# LSGI522 Spatial Data Acquisition

#### Practical 3 – Remote Sensing

N.P. This information is a guide only. What you see on your computer monitor and the information you enter may very well be different to that which is shown here.

#### Exercise (1)

#### Image to Map Registration

#### <u>Aims</u>

In doing this exercise you should achieve the following:

- 1. Register an image to a map coordinate system (geo-reference of an image)
- 2. Perform a supervised classification through training different sets of data

#### <u>Materials</u>

- A. Dataset
- 1. **Tsingyi.ers** (SPOT image dataset)
- 2. **11NWA.erv, 10NEB.erv, 7SWC.erv, 6SED.erv** (ER Mapper Vector files (.erv) of roads from HK Lands Department)
- 3. road\_kl.erv (ER Mapper Vector files of roads in Kowloon and northern HK Island)
  - All data can be downloaded from:

<u>https://connectpolyu-</u> <u>my.sharepoint.com/:f:/g/personal/18045096r\_connect\_polyu\_hk/EslyQR9umUlF</u> vyNbpoR28WQBuUUyZSVJPB8kVmZ1mlCcjw?e=EUgjDu)

#### **B.** Software

1. Erdas Ermapper 2016 (<u>https://www.hexagongeospatial.com/products/power-portfolio/other-producer-products/er-mapper</u>)

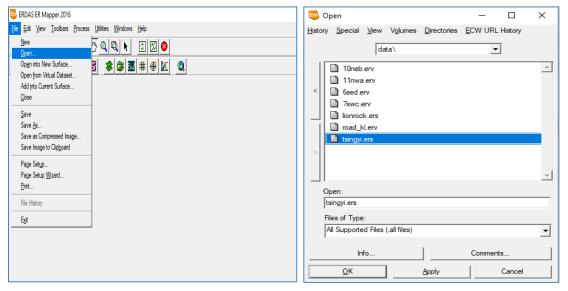
#### C. Tutorials

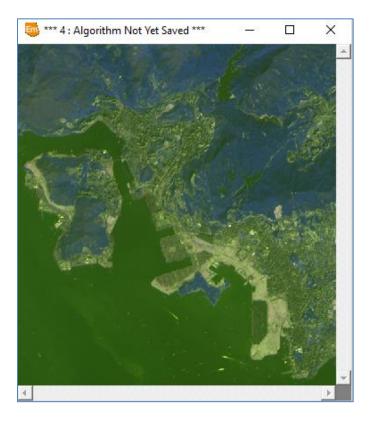
• User guide for Erdas Ermapper 2016

#### **Methodology**

Please conduct the following tasks following the provided instructions.

File → Open → Volumes → Choose the correct directory for the data → Choose "tsingyi.ers". Then press OK. A satellite image is shown on the pop-up window.



