GEOG 357

LECTURE 11

1

Change Detection Exercise

- Submit the description to the TA (stseng@unbc.ca) by Nov. 4th
  - No more than 300 words,
  - Paragraphs not bullet points
    - Include:
      - Location of the imagery (i.e., which country, city, reasons of choosing this location)
      - Dates of the imagery
      - Sensor and the bands used in the images
      - At least 3 detected differences in the images
- Do an in-class 3 mins presentation on Nov.4th

2

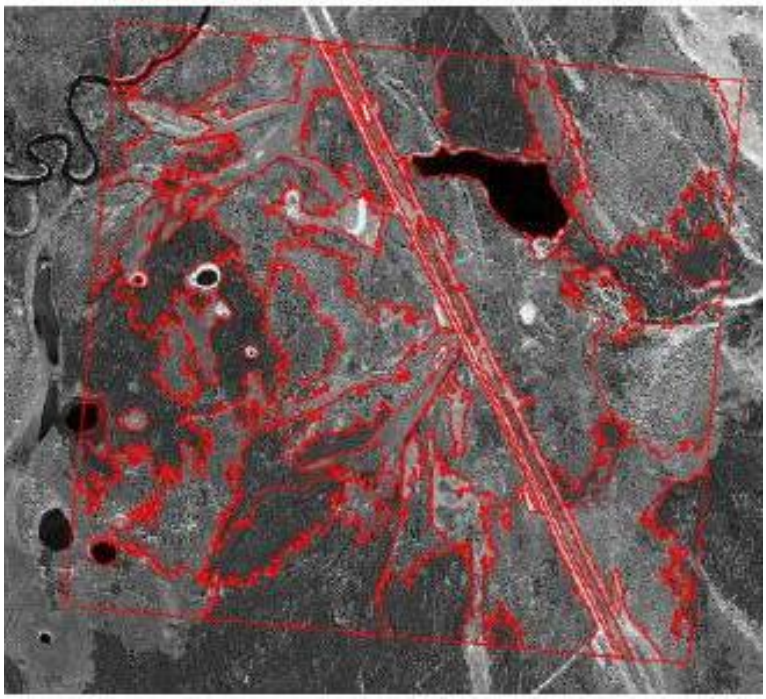
Feature Extraction

"The identification of geographic features and their outlines in remote-sensing imagery through post-processing technology that enhances feature definition, often by increasing feature-to-background contrast …. or using pattern recognition software."

ESRI GIS, definitions

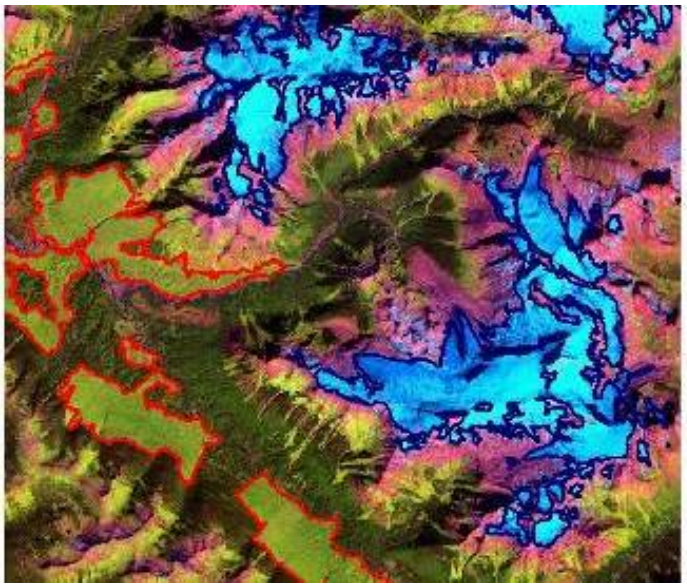
3

Manual 'feature extraction' by photo interpretation e.g. BC TRIM



4

Digital ‘feature extraction’ by ratio enhancement



5

Completion of the 1:50,000 National Topographic Database

Used Satellite Imagery 2000-2012

But used as background, not classifiable image data
Why not ?

