above Two

Extent:
 Specify Width / Height
 Specify Resolution on X / Y


Width: 656 Res. on X axis: 0.000320454
Height: 783 Res. on Y axis: 0.000259763

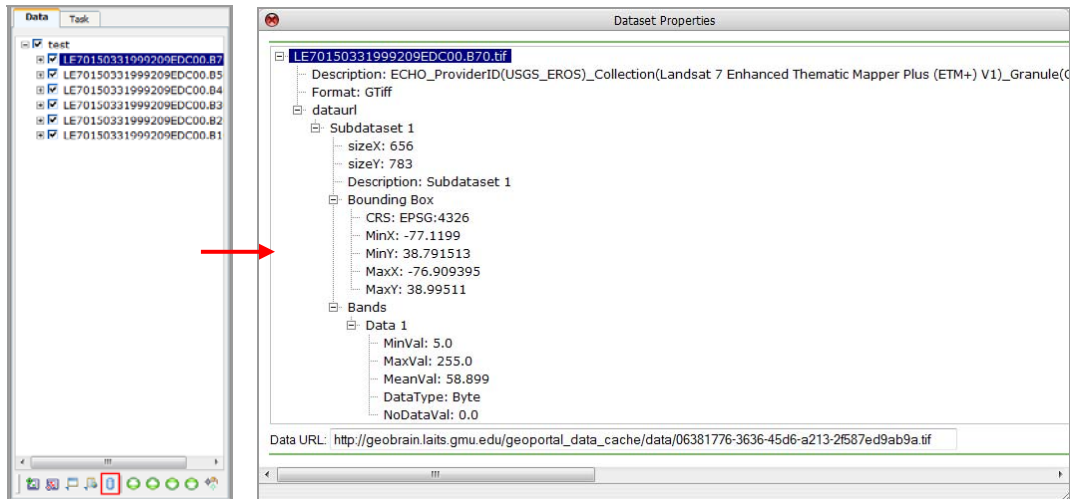
Apply these parameters to other coverages you selected within the same granule, if they have the same projection.
 Apply these parameters to all the other coverages you selected, if they have the same projection.





Reset Submit

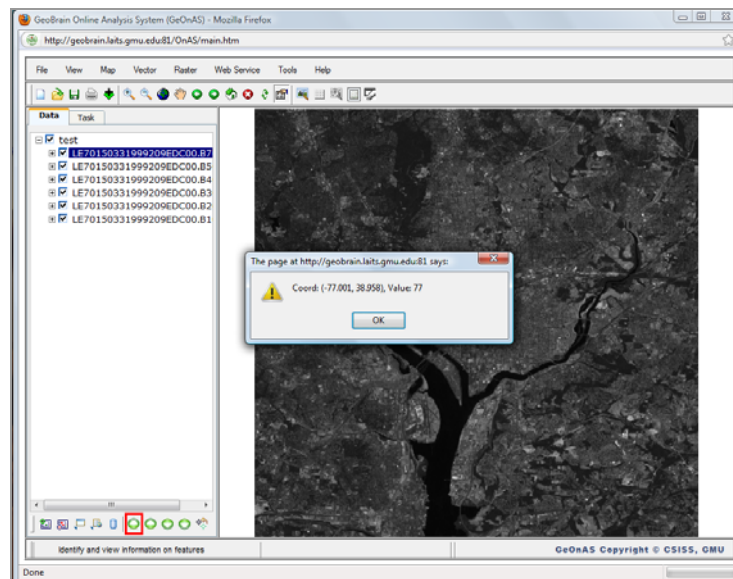
Please report the AOI and the Landsat image file name in your report

2. Raster Values Query




- 1) Click  on the toolbar which is at the bottom of left panel to show the basic properties of the selected layer.