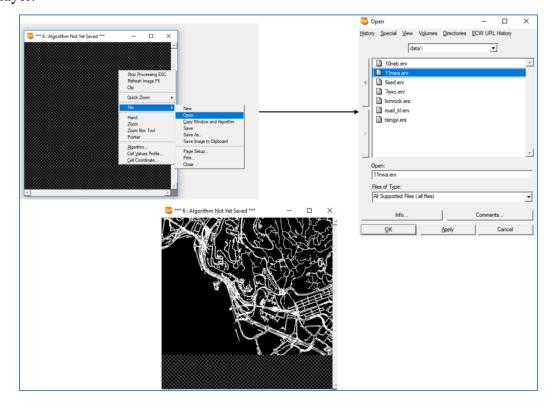


2. Press Edit Algorithm 🔊 button and press Edit Add Vector Layer->

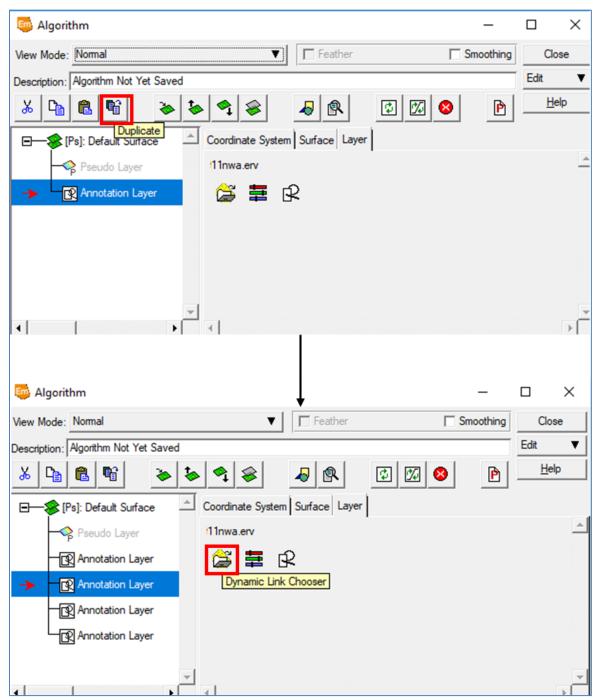
S Algorithe 5 ERDAS ER Mapper 2016 lose Close Vew Mode: Norma <u>File Edit View Toolbars Process Utilities Windows Help</u> Description: Algorithm Not Yet Saver 0 🛎 19 🖬 🛎 🕐 🤍 🔍 💺 🖾 🐼 😣 P Help Coordinate System Surface Layer x 🕸 🛤 🖉 🚱 🚳 🚳 🖧 🛤 🖗 📉 🍳 E-8 (RGB): RGB 321 Red Layer tsingyi.ers Edit Algorithm Green Lay 4 1 × Calgorithm X View Mode: Normal ₩ S Description: Algorithm Not Yet Saved 8 📭 🚯 📽 💊 🗞 🍕 🛞 1 1 P - 🛠 [RGB]: RGB 321 Coordinate System Surface Layer Region Layer ARC/INFO Coverage Red Layer Ctrl+X Ctrl+C Ctrl+V Ctrl+P Cut Anc. Inno Colerage Contours Grid Datasource Points Grid Datasource TIN AutoCAD DXF MicroStation DGN File External Vector formats PostScript Release 4 Map Composition (Daps Simple Grids Tabuter Data Tabuter Data (→ B3:Band 3 Green Layer I 業 ※ → Emit 3 Copy Paste Duplic Properti Ctrl+P • Example User Dynamic Link

**Annotation/Map Composition** 

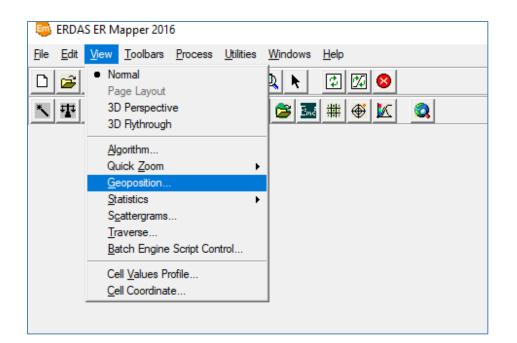
3. Windows New Windows. Load the ErMapper vector file 11NWA.erv to the selected layer.

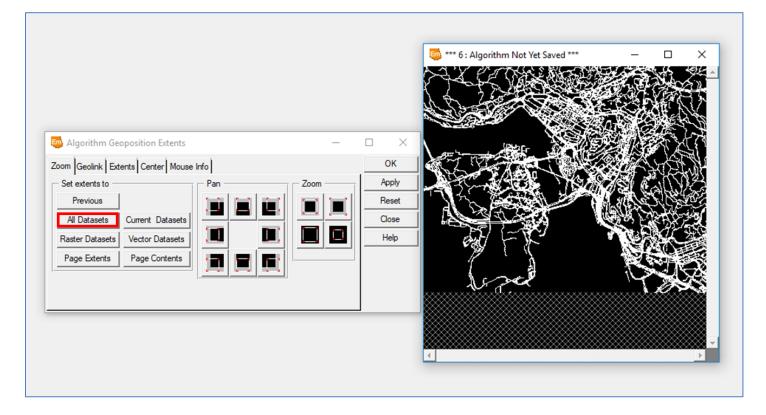


4. Add 3 more Vector layers by clicking the **Duplicate** button , <u>select them</u> <u>individually</u> and load into them the <u>other 3 vector files</u>.