Figure 12 illustrates the evolution of the Northern mapping project that began in 2004 up (light green to dark green). Complete map coverage will be achieved with the 2011-2012 production plan utilizing SPOT5/HRS and Radarsat-2 data sources (Figure 13)

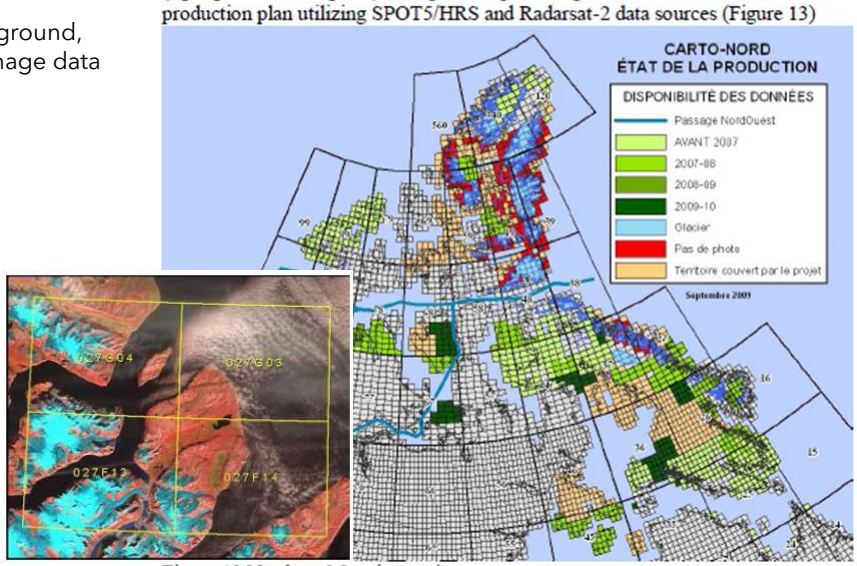


Figure 12 Northern Mapping project

https://cdnsciencepub.com/doi/pdf/10.5623/cig2011-004

6

Feature Extraction

- Feature Extraction uses an object-based approach to classify imagery
  - An object is a group of pixels with similar spectral, spatial, and/or texture attributes.
  - Provides more flexibility in the types of features to extract

7

Feature extraction (digitising) from aerial photography is the most tedious part of mapping ….. why hasn't remote sensing been used more to update GIS data layers ?

