PGEO6050 – Mini Project Guidelines for Spring 2017

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1 Objectives

The main objective of this assignment is to expose you to a practical application of GIS analysis involving Python programming. This work requires you to fully understand what is requested, what are the final deliverables, how to accomplish the development of deliverables using one dataset, and finally how to accomplish the development of deliverables using all the datasets. I hope that by the end of this project, you will have a better understanding of how to use Python programming within ESRI products to automate/expedite batch processing.

2 The Laboratory Experiment and Datasets

Laboratory experiment was conducted at the National Sedimentation Laboratory to investigate small-scale channel widening (lateral expansion) in the presence of a less erodible base layer. In this experiment, the channel was constrained vertically and therefore it could not incise; and thus, any morphological change would have to be through lateral expansion. During the length of the experiment, still images were collected at $10s$ time steps by digital cameras looking as close to nadir view as possible (Figure 1). After, extensive image processing steps, the edges of the channels were digitized into polygons (one polygon for each time step) (Figure 2). The ultimate objective is to determine channel width measurements at multiple locations in the flume and at all time steps (Figure 3 and Figure 4).

You are receiving the following files:

- Geo-referenced images: T10geo.tif and T2100geo.tif. These images will not be used in the program itself, however, these images are going to help generate information (X and Y coordinates) needed for your program. For example, Y-coordinates of flume outlet, Y-coordinates of initial and final cross-section, X-coordinates of left and right-hand side of the channel. This information should be used as input into your program.
- Polygon with channel edges: P2016-07-19.shp. This feature class contains multiple polygons representing measured channel edge at specific elapsed time periods (every 10s).

3 Mini Project

The deliverables for this mini project are the following:

3.1 Description of requirements and outcomes (5 points)

Before you start writing code, please provide a short write up of your understanding of the problem and expected deliverables.

3.2 Pseudo code (5 points)

Provide a pseudo code of generating the requested deliverables for one elapsed time period. This could be in plain English, list of geoprocessing tools, flowchart, and/or any combination of those. This step is the foundation for everything else.

3.3 Files (40 points)

Upon completion of your project you should submit:

- Individual width measurements. A single CSV file containing TIME, CROSS-SECTION ID, WIDTH, and DISTANCE-TO-OUTLET. This should include all elapsed time periods and all cross-sections.
- Summary of width measurements. A single CSV file containing TIME and AVERAGE_WIDTH.
- Source codes. All Python source code generated.
- Short report. Microsoft Word document containing the items 3.1 and 3.2 and examples of datasets generated (cross-sections, attribute tables, etc). Please include a graph of elapsed time (in seconds) and average channel width (in meters).

4 Notes

Please pay attention to:

- Length units are in meters and time units are in second.
- Distance between cross-sections:
    - Last names A-J use 2cm
    - Last names K-R use 3cm
    - Last names S-Z use 4cm
- Please work independently. It is very important that you try your best to solve this on your own. You have all the tools needed to get this done.
- Take baby steps. A good approach is to take incremental steps.

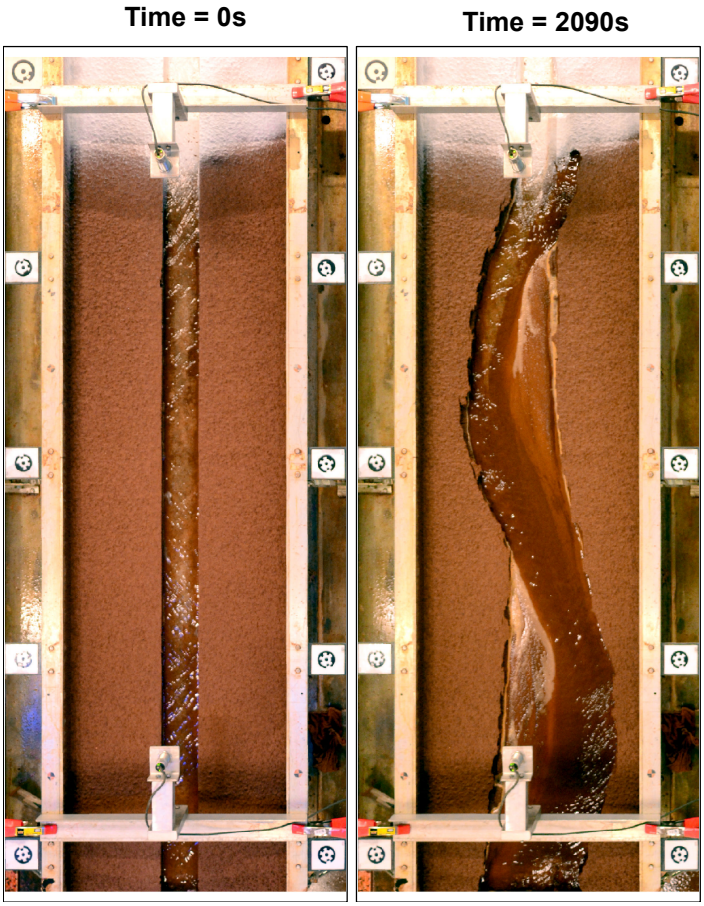

Figure 1: Illustration of the geo-referenced set of images generated in laboratory experiments designed to investigate channel lateral expansion. Initial and final time steps are shown.