 Under View → Geoposition, select Zoom to All Datasets. Check that all four maps are loaded. Press All Datasets to zoom to all data





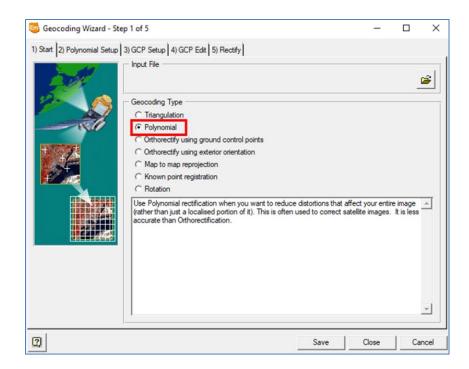
Under File → Save As, save the roads map composition as an <u>Algorithm</u> (\*\*.alg) to your own directory

👼 ERDAS ER Mapper 2016	👼 Save As — 🗆 🗙
Edit       View       Icolbars       Process       Utilities       Windows       Help         New       Open       Image: Color of the second	History Special View Volumes Directories ECW URL History  emapper  applications  data_types  functions_and_features
Save Save As Save as Compressed Image Save Image to Clipboard Page Setup Page Setup <u>Wi</u> zard Print	miscellaneous shared_data
1 C:\LSG\11nwa.erv 2 C:\LSG\tsingvi.ers 3 C:\LSG\6sed.erv 4 C:\LSG\10neb.erv 5 C:\LSG\road_kl.erv	Save as:
Egt	Info Comments           OK         Apply         Cancel

7. On the main menu, select Process → Geocoding Wizard , and enter the input image to be corrected (i.e. *Tsingyi.ers*)

👼 Geocoding Wizard - Ste	p 1 of 5			×
1) Start 2) Triangulation Setup	3) GCP Setup 4) GCP Edit 5) Rectify Input File			<u>é</u>
	Geocoding Type  Triangulation  Polynomial  Orthorectify using ground control points  Orthorectify using exterior orientation  Map to map reprojection  Known point registration  Rotation  Use Delaunay Triangulation to rectify your image when you want to reduce loc	al distor	tions.	
	This is often used with images from airborn scanners where inaccuracies hav introduced by unexpected aircraft movement (e.g. wind shears). It is less accu Orthorectification.	e been		*
2	Save	ose		Cancel

8. Choose **Polynomial registration**. This is a fairly simple type of correction as there are no scale distortions across a single SPOT image, as there are with air photos.