Principles of GIS: Aronoff (1986) – the first GIS textbook*

data are not well understood

data are too expensive

insufficient resolution

classification accuracies

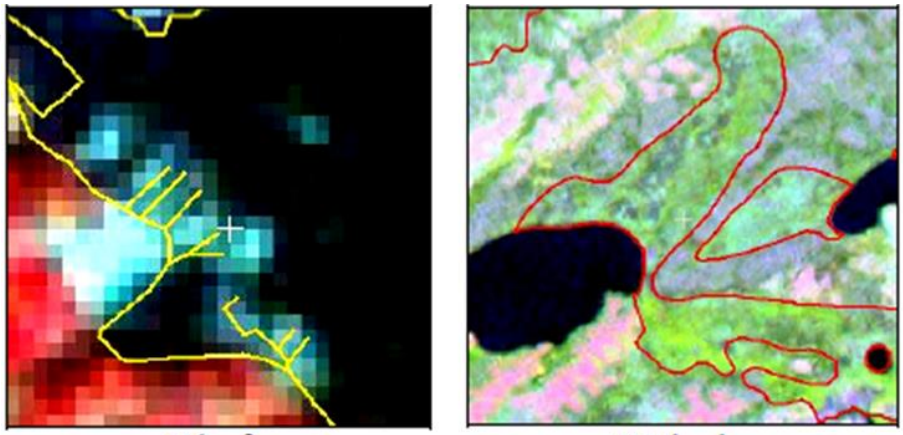
complexities of reality

– lack of homogeneity / contrast

** Stan Aronoff is a Canadian remote sensing author / expert*

8

Examples of resolution and complexity of reality



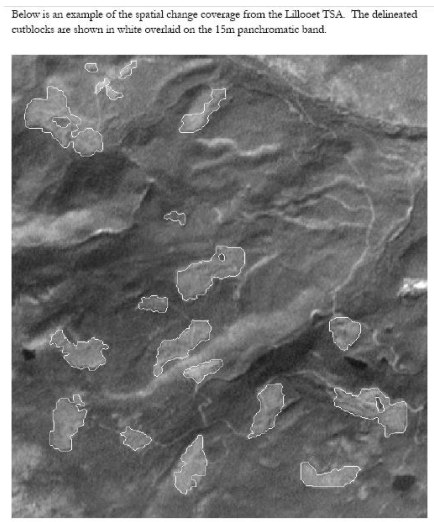
Higher resolution might help a. (left), but not b. (right)

9

BC: updating of Vegetation Resource Inventory

Where does it work?

- Feature **simplicity**
  - Consistent shape, contiguity
- Feature **homogeneity**
  - Consistency inside feature
- Feature **certainty**
  - Contrast with other features



10

- **Feature simplicity** e.g. cutblocks? alluvial fan deltas
- **Homogeneity** e.g. lakes, bare rock (sunlit)
- **Feature certainty** e.g. avalanche tracks, glaciers (?)

11

Process for creating feature vectors from image data:
(one could also manually digitise from digital imagery… boring / subjective)

1. Select bands / channels to maximise feature contrast

2. Classify (multispectral) or threshold (single channel)

3. Create feature raster channel or bitmap

4. Clean results -> sieve or filter (generalize)

… we've done all these …

12

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Coming up in the labs…

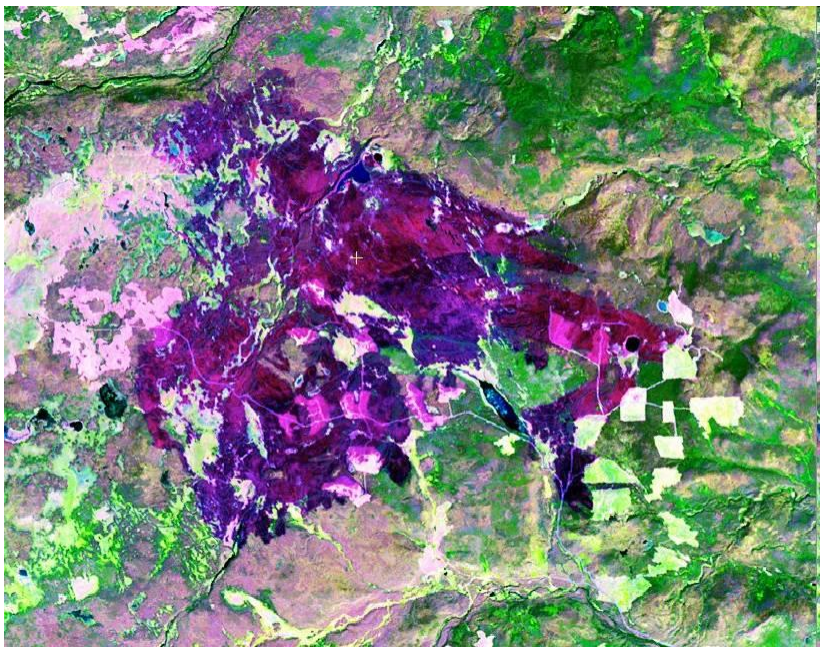
5. RTV -> Raster to Vector conversion -> polygons …

