Lab 0 Report

Title: Lab 0
Notice: Dr. Bryan Runck
Author: Alexander Edstrom
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Project Repository: *AlexanderEdstrom/GIS5571 (github.com)*
Time Spent: 6 hours

Abstract

This introduction lab covers the basics of using Esri ArcGIS products such as ArcOnline, ArcPro, and Arcpy/Python. It also goes over the creation and set up of a GitHub account and repository to store, manage, and share data and results. The bulk of this report is focused on the main problem statement of the project, dissecting the differences and similarities between the three main methods of functionality within Esri to complete the same task. The data used is sourced from the MN Geospatial Commons. The methods section outlines the workflow used for each of the three access methods. The results section compares and contrasts each method as well as verifies the results via simple output comparison. The discussion includes my personal notes on how each of the methods felt from a user standpoint.

Problem Statement

To assess the functionality of the three tools, the same analysis will be done in each of the tools. A buffer will be formed around the high-frequency transit routes found within the "High Frequency Network" data found on MN Geospatial Commons from the Metropolitan Council. A 25-meter buffer is used. The three tools used are ArcPro, Jupyter Notebooks in ArcPro, and Jupyter Notebooks in ArcOnline.

Table 1. Required Data for Project

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Transit Routes	Raw input dataset from Met Council	Road geometry centerlines of transit routes		Mn GeoSpatial Commons	Extracted shapefile and geodatabase
2	"High Frequency"	Service every 15 min		Frequency	Mn GeoSpatial Commons	

Input Data

The data used comes from the MN Geospatial Commons and is produced by the Metropolitan Council. The data contains the road centerlines of all or parts of transit routes with service every 15 minutes (or better) on weekdays from 6:00 AM to 7:00 PM and Saturdays from 9:00 AM to 6:00 PM.

Table 2. Data Used

#	Title	Purpose in Analysis	Link to Source

1	“High Frequency Network	Raw input dataset for routing and buffer base from Met Council	Mn GeoSpatial Commons

Methods

ArcGIS Pro Method:

Data import included downloading the shapefile and using the “Add Data” tool in the top ribbon underneath the “Map Section”. This was a very simple task using the GUI of ArcPro, I simply imported the data as stated, created a new model within the integrated Model Builder, dragged the “Buffer” tool from the “Geoprocessing” pane, and followed the prompts to specify an input, output, and the various buffer options such as distance and shape. After building the simple workflow, I executed the model using the “Run” button which then proceeded to create the output file for me. I then added that to the active Map to see the results

Figure 1. Model Builder from ArcGIS Pro Method

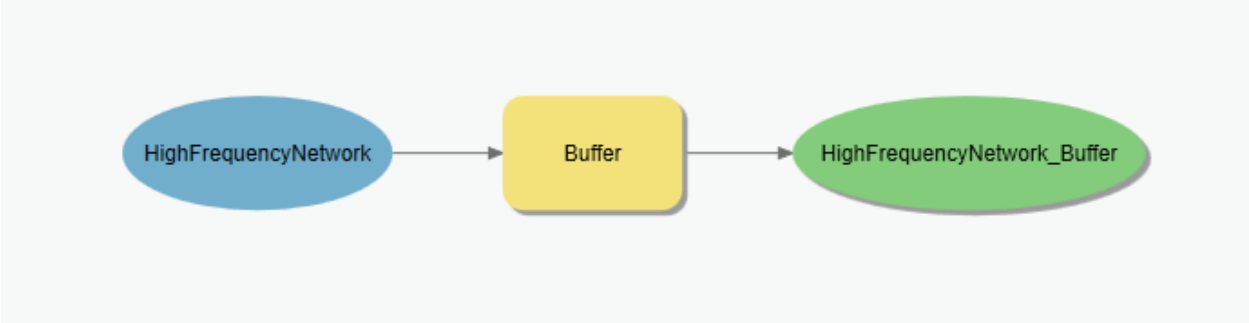
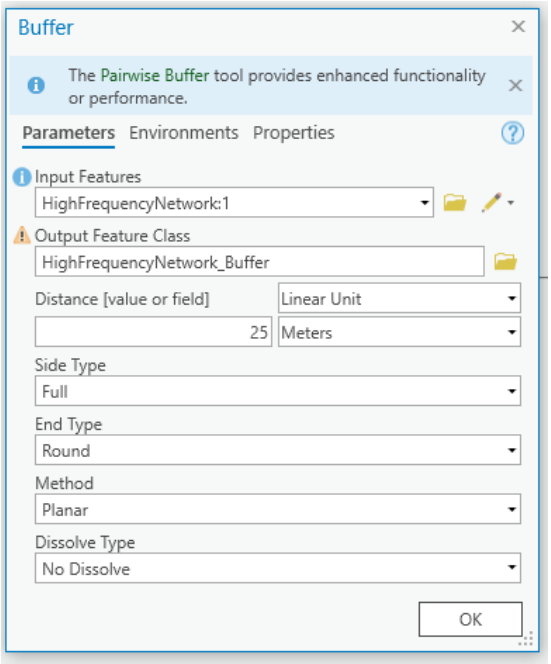