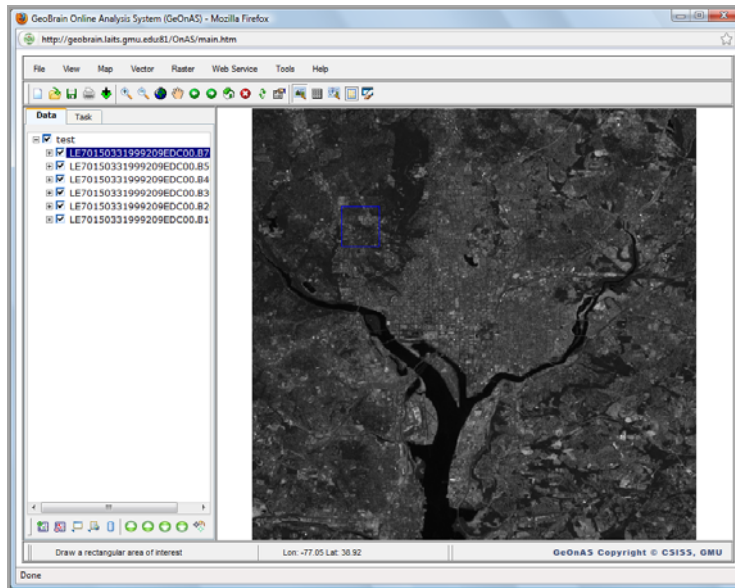


- 2) Click  on the *Toolbar*, when mouse is moved in the map display area, the cursor will be changed from  to , click the mouse at any position, its coordinates and value of the top layer will be popup.
Note: Select other layer and click  on the toolbar which lies at the bottom of left panel to move it top, and then perform above operation to get pixel value.

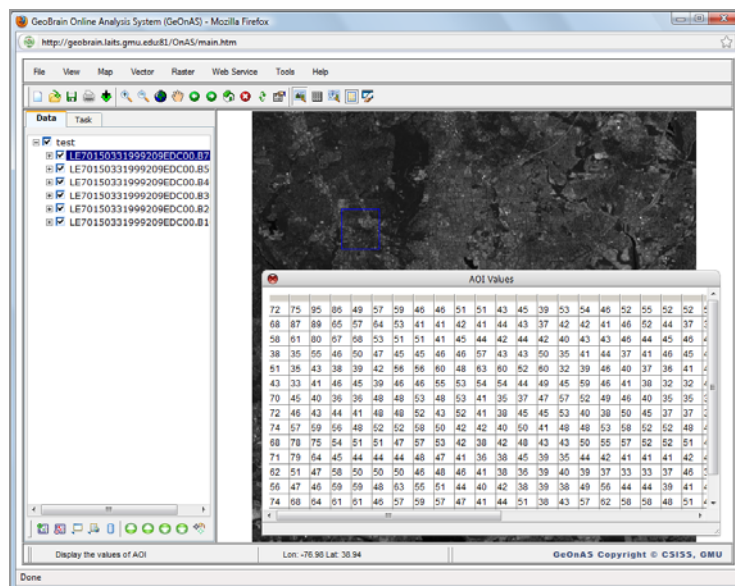



Please write down in your report the ground object type, band, coordinate, pixel value for at least 4 types of ground objects you can identify from the image by eyes in red, nir, green, and pan bands.

- 3) Click  on the *Toolbar*, then move the mouse to the map display area, the cursor will be changed from  to . Drag a small blue rectangle of area of interest.



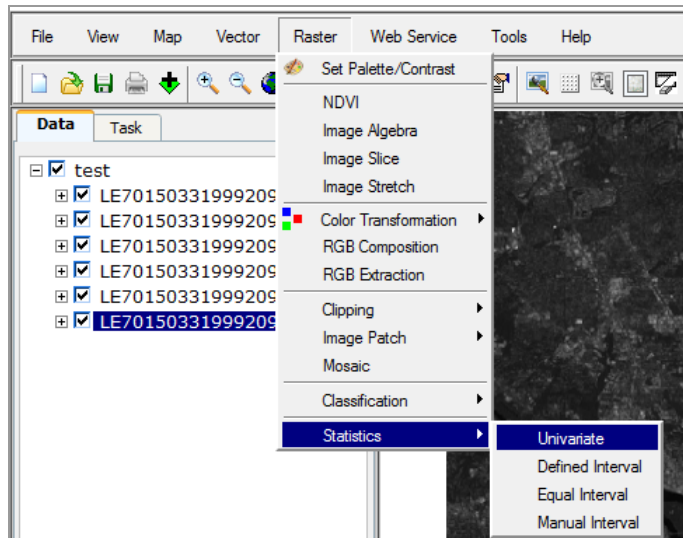
4) Click  on the *Toolbar*, the *AOI Values* window will be shown.