6. Smooth lines / generalise -> export to GIS

7. Massage attribute table / calculate areas etc.. (GIS)

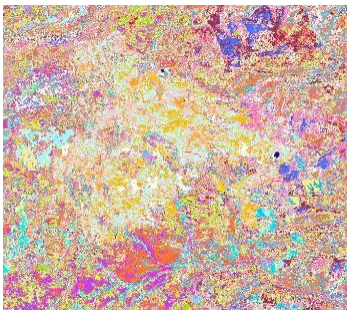
13

Project example to automatically map a complex fire polygon

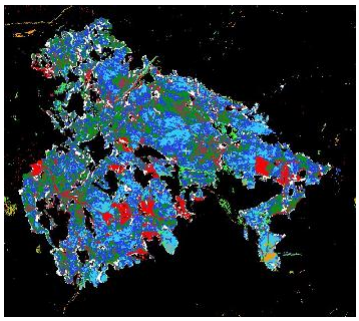


One approach: Normalised Difference Burn Ratio (NIR-MIR)/(NIR+MIR)

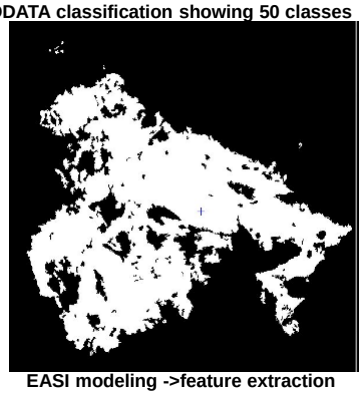
14



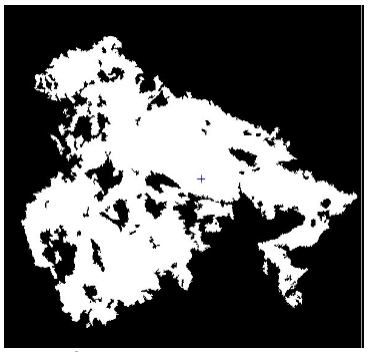
ISODATA classification showing 50 classes



