GEOG683: Project Proposal

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**Change Detection Analysis of Vegetation Cover at Carmel Valley**

**Introduction**

Remote sensing (RS) imagery has a synoptic and timely way of observing landscape across regions. It has been most commonly used to generate several land use and land cover (LULC) maps and to conduct LULC change analysis. Since vegetation is the majority of land covers on earth, understanding the change of vegetation cover assists human beings in developing many applications (e.g., resources and disaster management, urban planning, climate change mitigation, etc.) that promote our lives.

**Purposes**

Conventional approach to assess the change of vegetation cover primarily emphasizes on the area or speed of change. Hence, this study aims to provide more detailed perspectives of vegetation cover change at Carmel Valley. Three indicators will be built to represent the change: the area of change, the speed of change as well as the acceleration of change. Another purpose of this work is to test the utility of geoprocessing workflow made up by Python 2.7 and ArcPy.

**Data**

Four NAIP images, collected via Google Earth Engine, will be used in this project. The images represent 2010 (T1), 2012 (T2), 2014 (T3), and 2016 (T4), respectively. The NAIP imagery has 1m spatial resolution and Red, Green, Blue, Near-Infrared Red bands. The extent of the images is the entire area of 92130 zip code: Carmel Valley.

\*Note that T1 means time 1 and so on.

**Methods**

This work will adopt the following ArcPy methods to complete certain stage of this project.

1. arcpy.ProjectRaster\_management(): to project NAIP images (WGS84) into UTM coordinate system.
2. Raster(): to get raster data from specified file path
3. print(): to show the processing messages at the end of each stage. For example, print(“All NDVI calculation were completed”).
4. Minus():
5. to subtract the value of the Red band from the value of NIR band on a cell-by-cell basis. (NIR-Red)
6. to calculate change area: T1: Vegetation(2012) – Vegetation(2010), T2: Vegetation(14) – Vegetation(12) and T3: Vegetation(16) – Vegetation(14)
7. to calculate the numerator of change speed: T2-T1 and T3-T2
8. to calculate the numerator of change acceleration: S2 – S1
9. Plus(): to add (sums) the values of NIR and Red band on a cell-by-cell basis. (NIR+Red)
10. Divide():
11. to calculate NDVI by dividing the values of two rasters on a cell-by-cell basis. [(NIR+Red)/(NIR-R)]
12. to calculate change speed: S1: (T2-T1)/2 and S2: (T3-T2)/2
13. to calculate change acceleration: A1: (S2 – S1)/2
14. Reclassify(): to create a mask for vegetation classification. The determination of NDVI threshold will be manually observed through ArcGIS. The threshold will be used to break NDVI value in Reclassify() method. For example, if the observed NDVI threshold is 0.5, NDVI value over or equal to 0.5 will be reclassified to vegetation (psudo value:1); in the opposite, the value less than 0.5 will be reclassified to non-vegetation (psudo value: 0).
15. for-loop statement: to iterate step4 to 6 in regard to NDVI calculation from four dated images (2010, 2012, 2014, 2016).

\*Note that T means time (year), S indicates speed, and A represents acceleration.

**Psudo Code**

Import arcpy, time

set up workspace

set up starting time

Create three empty list: NIR, Red and NDVI

Import 4 dated band 4 (NIR) to NIR list

Import 4 dated band 1 (Red) to Red list

Create a for-loop statement to iterate each element in NIR and Red list

do NDVI calculation within for-loop

Append the result of NDVI calculation to NDVI list

Create an empty Veg list

Create a if-else-statement to classify vegetation based on observed NDVI thresholds at four dates. Append vegetation classification result to Veg list.

Create a for-loop statement to iterate each element in Veg list

Calculate change speed

Print (“change speed calculation complete!!”)

Calculate change acceleration

Print (“change acceleration complete!!”)

Export (Save) the result of change speed calculation to output path

Print (“change speed has been output!!”)

Export (Save) the result of change acceleration calculation to output path

Print (“change acceleration has been output!!”)

Calculate the computational time

Print computational time

**Expected results**

This study expects to find the area, speed and acceleration of vegetation cover change at Carmel Valley as well as explain the possible the results and limitations.