Figure 2. Buffer Tool Prompt Variable Selection



Jupyter Notebooks in ArcPro Method:

ArcPro has built in Notebook editing functionality. To replicate what I did in the GUI version of ArcPro with the Notebook, I simply created a new notebook by using the "Insert" → "New Notebook" button within the top ribbon of ArcPro. Here is the code I used to perform the 25-meter buffer (all code was placed into one cell):

```
import arcpy

arcpy.analysis.Buffer("HighFrequencyNetwork", r"C:\Users\Alexander\Desktop\GIS Work\GIS5571\Lab0\GIS5571 Lab0\GIS5571 Lab0.gdb\HighFrequencyNetwork_Buffer1", "25 Meters", "FULL", "ROUND", "NONE", None, "PLANAR")
```

Running this code created a new layer titled "HighFrequencyNetwork_Buffer1" within my contents pane to be added to the active map. This layer is identical to the one made in the GUI steps above (the only difference is the title of the layers).

Jupyter Notebooks in ArcOnline Method:
Both Notebook methods are very similar in content as the code used is similar. I uploaded the same shapefile used before and created a feature layer of the data as prompted in the upload process. I created a new notebook under the "Notebook" section of the top ribbon, is this new notebook I entered the following code snippet:

```
from arcgis.gis import GIS
gis = GIS("home")

# Item Added From Toolbar
# Title: shp_trans_hi_frequency_transit_servc | Type: Feature Service | Owner: edstr117_UMN
item = gis.content.get("7c1cc811f522437ebf297a6cc4668afb")

from arcgis import features
buffer = features.use_proximity.create_buffers("item", distances=[25], units='Meters')
buffer
```

The layer was imported using the add data tool on the lefthand side of the notebook.

Figure 3. Jupyter Notebook Cell

Results

Each of the outputs is identical to the others as they are utilizing the exact same tool in each of the methods, they were simply accessed in different ways. Overall I think the ArcPro Desktop Notebook method is the simplest and fastest. The GUI within ArcPro is a much more visual and easier-to-follow version of the analysis that is great for not GIS professionals or for someone who does not know python, however, it took significantly longer than simply writing the line of code. The ArcOnline version of the notebook feels like a watered-down version of the desktop Notebook functionality. This was frustrating to work with as it does not utilize arcpy in the same way that the desktop does. This comes down to user preference, some would rather not work with arcpy.

Figure 4. Workflow Model Output - 25-meter Buffer

Results Verification

The output data all being identical means that each of the methods worked and was functionally the same as one another.

Discussion and Conclusion

Esri Training: This was very straightforward, I had seen most of this in previous GIS courses. The intro to arcpy was written very well.

GitHub: This portion was also a breeze as I have used GitHub in the past, I simply added a new repo to my profile and went from there. Using the desktop app version of GitHub is the easiest for me and I had great success using it for this project.

ArcPro, Jupyter Notebooks in ArcPro, and Jupyter Notebooks in ArcOnline:
As stated above in methods, I had the most success using the built-in Notebook functionality of ArcPro Desktop, it felt like the most streamlined and fastest way to create a simple buffer. The GUI method was also very straightforward as each of the steps is given to you by the software, this is nice for beginners but took away from the speed and elegance of the process compared to the code version of the same analysis. I struggled with the ArcOnline Notebook method the most. I had a hard time finding the right function to use as arcpy could not be imported (at

least to my knowledge). I dug around the documentation and found the right function eventually. Even if I had known what to do ahead of time, it still would have been harder and slower than the ArcPro method even though it is functionally the same thing.

References

No works cited or referred to.

Self-score

Fill out this rubric for yourself and include it in your lab report. The same rubric will be used to generate a grade in proportion to the points assigned in the syllabus to the assignment.

Category	Description	Points Possible	Score
Structural Elements	All elements of a lab report are included **(2 points each)**: Title, Notice: Dr. Bryan Runck, Author, Project Repository, Date, Abstract, Problem Statement, Input Data w/ tables, Methods w/ Data, Flow Diagrams, Results, Results Verification, Discussion and Conclusion, References in common format, Self-score	28	**28**
Clarity of Content	Each element above is executed at a professional level so that someone can understand the goal, data, methods, results, and their validity and implications in a 5 minute reading at a cursory-level, and in a 30 minute meeting at a deep level **(12 points)**. There is a clear connection from data to results to discussion and conclusion **(12 points)**.	24	**22**
Reproducibility	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data operations. Every step is documented and justified.	28	**28**
Verification	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated **(10 points)**, the method of comparison is clearly stated **(5 points)**, and the result of verification is clearly stated **(5 points)**.	20	**18**
		100	**96**