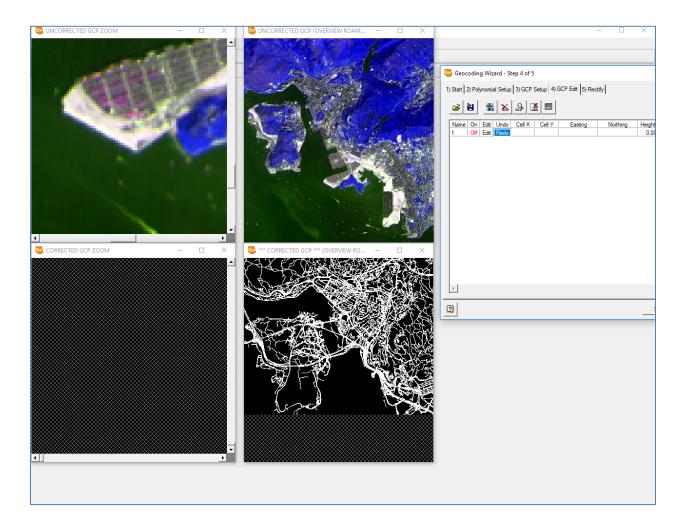


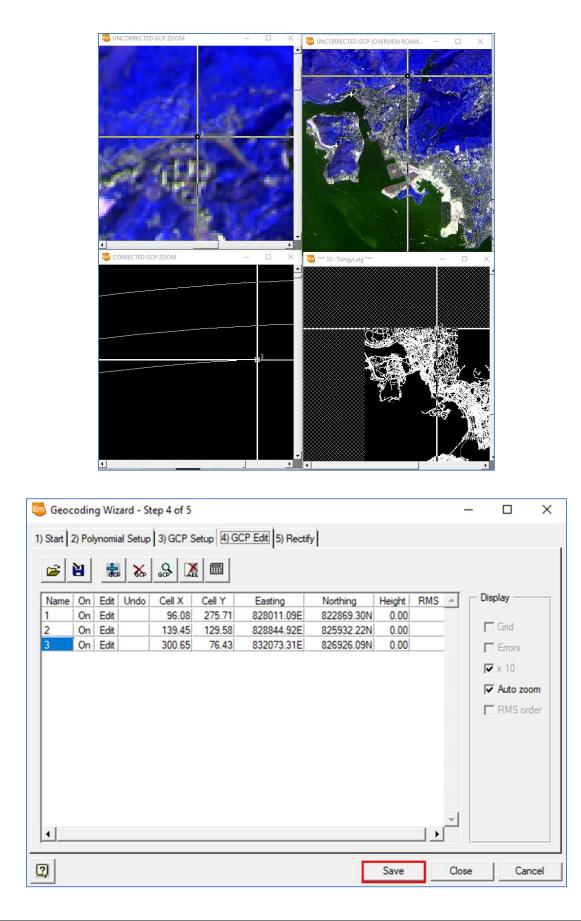
- 9. Click on GCP Setup. Your picking method is Geocoded image, Vectors or Algorithm, so enter the <u>algorithm of roads</u> that you just saved
- 10. Your output coordinate space will be given.

5 Geocoding Wizard - Ste	o 3 of 5	_		×
	3) GCP Setup 4) GCP Edit 5) Rectify GCP Picking Method ✓ Geocoded image, vectors or algorithm. C:\LSGI522\Practical 3 - Remote Sensing\Tsingyi.alg ⊂ Select GCP's from a digitizer.			3
	Ground control points (GCP's) are identifiable features in the uncorrec coordinate location. GCP's can be entered from survey sheets, from i coordinate space or from paper maps using a digitizer. Output Coordinate Space Choose Coordinate System			wn
	Coordinate type: Eastings/Northings  Coordsys Description: LOCAL Units: natural EPSG Code: N/A GDT Code (Datum/Proj): WGS84 / LOCAL	J		
0	Save	Close	Car	ncel