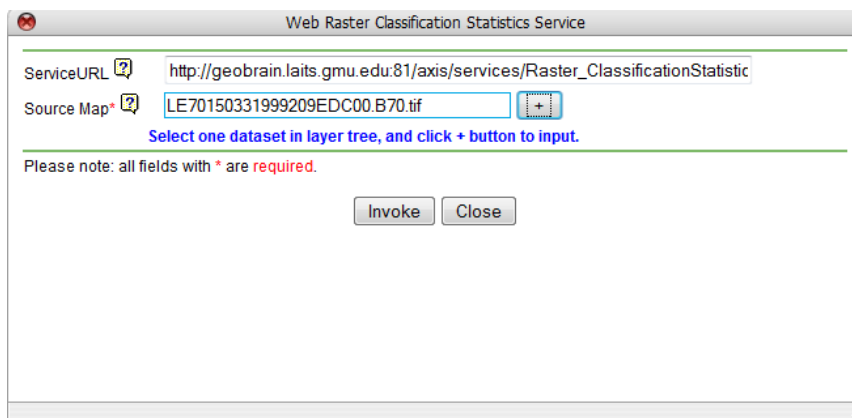
5) Click  on the *Toolbar* to remove the AOI blue rectangle,  will be disabled.

3. Univariate Statistics

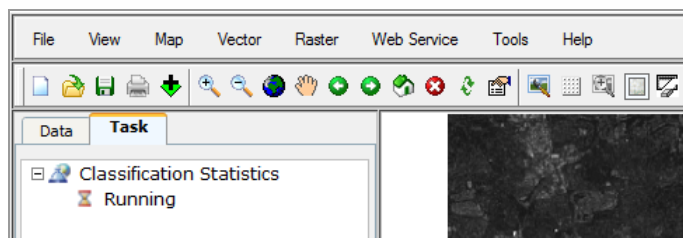
1) Click *Raster->Statistics->Univariate*.



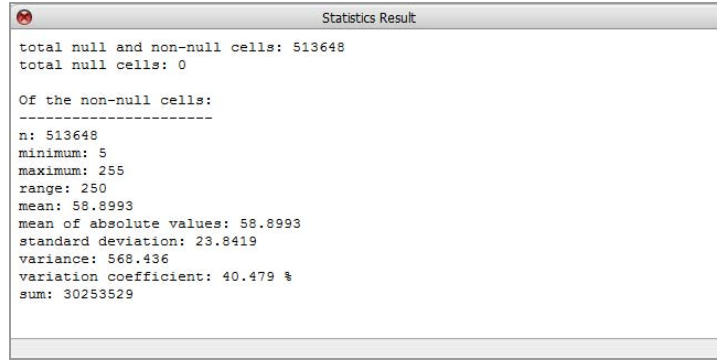
2) Select the dataset on the left panel, and click + button to add it; click *Invoke*;



3) Wait a moment for it to complete.



4) When it is finished, the statistics result will be displayed.

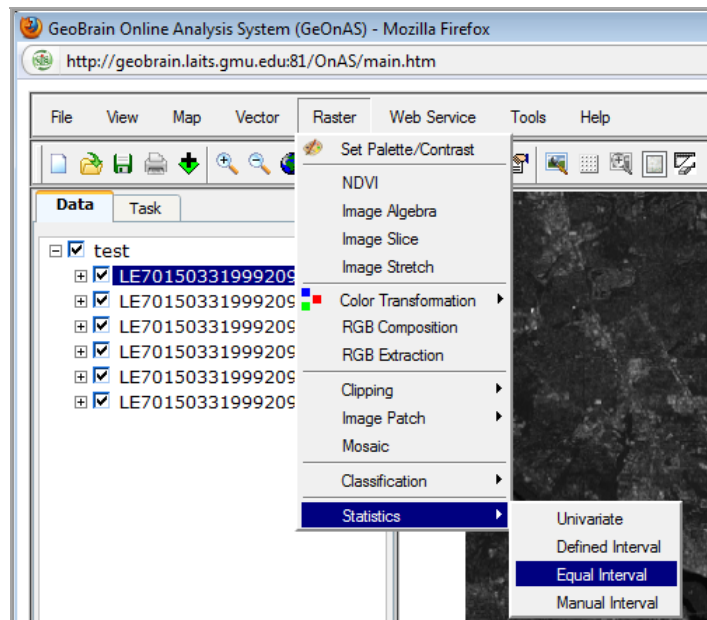


- 5) Execute the same operation on the other bands and **provide a summary table similar to the one below in your report**. In your case, you will only have bands 2, 3,4 and 8

