

Land cover classification and validation

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Resilient nations



Outline

- Remote sensing and Satellite images
- Landsat 8
- Pre-processing and Processing
- Tools to process satellite images
- Supervised and Unsupervised classification
- QGis Dzetsaka plugin for land cover classification
- Validation of derived datasets
- Limitations







Remote sensing



"The process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area. Special cameras collect remotely sensed images of the Earth, which help researchers "sense" things about the Earth."







Wave bands

"Observations of earth from space use small number of wave-bands where atmosphere is relatively transparent and radiation can travel unimpeded visible, infrared and microwave"



Water Quality Assessment for Dukan Lake Using LANDSAT 8 OLI Satellite Images - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/Fig-3-2-The-diagram-shows-the-wavelength-and-frequency-ranges-of-EM-radiation_fig2_315717521 [accessed 18 Apr, 2018]

















Imaging satellites

- *GeoEye:* 0.41-1.65 meters ground resolution
- **Digital Globe:** 0.46-0.31 meters ground resolution
- *Spot Image:* from 2.5 m to 1 km ground resolution
- **ASTER:** 15m
- BlackBridge (previously RapidEye): 5 meters EROS: 70cm resolution panchromatic
 Landsat 8: 30m (15m)
- panchromatic)
- Sentinei: 10m









Landsat a timeline



UN-REDD

PROGRAMME

Source: Young et al. (2017) "A survival guide to Landsat preprocessing"





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Pre-processing and processing

- Pre-processing: procedures to format, correct the data for the distortion caused by sensor, solar, atmospheric and topographic effects, and enhance the data to facilitate the interpretation
- **Processing:** classification of targets and features

	Digital number			
ssing	At-sensor: (radiance)	Conversion to radiance		
More preproce	Top-of-atmosphere: (reflectance, brightness temperature)	Solar correction/ thermal calibration	Electromagne	
	Surface: (reflectance, temperature)	Atmospheric correction		Source: Young et al. (2017) "A survival guide to Landsat preprocessing"





Tools to process satellite images

- Google Earth Engine
- ERDAS Imagine
- ENVI

- ENVI
- FAO Collect Earth and OPENFORIS tools
- QGis toolboxes: Orfeo toolbox, Semiautomatic Classification Plugin, Dzetsaka plugin





ERDAS











Pre-processing in QGis: the Semiautomatic Classification Plugin

bownload images	🎎 Tools	Preprocessing	Postprocessing	Band calc	💋 Band set	S Batch	👗 Settings	🤛 About
		Se	emi-Automatic C	lassification	Plugin			
			Version 5.3	.11 - Kourou				
Developed by <u>Luca</u>	Congedo (ing.	.congedoluca@gmai	l.com), the Semi-Au	Itomatic Classif	ication Plugin	(SCP) is a fre	e open source	plugin for
	ule semi-du		i(also supervised cia	ssincation) of rei	note sensing in	ayes.		
It provides several t	ools for the d	lownload of free ima	iges, the preprocessi	ing, the postproc	essing, and the	raster calcula	ition.	
For more informatio	on and tutoria	Is visit the official sit	e From GIS to Rem	ote Sensing				
or more mornidu		is their the official all		oce oenoing.				
		GIS						
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Semi-Automatic Class		i group on Facebook						
Semi-Automatic Clas	sification Plugir	<u>n community on Goo</u>	<u>qle+</u>					
This pluain reauires	s the installati	on of GDAL. OGR. N	umpy, SciPy, and Mat	tolotlib (alreadv l	oundled with OG	<i>15).</i>		
				,	,			





The Pre-processing toolbox

Canasat Sentinel-2	ASTER	🙈 MODIS 🛛 👌 💑 Clip multip	ple rasters 🛛 🎶 Split raster t	bands 🛛 🌅 Stack raster bands	s 🔰 PCA 💽 Vector	to ras		
Landsat conversion to TOA reflectance and brightness temperature								
Directory containing Landsat bands D:\SatelliteImages Liberia\LC08 L1TP 200055 20180113 20180119 01 T1								
Select MTL file (if not in Landsat d	directory) D:/S	atelliteImages_Liberia/LC08_L	1TP_200055_20180113_201801	19_01_T1/LC08_L1TP_200055_20	0180113_20180119_01_T1_MT	L.txt		
Brightness temperature in Ce	elsius							
Apply DOS1 atmospheric corr	rection			🔽 Use NoData v	alue (image has black border)	0		
Appry DOST atmospheric correction								
Perform papeharpening (Land	Perform pansharpening (Landsat 7 or 8)							
Perform pansharpening (Land	lsat 7 or 8)							
 Perform pansharpening (Land Create Band set and use Band 	lsat 7 or 8) d set tools							
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Corresponding Bands in Landsat 8