Clusters 5, 7, 12, 15, 20, 25, 37 -> burn extent



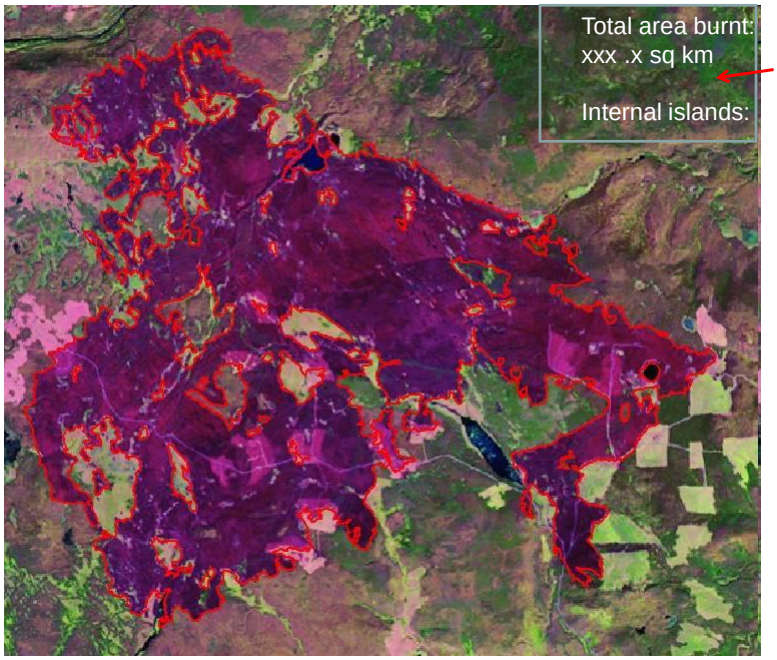
EASI modeling ->feature extraction



Sieve

15

5,6,7: RTV: Raster to vector conversion, smoothing, and tabulation

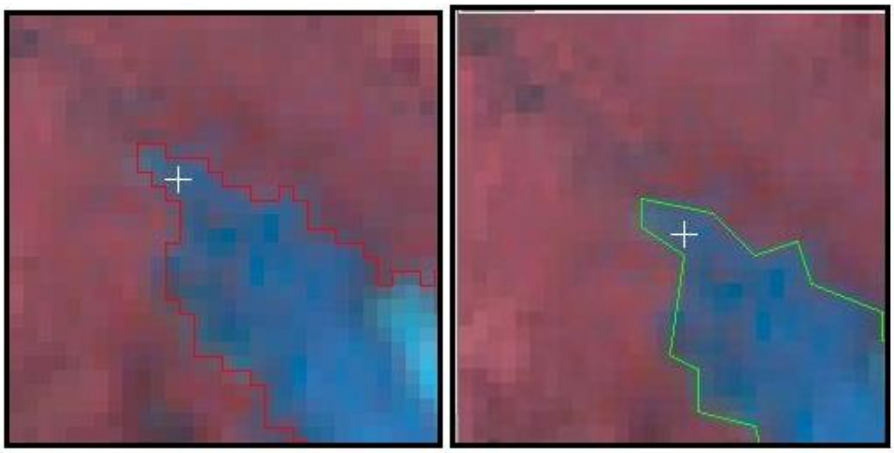


GIS tends to do this easier !

16

6. Generalise 'Smoothing the jaggies' … e.g. algorithm: smmcmaster

- Robert McMaster, derived from Douglas-Poiker algorithm

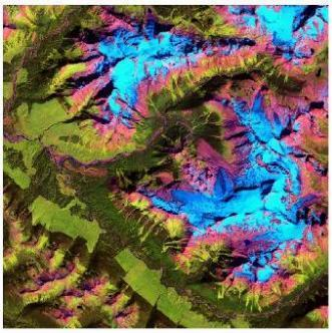


Several different algorithms for line generalisation (from GIS history)

Smoothing – more faithful to geography, but is it as accurate ?
- Compare with higher resolution PAN band if available or Google maps

