GE 440 Site Proposal and LandTrendr Support Plan

Don Johnson

Note: Milestones are in parenthesis at the end of each action item

1. My Understanding of the LandTrendr and Time Sync Projects

“LandTrendr” is a set of automated algorithms for detecting interesting features from a times series of data points originating in Landsat images. LandTrendr is a acronym for “**L**andsat base **D**etection of **T**rends in **D**isturbance and **R**ecovery.” These algorithms have the ability to distinguish between actual disturbances in the time series caused by unusual events like a landside or bug infestation from seasonal changes in vegetation or from noise caused by atmospheric disturbances.

The LandTrendr process transforms a spectral trajectory scatterplot of indices like NBR versus time, into a series of time segments whose vertices represent important inflection points in the pixel history of a landscape. Each vertex is either a disturbance or the beginning of a recovery for the vegetation represented by the pixels. For example one time segment in the time series might represent a bug infestation and the adjacent segment in the series might represent the regrowth in forest vegetation. Dr. Kennedy calls this process “temporal segmentation” to distinguish the process from segmentation that breaks a single image into a set of spatial features. After analysis, information about the vertices: the index value, the point in time, and source image, are stored in a database of vertex maps.

Accuracy of the LandTrendr algorithms is assessed by another project called “Time Sync.” Time Sync is conceptually similar to the LandTrendr project, but uses human experts instead of computer algorithms to separate genuine inflection points in Landsat time series data from noise. The human expert is aided by tools like a display of “chips,” small historical images of the area immediately around the pixel being studied, Z-plots and automatic linking to Google Earth imagery for the same spot in the landscape. The expert also uses other databases like the NLCD to do the time series classificationi. This is a time consuming, but necessary process, used to validate automated LandTrendr results.

Once the time series for each of the pixels in a set of historical images has been classified into a series of time segments and stored, adjacent pixels showing a simultaneous onset of a disturbance can be group into a “patch.” Patches are really polygons resulting from spacial segmentation of the change map based on time segmentation results. At this point, we know that, most likely, the same disturbance happened to the landscape at the same point of time over the area of the patch. However, we don’t know the nature of the disturbance. A human expert must now characterize the type of the land cover before the disturbance, the nature of the disturbance, and evolution of the land cover after the disturbance. The human expert uses a piece of software, the LandTrendr change attribution interface, to add a description of what happened to the patches of land, to the vertex map associated with the patches. The vertex map plus the attribution labels (descriptions) are the basis for the disturbance patch maps (change maps). The results from this attribution process are then used as a training data for an algorithm that attempts to generalize the results to larger datasets covering greater periods of time. LandTrendr is a machine learning application that uses unsupervised classification of events in time, checks the results with human experts, uses humans to characterize the nature of change and then uses these result to further refine the temporal segmentation process, the spatial segmentation process and production of change maps in its goal to produce yearly change maps of landscapes more efficiently.

1. My Site Proposal and Goals for This Course
   1. Select a site that has already been classified by the Time Sync project cloud and masked by Zhu Zhe using Fmask. (March 7)
   2. Study and manually apply the processes used by the Time Sync project and by Zhe Zhu to see if I arrive at the same classifications of land cover and change through time. (March 31)
   3. Study and manually apply the LandTrendr processes to the site. (Apr 15)
   4. Finally, automatically apply the LandTrendr automated process to the same site for the same period in time and compare the results. (Apr 20)
2. My Planned Contributions to the LandTrendr Project
   1. Install the LandTrendr attribution interface website on an Amazon AWS VM instance. (March 31)
   2. Create evolving plans to publish and provide client support the LandTrendr algorithms. This action item may include creating a public version repository, bug database, installation package and wiki. (June 30)

Need time sync login

LandTrendr login: robert password: Robert

Miscellaneous

Mapping is achieved with LandTrendr (Kennedy et al. 2010), a set of automated algorithms to characterize the “life history” of each point on a landscape, and maps are evaluated with TimeSync, a visualization tool that allows expert interpretation of changes at randomly-selected validation points

Difference between USGS’s National Land Cover Dataset (NLCD), and landsat image?

What is public and what is secret sauce? How import is security?

**Improvements**

Bottlenecks acquisition vs plot interpretion vs producing change maps vs patch attribution

seit@home

users request change maps

trademarks

lay people involvements – citizen science

urban areas

build software team

ALM

**Roles**

Software development team

In what capacity will Zhiqiang Yang stay involved?

Do you want to assemble a team?

**Science team**

**Interpreters**

What is plot interpretation vs patch attribution?

How many interpreters assess each patch?

What is the role of an arbitrator?

**Definitions**

agent – an event, process or actor that caused a change in a landscape

attribution – the process of assigning an agent to a change site in a landscape

time sync – human interpretation of image time series. Human interpretation at the pixel level of Landsat imagery alone. No a priori expectation of what you are going to find. Warren Cohen lead. Domain knowledge is necessary.

project – a process whose goal is to use human interpreters to assign agents to change sites in image time series for a geographic area.

chip – small area of a scene

My Goals

Create change map

select a geographic area

process data manually to produce change maps

IDL scripts

document the process?

do the attribution process

assess the accuracy of the attribution – compare to ground truth

**Application Support**

Help system

Bug reporting system

**Big Picture**

Portable?

Wiki

Version control

Wait for now or full steam ahead?

Assemble team

contractors

grad students / post docs

professionals

Money approach