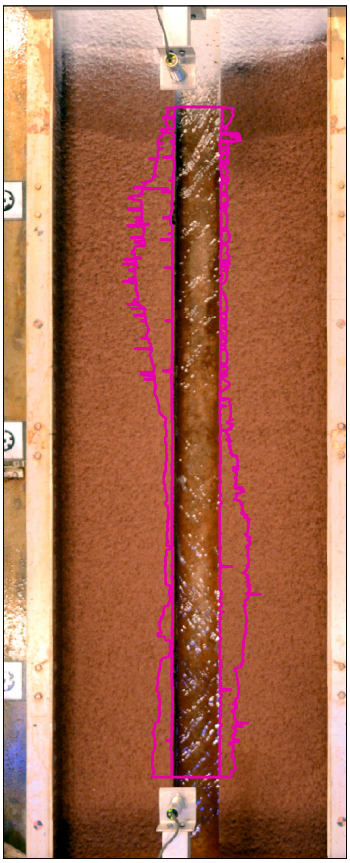

Figure 2: Polygon representing edge of channel and generated using advanced image processing techniques. Inner polygon represents edge of channel at 10s and outer polygon 850s.

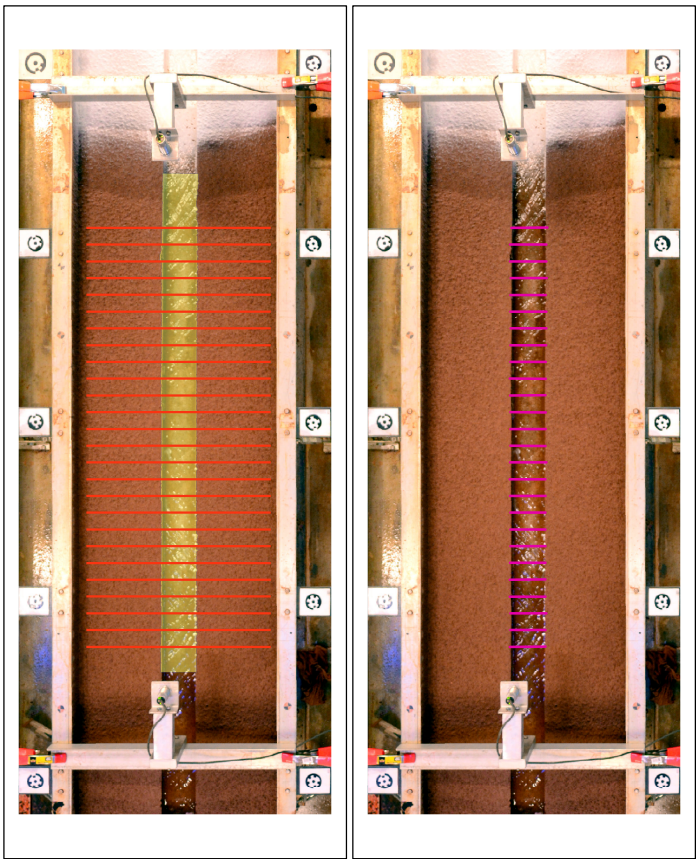

Figure 3: Measuring of channel width at elapsed time 0s using cross-sections separated at 5cm. Channel edge (yellow polygon) is intersected with general cross-sections (red lines) to generate measured cross-sections (magenta lines) in which line length represents the channel width.

Table

time0

FID	Shape *	FID_profil	Id	FID_T0E	TIME	WIDTH	DIST
0	Polyline	0	0	0	1	0.1071	0.5
1	Polyline	1	0	0	1	0.1049	0.55
2	Polyline	2	0	0	1	0.108	0.6
3	Polyline	3	0	0	1	0.106701	0.65
4	Polyline	4	0	0	1	0.106401	0.7
5	Polyline	5	0	0	1	0.1059	0.75
6	Polyline	6	0	0	1	0.1049	0.8
7	Polyline	7	0	0	1	0.1049	0.85
8	Polyline	8	0	0	1	0.1052	0.9
9	Polyline	9	0	0	1	0.1056	0.95
10	Polyline	10	0	0	1	0.1064	1
11	Polyline	11	0	0	1	0.108502	1.05
12	Polyline	12	0	0	1	0.105304	1.1
13	Polyline	13	0	0	1	0.1058	1.15
14	Polyline	14	0	0	1	0.106501	1.2
15	Polyline	15	0	0	1	0.105701	1.25
16	Polyline	16	0	0	1	0.1079	1.3
17	Polyline	17	0	0	1	0.1065	1.35
18	Polyline	18	0	0	1	0.107501	1.4
19	Polyline	19	0	0	1	0.106901	1.45
20	Polyline	20	0	0	1	0.108	1.5
21	Polyline	21	0	0	1	0.1065	1.55
22	Polyline	22	0	0	1	0.107901	1.6
23	Polyline	23	0	0	1	0.108901	1.65
24	Polyline	24	0	0	1	0.1087	1.7
25	Polyline	25	0	0	1	0.108402	1.75

Figure 4: Example of intersected feature classes (polygon and general cross-section). Highlighted fields indicated desired information of elapsed time period (TIME), channel width (WIDTH), and distance from cross-section to channel outlet (DIST).