Band	Wavelength	Useful for mapping
Band 1 – Coastal Aerosol	0.435 - 0.451	Coastal and aerosol studies
Band 2 – Blue	0.452 - 0.512	Bathymetric mapping, distinguishing soil from vegetation, and deciduous from coniferous vegetation
Band 3 - Green	0.533 - 0.590	Emphasizes peak vegetation, which is useful for assessing plant vigor
Band 4 - Red	0.636 - 0.673	Discriminates vegetation slopes
Band 5 - Near Infrared (NIR)	0.851 - 0.879	Emphasizes biomass content and shorelines
Band 6 - Short-wave Infrared (SWIR) 1	1.566 - 1.651	Discriminates moisture content of soil and vegetation; penetrates thin clouds
Band 7 - Short-wave Infrared (SWIR) 2	2.107 - 2.294	Improved moisture content of soil and vegetation and thin cloud penetration
Band 8 - Panchromatic	0.503 - 0.676	15 meter resolution, sharper image definition
Band 9 – Cirrus	1.363 - 1.384	Improved detection of cirrus cloud contamination
Band 10 – TIRS 1	10.60 - 11.19	100 meter resolution, thermal mapping and estimated soil moisture
Band 11 – TIRS 2	11.50 - 12.51	100 meter resolution, Improved thermal mapping and estimated soil moisture







Results for Bomi county









Supervised and Unsupervised classification







Dzetsaka plugin

It's a fast and easy to use, but also powerful classification plugin for QGis.

It uses the following classifier:

- Gaussian Mixture Model
- Random forest

R

O

• Support Vector Machines

GRAMME

• K-Nearest Neighbours

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Photography b	y Guillaume Feuillet. PAG	
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id		▼) Model
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Dzetsaka step 1

- Define the land cover classes and create a table
- Create the training polygons using the field data

Id	Class name
1	
2	
3	
4	
5	







Dzetsaka step 2















Validation of land cover datasets

Step 1 Harmonize the classes in the datasets to be validated and the field data classes

Step 2 Compile the data collected in the field in a spreadsheet and import the file in QGis . Compare the data

Step 3 Create a confusion matrix

Step 4 Calculate accuracy parameters







Validation step 1: Harmonize data

Map land cover class	Field data
Tree cover > 80%	
Tree cover 30-80%	
Tree cover <30%	
Settlements	
Surface water bodies	
Grassland	
Shrub	
Bare soil	







Validation step 2: compile and compare the data

GPS point	x	Y	Forest type	CC1	CC2	CC3	CC4	CC percentage class	Geoville Classificat ion









Validation step 3: confusion matrix

	Ground tr	uth data								
Map classification	Tree cover > 80%	Tree cover 30-80%	Tree cover <30%	Settlem ents	Surface water bodies	Grassland	Shrub	Bare soil	Classifica tion total	Correct samples
Tree cover > 80%										
Tree cover 30- 80%										
Tree cover <30%										
Settlements										
Surface water bodies										
Grassland										
Shrub										
Bare soil										
Reference total										







Validation step 4: calculate accuracy parameters

- Overall accuracy parameter: <u>N. correct points/total number of points</u>
- User's accuracy: *Diagonal total for class a/Row total for class a*
- Producer's accuracy: *Diagonal total for class a/Column total for class a*
- Commission error: *1-User accuracy for class a*
- Omission error: 1-Producer accuracy for class a
- Kappa coefficient:

 $\frac{OA - \sum (Row \ i \ total * Column \ i \ total/N) / N}{1 - \sum (Row \ i \ total * Column \ i \ total/N) / N}$







Kappa statistic strength of agreement

Kappa statistic	Strength of agreement
< 0.00	Poor
0.00 – 0.20	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 – 0.8-	Substantial
0.81 - 1.00	Almost perfect







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Thank you!

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