GIS in Water Resource Project Update

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Objective

The ultimate goal of Geographic Information System (GIS) is to model our world. However, the modeling process is too complicated and requires elaborateness that we should not rely entirely on computer. At this time, I will do the accuracy assessment of classification of raster pixels which is usually done by computer by comparing hand digitized reference image and look into how it varies depending on spatial resolution of the image by using spatial autocorrelation analysis.

Title

Application of spatial autocorrelation analysis in determining optimal classification method and detecting land cover change from remotely sensed data

STUDY AREA

- Fluvial region around Lake Travis, Austin TX (approximately 2km*1.5km)

DATA SOURCE

- Scene
  - · 2009 Landsat 7 ETM+ Images from USGS
    - · *LE70270392009032EDC00*
    - · *LE70270392009064EDC00*

- Reference data
  - · 2009 Aerial Photograph from Capcog (capcog.org) and Trinis (trinis.org)
    - · *TOP0809_50cm_3097_33_4_CIR_01062008 (natural color)*
    - · *TOP0809_50cm_3097_33_4_NC_01062008 (color infrared)*
    - · *MANSFIELD_DAM (29 mrsid files stitched)*
  - · Field Visit with GPS
  - · Other reference data
    - · *Land-cover map, vegetation cover map, hydrograph map, Google earth (for oblique view), daily water level data of Lake Travis from 2009*

PROCEDURE

- Three major analysis will be introduced in this research using spatial autocorrelation: 1) analysis of error produced based on different types of classification method, 2) monthly change detection using spatial autocorrelation, 3) changing pattern of error depending on spatial resolution.

- First, I will do hand digitizing for the aerial photograph and classify to 5 land-cover types: c_1, c_2, c_3, c_4, c_5 based on spectral value (i.e. c_1 is a class with the lowest spectral values and c_5 with the highest which are water and road respectively). Several methods of classification will be used including maximum likelihood, ISODATA, nearest neighbor and etc., for Landsat scene and will be overlaid with the hand digitized reference image to produce difference images. Different values of 0, 1, 2, 3, and 4 depending on the degree of disagreement will be assigned to each of the pixels in difference image in a white (0) to grey color scale (1, 2, 3, 4)[1]. Spatial autocorrelation will be performed within grey and black pixels in difference images in various distances to determine the most suitable classification method. For some of the sites that I'm not sure with the land-cover type, I will visit and see exactly what is there at the site.

- Once the optimal classification type is determined then multi-temporal (monthly) change detection based on spatial autocorrelation analysis will be performed between two different dated Landsat imageries. Difference image will be produced using the same method which is by using degree of disagreement to quantify the result. Through this process measuring the amount and quality of changing is possible.

- Last part of my study would analyzing the relationship between spatial resolution and the accuracy of automatic classification using spatial autocorrelation. The effect of level of spatial resolution to the map using spatial auto correlation has been performed (Chou, 1991); however, how the spatial resolution affect the difference image based on various classification method has not been done yet even though this is highly inferable. So at this time, I will quantify the effect of resolution in difference image using spatial autocorrelation.

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[1] **Difference Table**

Color scheme below will be assigned to the corresponding pixel. For example, if C_2 is classified as C_4 then 3 will be assigned to the corresponding pixel in difference image.

ETM+ / Reference	C_1	C_2	C_3	C_4	C_5
C_1	0	1	2	3	4
C_2	1	0	1	2	3
C_3	2	1	0	1	2
C_4	3	2	1	0	1
C_5	4	3	2	1	0

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 # As Project proceeds, more data and techniques will be added.