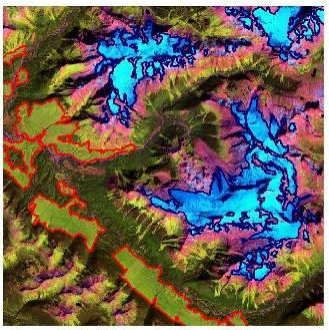
17

Extracting glaciers and cutblocks in Kakwa



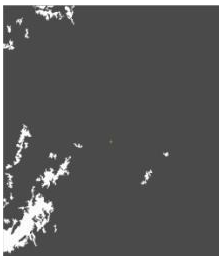
Glaciers/snow
TM 3/5
ratio -> 2.0

Cut blocks
-Deciduous
<-TM 4/3 ratio > 2.0



18

Extraction of Glaciers, Water, and Vegetation - the Southeast Coast of Greenland



Threshold images for ice, water and vegetation derived from ratios

19

Mt. Edziza, BC

Land cover boundaries

Based on: Classification or Greenness
a. 4/3
b. NDVI
c. TCA 2

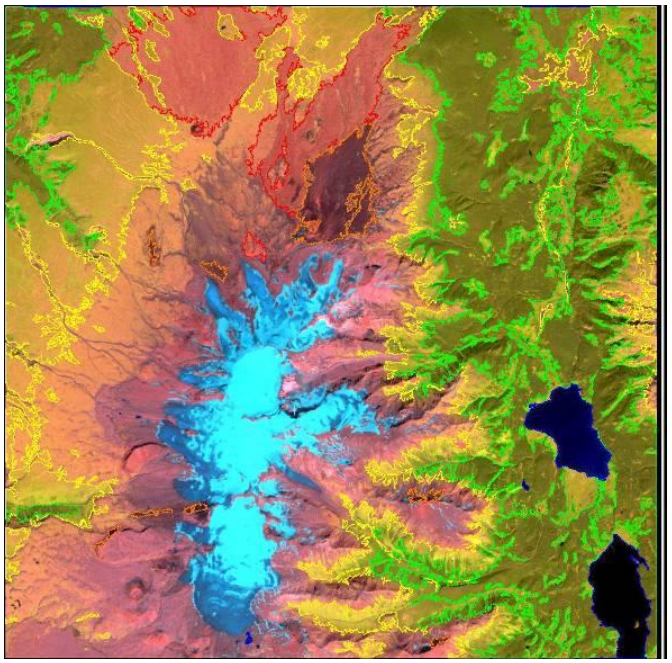
- Lava flows

- Bare ground

- Deciduous

- **Coniferous**

- **(Glaciers)**



20

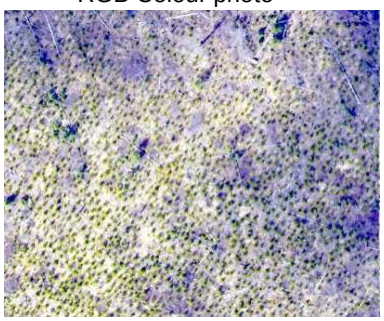
Extraction of road networks – lines – not easy!

http://www.gis.unbc.ca/courses/geog432/projects/2006/jaminf/index.htm

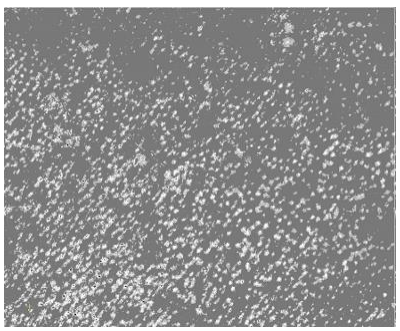
21

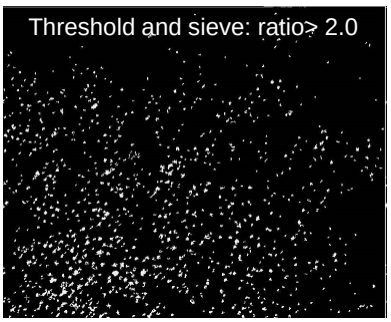
Experiment to extract trees as points to avoid digitising

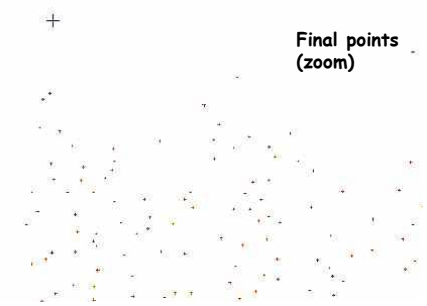
RGB Colour photo



Green / red ratio

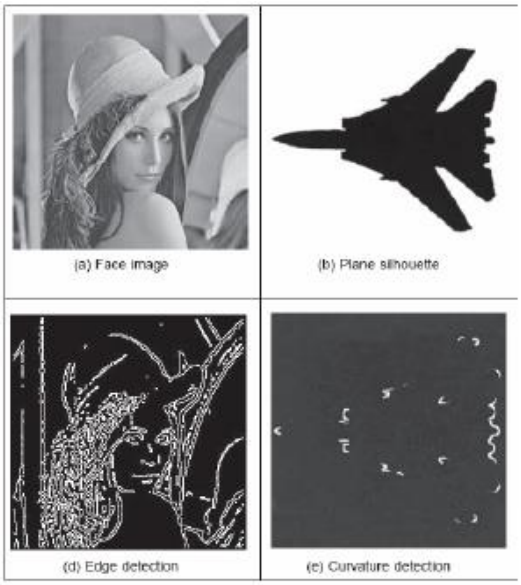






22

Feature extraction – other applications



http://www.ualberta.ca/~szepesva/CMPUT412/ip2.pdf

23