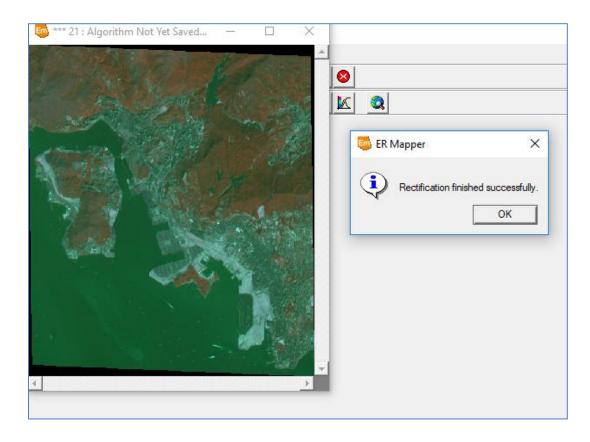
## 11. Click on GCP Edit

	up 3) GCP Setup 4) GCP Edit 5) Rectify GCP Picking Method
	Geocoded image, vectors or algorithm. C:\LSGI522\Practical 3 - Remote Sensing\Tsingyi.alg
	Select GCP's from a digitizer.
<b>()</b>	Ground control points (GCP's) are identifiable features in the uncorrected image that have a known coordinate location. GCP's can be entered from survey sheets, from images in a compatible coordinate space or from paper maps using a digitizer.
	Output Coordinate Space Choose Coordinate System
	Coordinate type: Eastings/Northings
	Coordsys Description: LOCAL Units: natural EPSG Gode: N/A
	GDT Code (Datum/Proj): WGS84 / LOCAL





👼 Geocoding Wizard - St	tep 5 of 5 — 🗆 🗙
1) Start 2) Polynomial Setup	3) GCP Setup 4) GCP Edit 5) Rectify
	Output Info File: C:\LSGI522\Practical 3 - Remote Sensing\data\rec6_tsingyi.ers
	Size: 1.03 MB ECW
	Lines: 645 Target Compression Ratio: 20
	Cells: 558 Target ECW Version: ECW v2
<b>*</b>	Edit Extents
<u>5 5 7 5 5</u>	LZW Compress
	Cell Attributes
	Cell size X: 19.7543 Meters
	Cell size Y: 19.7543
	Null cell value: 0
	Resampling: Nearest Neighbor   Default Cell Size
	Display rectified image
2	Save Close Cancel



#### **Procedures in ArcGIS**

#### Go into ArcGIS $\rightarrow$ ArcMap

- 1. Under File, on the main menu, select Add Data
- 2. You can now add the <u>rectified image</u> as an <u>Image Theme</u>.
- 3. Choose the <u>.ers</u> file which you saved in ER Mapper.
- 4. Select this ers image, then **Right Click**, go to **Properties** → **Symbology**, choose the appropriate bands for <u>Red Green Blue channels</u>, and then select <u>Stretch Type</u> as **Standard Deviations**, this is the color equalization and same as that in ER Mapper.

tretched	Draw raster as a	n RGB composite
GB Composite	Bands	
	Red Red	Band_1
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	🔽 Blue	Band_3
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		Display Background Value: 0 as Display NoData as

- 6. Load the road vector layers <u>road\_kl.erv</u> and change the line colors to yellow and white by clicking on the **Symbol Selector** of the layer
- 7. Examine the performance of rectified image by comparing with the reference vector layers.

#### Exercise (2)

#### **Supervised Classification**

- Copen × 🌼 \*\*\* 9 : Algorithm Not Yet Saved \*\*\* × History Special View Volumes Directories ECW URL History data \ • ^ 10neb.erv 11nwa.erv 6sed.erv 7swc.erv rec6\_tsingvi.ers road\_kl.erv tsingyi.ers Open lionrock.ers Files of Type: All Supported Files (.all files) • Info Comments. OK Cancel Apply
- 1. Open a color display algorithm and load the lionrock.ers dataset

2. From the Edit menu, select Edit/Create Regions (<u>draw vector polygons to define several</u> <u>feature classes in the image as raster regions</u>)

					1	Select Rectangle
5 New Map Con	nposition	-			tools X	*** 1 : Algorithm Not Yet Saved *** – 🗆 🗙
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					Close	



3. Click on the '**Region Layer**' layer to select it, then click the **Open Color Chooser button** to choose a color on the Algorithm window for your training polygons to be defined. Click OK.

## A) Define a region to represent the first feature type

- I. Take extra care as you digitize the regions making sure that you do not create small, 'invisible polygons' by clicking more than once, except when you want to close the polygon (do this by two sharp clicks – only two!). Name your regions as you define them (using the **Edit Object Attributes button**). Make sure that all polygons of the same feature class have the same name, as the name becomes the text attribute of the feature type. Any misspelling will be recognized as a different class.
- II. Continue to define all classes in the image in the same way,
- III. Save the regions to your LIONROCK.ERS dataset using the Save button on the Tools palette dialog. When asked to confirm the overwriting, click OK to proceed. The next dialog indicates that all your training regions were added to the dataset header. Click Close to close it.

