Remote sensing, Fall 2018

Lab 7 Feature Extraction

Lab goals

Satellite images like air photos can be used for manual interpretation, but because they are digital, we can use image processing techniques to semi-automatically extract vector features. The specific goal in this week's lab is to create vectors for 2-3 class features which you can clearly identify and reduce to a manageable number of polygons.

There are five main steps:

- Generate a clean layer containing the desired features –a bitmap or raster channel from THR or Ratio-Index-Transform or Classification
- SIEVE to create a manageable number (sieve works only on raster channels)
- Generate vectors (raster to vector) –RAS2POLY or BIT2POLY
- Smooth vectors - SMMCMASTER
- Examine and clean attribute table - calculate area stats (in Geomatica or GIS)

Features to extract:

- 1. Water (twice)
- 2. Avalanche slopes

Start PCI Geomatica in the usual way

Open your copy of the Bowron Lakes clipped 2009 image you used in last week's lab
You should know/remember what each channel is - relabel them if it's not clear - files tab, right-click on filename, right-click on the channel - properties, and relabel
You will need: bands 3,4,5, NDVI slope and incidence ('ANG')

---

1. Extracting water

We need to create a layer that has only water …

Query the DN values in the NIR band (4) to find typical maximum values for water
we will first try to use the thresholding Tool THR in the Algorithm Librarian

In the THR options, input raster is the NIR band (4)
Output = viewer
Minimum = 0 (Input params)
Maximum = you pick!

In Prince George (lab 2), this worked quite well apart from a few shadowed eskers pixels, but here the deeply shadowed mountainsides have values as low as water.
What else might distinguish water from shaded mountainsides – how about slope DUH !
Water is flat, but sadly our slope model from last week created N/A instead of 0 for flat.

Instead we can use ANGle of Incidence - remember how the ANG DNs on water was the same as the vertical angle you chose to create ANG ? (likely 52, possibly 51)
So we know the DN (Incidence) for water - some slopes would have the same DN, but NOT on shadowed slopes (why not ... good exam question!!)

Refine our method for extracting water - we need a double query which we can't do in THR

First create some empty bitmaps and add the first (empty) one to the display
Add bitmaps to pixfile: Files Tab -right-click on filename, new-bitmap layer (and add maybe 3)
Add to display: Maps tab, layer-add-bitmap (and pick your first empty bitmap)

Select Tools-EASI modelling

the conditions will be Band 4 < ?? (the maximum DN for water) AND Incidence channel > 50

e.g. (don't type '???' or 'bitmapnumber'- insert the appropriate numbers!)

If %4 < ?? AND %???>50 ..... then
%%bitmap number =1
endif

This should give you a separation of just lakes - maybe not rivers which are often too narrow to fill a steady line of pixels

1b. SIEVE - NO SIEVE this time

In fact we can't sieve a bitmap and in this case we won't try to sieve the water, so we skip to convert to vector ...

1c. algorithms -> use BITPOLY (converts bitmap to polygon)

Input bitmap: enter the bitmap number
Input params: smooth vectors box should be checked
display on viewer
Run .... how does it look - you may need to check off the bitmap display to see the lines OR change the colour of the lines (right-click on the vector layer name ... colour

If it's good, run again, but direct final output to your 2009 .pix file (always your PIX file !!!)

Repeat but this time uncheck the 'smooth vectors' option and save to file

You now have 2 new vector layers - edit the layer names so you know which is smoothed
Zoom in A LOT to view the difference

1d. SMCMASTER to smooth unsmoothed vector

the smoothing algorithms give different results - usually this one works better than the auto version in BIT2POLY. The inputs should be obvious by now
Run and compare with the previous vectors: zoom in a LOT again, and identify which you prefer

---

2. Vector clean-up

Right-click the vector layer in the contents, and view the attribute manager.

The areas are likely in square metres and we want them in square kilometres
Right-click on the Area column heading, select Table definition, change decimal places to 4 and display units to kilometres.

Now select field-> update geometry, apply and the summary values should be converted to kms.
What is the value given for total (sum) of all water ?

Layer-save as and save the water vectors as an **Arcview shapefile**. You can open/add this in geomatica or your favourite GIS. Name it so you know what it is (water)
- you could also have saved it using right-click on the polygon layer in the files tab
Note: you will need to 'hand in this shapefile' and area total for this week's lab assignment

---

3. Another way to isolate water - unsupervised classification

Use unsupervised classification
Input channels: bands 3,4,5 plus incidence*
Output - create an empty channel if you need one
k-means: use default values and run
*Including ANG (incidence) separates water from shadows, just as it did in EASI-modelling

Note the resulting class/cluster number for water (query the layer values)
Use THR to isolate just this cluster class e.g. input channel is the classification channel; if water is cluster 2, then min and max values are 2; the new bitmap from THR will be just water.

Repeat steps 1c and 1d to create this alternate water layer and determine its area in km^2 as in 2. above and save as a shapefile, named water 2. It should be quite similar to your first saved version, or you should know why it is slightly (but not hugely) different.

2. Avalanche slopes

These are not as easy to extract as water - nothing is !
One would assume they generally have the highest DN values in the NDVI layer.
Query the NDVI layer and determine approximate values for av.slopes
Use THR to check possible minimum threshold values maybe .50, .60 or .70 (?)

But you can see this includes other sites which are unlikely to be av. slopes.e.g. cutblocks
However we know (don't you?) that av.slopes are generally between 25-45 degree angles.
Too steep and snow doesn't settle; too gentle and it doesn't slide.

Use EASI modelling to create a condition where:
NDVI > 65 AND slope >25 AND slope <45
- and output this to an empty bitmap

Display the result on a 543 composite and you can see there's a problem - it excludes the lower part of the av.slope - the so-called 'run-out' section which has a lower gradient. Re-run your model changing slope >25 to slope >10
This won't be perfect and will add some non-slopes, but it should do

Change the output from an empty bitmap to an empty CHANNEL
e.g. in EASI modelling, instead of %%4=1; change to %15=255
(as we will need to SIEVE the result).

Sieve to a 1 hectare minimum area using connectedness value of 8 (to allow a diagonal slope); change to 2 hectares if there are still too many polygons

Run RAS2POLY (instead of BIT2POLY)
SMMCMASTER
Edit the vector layer as before to change area to kilometres, and save to a shapefile (avslope)

Final products for lab assignment 5%:

1. Area in square kms:

a. water from band4 threshold method

b. water from classification method

c. Avalanche slopes

2. supply the 3 shapefiles - as a zipped attachment (remember one 'shapefile' consists of a minimum of 3 files each .... in the Linux folders window, highlight all the vector files for water, water2 and avslope. Right-click and choose compress. Name it lab7.zip