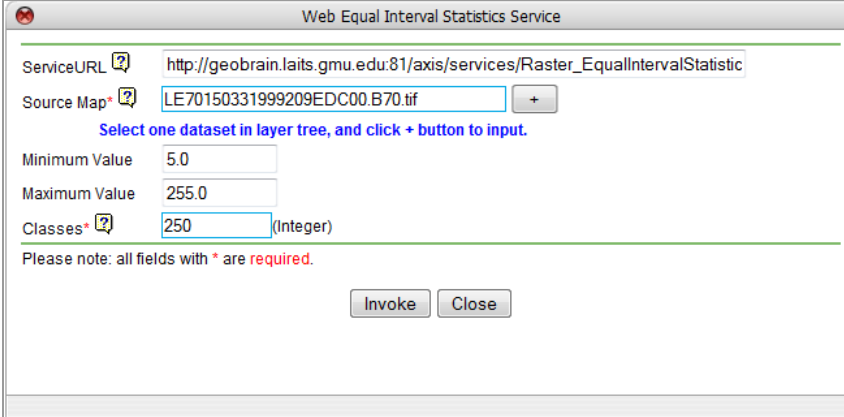
	Band 1	Band 2	Band 3	Band 4	Band 5	Band 7
Total Cells	513648	513648	513648	513648	513648	513648
Minimum	70	49	36	22	5	5
Maximum	255	255	255	255	255	255
Range	185	206	219	233	250	250
Mean	96.6184	76.3245	73.7138	112.954	91.9885	58.8993
Mean of Absolute Values	96.6184	76.3245	73.7138	112.954	91.9885	58.8993
Standard Deviation	13.4465	15.553	23.7011	27.3938	28.4459	23.8419
Variance	180.808	241.897	561.742	750.418	809.171	568.436
Variation Coefficient	13.9171%	20.3775%	32.1529%	24.2521%	30.9234%	40.479%
Sum	49627856	39203908	37862940	58018699	47249684	30253529

4. Histogram

- 1) Click *Raster->Statistics->Equal Interval*.



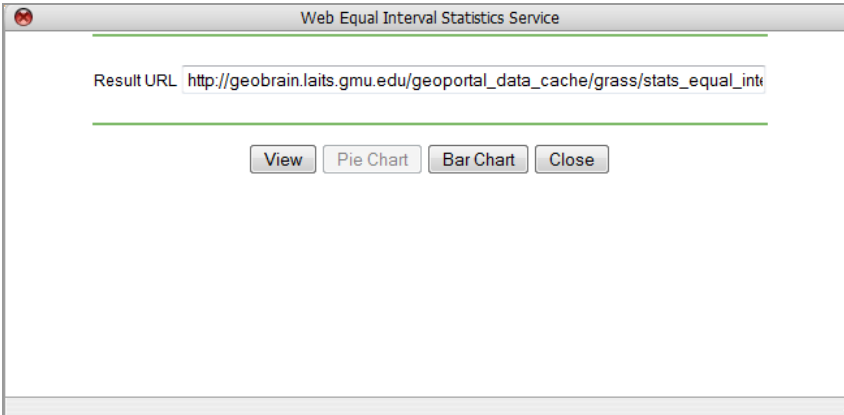
- 2) Select the dataset on the left panel, and click + button to add it; Input the expected classes number based on *Maximum* and *Minimum Value* (**should be less or equal to maximum value - minimum value**); click *Invoke*;



The screenshot shows a web application window titled "Web Equal Interval Statistics Service". It contains several input fields and buttons:

- ServiceURL**: A text input field containing the URL `http://geobrain.laits.gmu.edu:81/axis/services/Raster_EqualIntervalStatistic`.
- Source Map**: A text input field containing `LE70150331999209EDC00.B70.tif`, followed by a "+" button.
- Minimum Value**: A text input field containing `5.0`.
- Maximum Value**: A text input field containing `255.0`.
- Classes**: A text input field containing `250`, with "(Integer)" written next to it.
- Instructions**: A blue text prompt: "Select one dataset in layer tree, and click + button to input."
- Note**: A red text note: "Please note: all fields with * are required."
- Buttons**: "Invoke" and "Close" buttons at the bottom.

- 3) Once the *Web Equal Interval Statistics Service* is invoked successfully, the result window will be shown.