Now the region outlines, and names are saved to the header file (.ers) of the LIONROCK dataset. You can now calculate statistics for the pixels in each region.

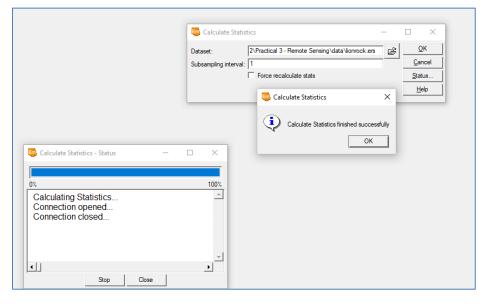
- IV. Click Close on the Tools palette to close it.
- V. Close ALL the windows (including the algorithm window for image display) except the ERMapper Main Menu.

#### B) <u>Calculate statistics for the training regions</u>

I. From the Process menu, select Calculate Statistics.

# The LIONROCK dataset should be chosen by default because it is the dataset used in the current algorithm.

- II. Select the Force Recalculate Stats option (to calculate statistics again in case they have previously been calculated). Change the default subsampling interval of 4 to 1.
- III. Click OK to start the statistics calculation.
- IV. When the calculation is finished, click Close and Cancel on the two menus respectively

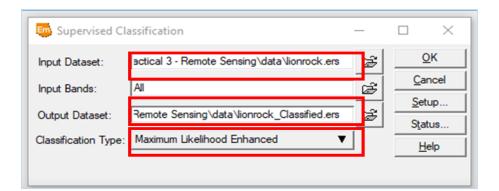


#### C) <u>Classifying the image</u>

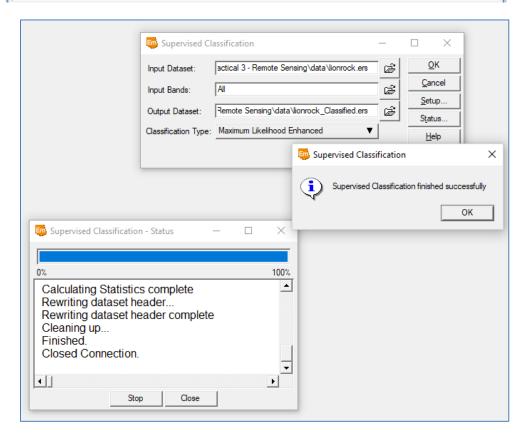
Training region statistics can now be used to perform a Supervised Classification on the entire image that assigns each pixel to one of the "**n**" feature classes you defined.

I. From the Process menu, select **Classification**, then select **Supervised Classification**.

#### N.P: Each group should try at least two different classifiers



Supervised Classification	secup	_	
	num Likelihood Enhanced	<b>V</b>	Close
Equal Prior Probability: 🔽			Add New
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Training Area Information:		Bayesian	Gen Post Pro
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lionrock.ers	Natural ground	0.25000	× -
lionrock.ers	Ocean	0.25000	<b>v</b>
lionrock.ers	Building	0.25000	~
lionrock.ers	Vege	0.25000	V



#### D) **Displaying the classification**

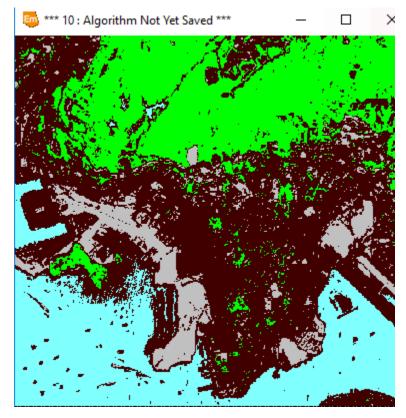
- I. First close all files/algorithms, then click on the View | Algorithm for Image window button.
- II. Click on Surface and choose Colour mode as Pseudocolour and Colour table as Greyscale. Switch back to 'Layer'.
- III. Click on the Load a Dataset button and load your classified image (lionrock\_classified.ers)
  Your classified image will be displayed in grey scale, but you need to set Limits to Actual on the Transform dialogue, in order to see it!.
- IV. Examine the classified pixel values using View, Cell values profile. Values should not exceed the number of classes you defined. Close all windows except Main Menu.
- V. Open the Algorithm for image window and under Edit, choose Add Raster Layer and select Class Display.

	Algorithm     -     □       Vew Mode: Nomal     ▼     Feather     □ Smoothing       Description:     Image: Smoothing     Image: Smoothing     Image: Smoothing       Image: Smoothing     Image: Smoothing     Image: Smoothing     Image: Smoothi	Close idit ▼ Help	
	Algorithm		- x
A) <u>Displaying the classific</u>	Vew Mode: Normal	Smoothing Pseudo Red Green Blue Hue Saturation Intensity Height	Close Edit Add Raster Layer Add Vexor Layer Add Vexor Layer Add Vexor Layer Add New Surface Ctrl+N Cut Cut Copy Ctrl+C Paste Ctrl+V Duplicate Ctrl+D
Algorithm View Mode: Normal Verw Mode: Normal Description Descrip		Class Display Classification	Properties Curl+P

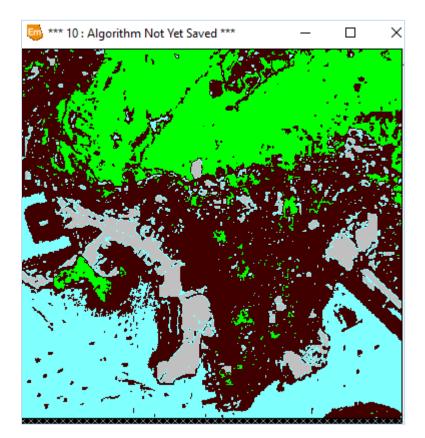
- VI. Under Load Dataset, read in your classified image.
- VII. On the ErMapper main menu, select Edit...Class Region Color and Name.

taset:	C:\Users\REDA\Documents\LSG	1522\data\lionrock_calssified.	ers	6	Save	e
Class	Name	Co	blor		<u>C</u> anc	
	All	black	Set color	∎≜	<u>A</u> uto-gen o <u>H</u> elp	
1	Natural ground	192,192,192	Set color		<u></u>	
2	Ocean	128,255,255	Set color			
3	Building	128,64,64	Set color			
4	Vege	green	Set color			

VIII. Make sure your classified image is in the file selection window, then select colours for each class. Save this colour scheme (it will save to the image header) then read your image in again under Load Dataset.



IX. Finally, make your classified more map-like by using a Modal (majority) filter. Click on the Edit Filter button on the Process Diagram.



# **Submission**

Each student is required to submit a zipped file (named with your student number e.g., 1800xx1g.zip) that contains:

- 1. The algorithm files and a step by step images for the image to map registration process.
- 2. Images include the training samples (at least two sample for each class) and the classification results
- 3. A report of 20 pages maximum that accurately describes:
  - a. The representative screenshots in each step
  - b. The evaluation of the rectified image with the vector map on ArcMap
  - c. A discussion about the results (image to map registration remarks and the effect of changing the classifier on the classification results)

# <u>The report must reflect what you have learned in this practical may be re-assessed in the</u> <u>final exam.</u>

The zipped report should be sent to (<u>fekry.khaliel@connect.polyu.hk</u>) before the submission deadline.

# Submission deadline: 27<sup>th</sup> October 2020

Contact: <a href="mailto:fekry.khaliel@connect.polyu.hk">fekry.khaliel@connect.polyu.hk</a>

Room: **ZN617**