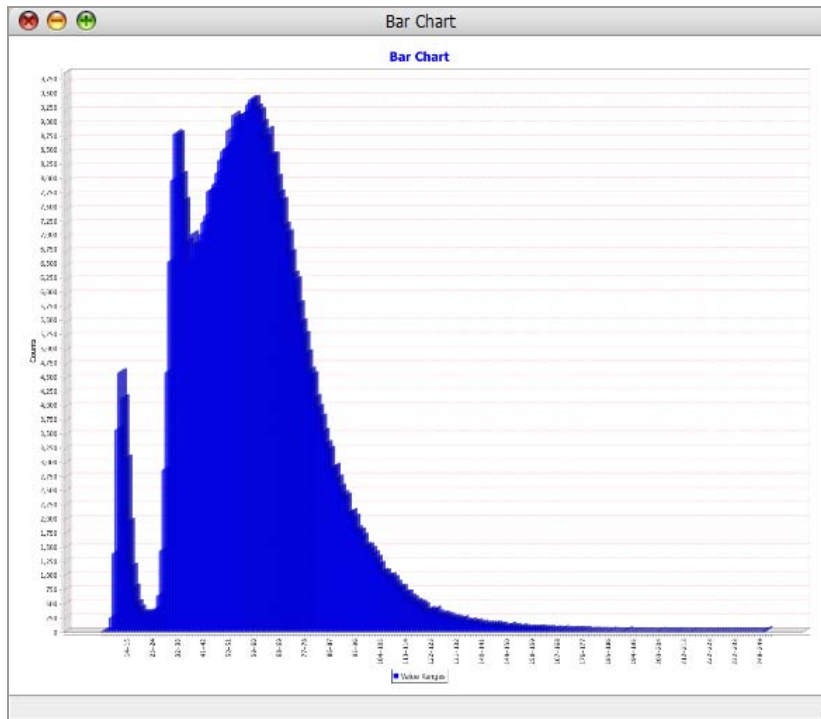
The screenshot shows the same web application window after a successful invocation. The interface is now mostly empty, with the following elements:

- Result URL**: A text input field containing `http://geobrain.laits.gmu.edu/geoportal_data_cache/grass/stats_equal_int`.
- Buttons**: "View", "Pie Chart", "Bar Chart", and "Close" buttons arranged horizontally below the Result URL field.

- 4) Click *View* to view the statistics result (*range, counts and percentages*) in text.

Age Group	Count	Percentage
23-24	348	0.07%
24-25	410	0.08%
25-26	640	0.12%
26-27	1440	0.28%
27-28	2878	0.56%
28-29	4612	0.90%
29-30	6581	1.28%
30-31	8025	1.56%
31-32	8855	1.72%
32-33	8841	1.72%
33-34	8114	1.58%
34-35	7653	1.49%
35-36	6930	1.35%
36-37	6574	1.28%
37-38	7059	1.37%
38-39	6898	1.34%
39-40	6867	1.34%
40-41	7056	1.37%
41-42	7277	1.42%
42-43	7397	1.44%
43-44	7833	1.53%
44-45	7846	1.53%
45-46	7959	1.55%
46-47	8153	1.59%
47-48	8383	1.63%
48-49	8544	1.66%
49-50	8595	1.67%
50-51	8911	1.74%
51-52	8709	1.70%
52-53	9185	1.79%
53-54	9141	1.78%

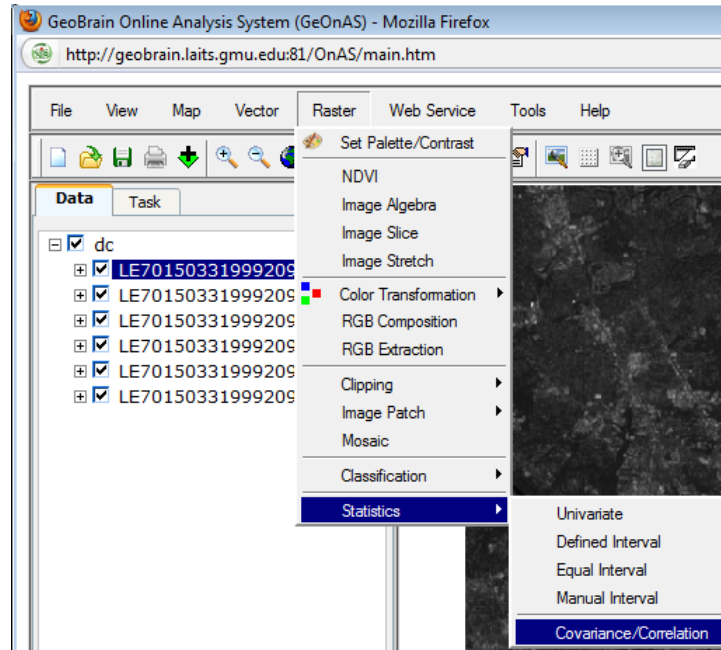
5) Click *Bar Chart* to view the histogram chart.



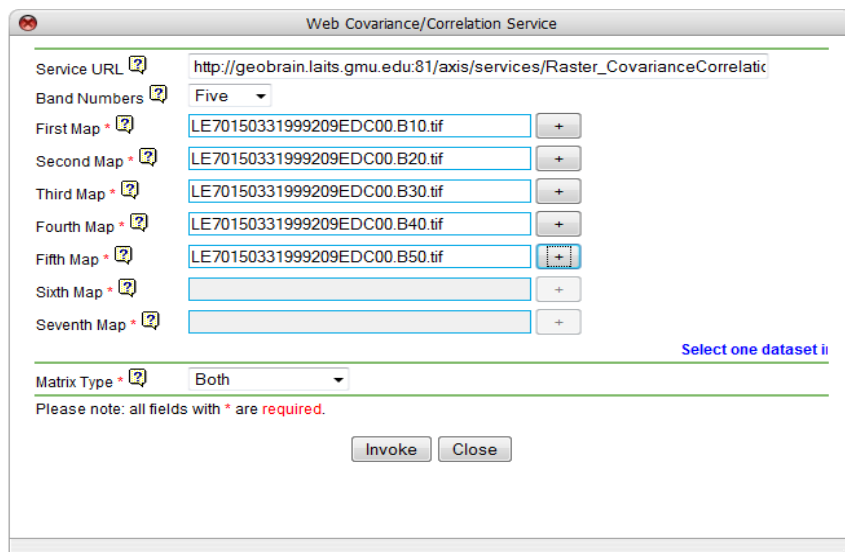
Please do the histograms for all 4 bands and include the histogram in your report. Please discuss your histogram types. If your histograms have multi-modes, can you relate them to land cover types?

5. Correlation Matrix

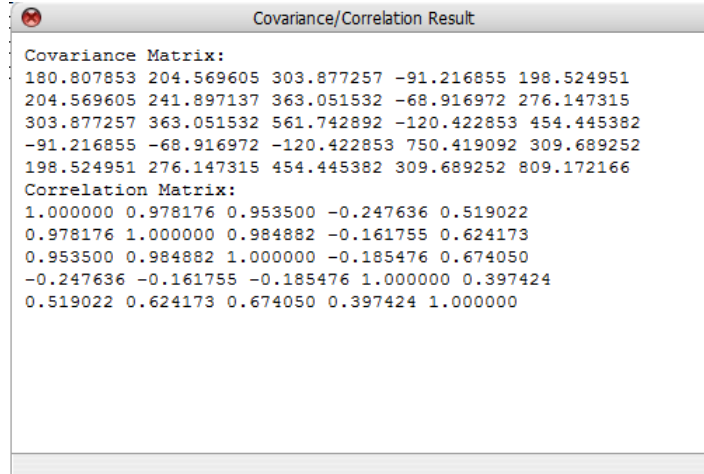
1) Click *Raster->Statistics-> Covariance/Correlation*.



2) Choose the number of bands. In your case, select "four"; Select the dataset on the left panel, and click + button to add it, *First Map* will be the 1st row and column of the output matrix, *Second Map* for 2nd, and so forth; Select output matrix type: *Covariance Only*, *Correlation Only*, and *Both*(default); click *Invoke*;



- 3) Once the *Web Covariance/Correlation Service* is invoked successfully, the result window will be shown.



```
Covariance Matrix:
180.807853 204.569605 303.877257 -91.216855 198.524951
204.569605 241.897137 363.051532 -68.916972 276.147315
303.877257 363.051532 561.742892 -120.422853 454.445382
-91.216855 -68.916972 -120.422853 750.419092 309.689252
198.524951 276.147315 454.445382 309.689252 809.172166
Correlation Matrix:
1.000000 0.978176 0.953500 -0.247636 0.519022
0.978176 1.000000 0.984882 -0.161755 0.624173
0.953500 0.984882 1.000000 -0.185476 0.674050
-0.247636 -0.161755 -0.185476 1.000000 0.397424
0.519022 0.624173 0.674050 0.397424 1.000000
```

Please include the results in your report, and discuss which two bands are mostly correlated and why.

6. Band substitute color composite

Do the standard color composite, and then substitute one of bands in the standard composite with the Pan band, and do the color composite. Place tell which band should be substituted by the pan band and why (hint: based on the covariance matrix). Zoom in both color composite, and see what is difference between two composites in term of resolutions.

Also please discuss why we need to set the spatial resolution for red, green, and NIR bands at the same resolution as the Pan band.