Lab Report

Title: Lab 0 Report - GIS 5571
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Project Repository: https://github.com/kylejsmith4/GIS5571/Lab0
Time Spent: 36.5 hours over four days

Abstract

The Esri ecosystem provides multiple ways to perform the same task. This project will look at buffering a network dataset using ArcPro, Jupyter Notebooks in ArcPro and Jupyter Notebooks in ArcOnline. Each platform uses different approaches with different user experiences. Jupyter Notebooks in ArcPro and Jupyter Notebooks in ArcOnline utilize the Python coding language while ArcPro is graphic oriented desktop software. When using each platform to create a 5-mile buffer from a road using a common shapefile, similarities and challenges of each can be discussed.

Problem Statement

The Esri ecosystem has many different ways that you can access the same underlying functionality. Your objective is to compare and contrast performing the same simple activity - buffer a network dataset - using three different tools: ArcPro, Jupyter Notebooks in ArcPro, Jupyter Notebooks in ArcOnline.

Specifically, this project will identify areas within 5 miles of the Federal Strategic Highway Network in Minnesota using available data from Minnesota Geospatial Commons. I will attempt to do this using ArcPro, Jupyter Notebooks in ArcPro, and Jypyter Notebooks in ArcOnline.

Input Data

The data used here is spatial road data of the National Highway System hosted by the Minnesota Geospatial Commons. This dataset contains three feature layers, however for this project we are only focusing on the feature layer “Strategic Highway Network in Minnesota”. This shapefile contains a series of polylines representing the federally identified as strategic highways for the movement of people and military for interstate purposes. This road geometry dataset contains the following attributes:

OBJECTID
ROUTE_ID
FROM_MEASURE
TO_MEASURE
STRAHNET_TYPE
DESCRIPTION
Shape__Length

Here preview of the dataset for reference:

For purposes of this lab, the above-described dataset will be used to demonstrate a 5-mile buffer using ArcPro, Jupyter Notebooks in ArcPro, and Jypyter Notebooks in ArcOnline. While this is an exercise in demonstrating skills with each of the three platforms, a project of this type could be used to identify areas with high visibility and/or access to a major Interstate highway in Minnesota.

Data Source: https://gisdata.mn.gov/dataset/trans-federal-routes

Methods

The following sections contain the steps used with each of the three platforms.

- **ArcPro**

1. Set up ArcGIS Pro and find dataset:

• Log in to ArcGIS Pro and start a new project.
• The Dataset to be used here is National Highway System from Minnesota Geospatial Commons.
• For simplicity, I am using only the Strategic Highway Network in Minnesota layer for this project, other layers are available in this dataset but are not to be used here.
• Find, copy and save the zip shapefile path

2. Load Data to ArcPro:

• Add shapefile via "Add Data" in ribbon bar.
• Once layers are loaded, we are only using Strategic Highway Network in Minnesota, all others can be removed.
• Assuming data is visible and understood, move forward to creating the buffer.

3. Create a 5-Mile Buffer:

• On the Analysis tab, select Tools and find the "Buffer" Geoprocessing Tool. Enter the following:
• Input Feature: Strategic_Highway_Network_in_Minnesota
• Distance: 5 miles
• Output Feature Class: Strategic_Highway_Net_Buffer saved where appropriate
• Run the Buffer tool.

4. Analyze and Save

(results shown and discussed below)

- **Jupyter Notebooks in ArcPro**

1. **Find dataset & set up Jupyter Notebooks in ArcPro:**

   • Log in to ArcGIS Pro and start a new project or open existing project.
   • The Dataset to be used here is National Highway System from Minnesota Geospatial Commons.
   • For simplicity, I am using only the Strategic Highway Network in Minnesota layer for this project, other layers are available in this dataset but are not to be used here.
   • Find, copy and save the zip shapefile path
   • On the Insert tab, select "New Notebook" button to create a new Python sheet.

2. **Jupyter Notebooks coding:**

   • The following code is used. Markup notes are provided for reference.

Establish dataset

```
import arcpy
```

```
arcpy.env.workspace = r'C:\Mac\Home\Downloads\shp_trans_federal_routes'
```

```
#upload dataset - Strategic Highway Network in MN
data = r'C:\Mac\Home\Downloads\shp_trans_federal_routes\Strategic_Highway_Network_in_Minnesota.shp'
```

Make Buffer

```
#I want to save the new buffer file here and name it "Buffer.shp":
buffer = r'C:\Mac\Home\Downloads\shp_trans_federal_routes\Buffer.shp'
```

```
#Per guidance at 'help(arcpy.analysis.Buffer)', here are the details for the buffer.
#I want a 5 mile buffer around the highway polylines in the Strategic Highway Network in MN dataset
arcpy.Buffer_analysis(

    # Input (dataset)
    in_features=data,

     # Output (buffer)
    out_feature_class=buffer,

    # Buffer details
    buffer_distance_or_field="5 Miles")
```

Export and Save

```
# Export and Save the buffer shapefile
export=r'C:\Mac\Home\Downloads\shp_trans_federal_routes\Buffer_Export.shp'
```

Return to ArcPro to view data

(results shown and discussed below)

- **Jupyter Notebooks in ArcOnline**

1. Find dataset & set up Notebooks in ArcOnline:

• Log in to ArcOnline using appropriate credentials.
• The Dataset to be used here is National Highway System from Minnesota Geospatial Commons.
• For simplicity, I am using only the Strategic Highway Network in Minnesota layer for this project, other layers are available in this dataset but are not to be used here.
• Find, copy and save the zip shapefile path
• In ArcOnline, select the menu in the top left corner and select "Content".
• In the Content menu, select "New Item" and navigate to upload the ziped shapefile identified above. The shapefile is to be a hosted feature layer.
• Once the upload is verified, select the menu in the top left corner and select "Notebooks".
• In the Notebooks menu, select "New Notebook" to create a new Python sheet.

2. Notebook coding:

• The following code is used. Markup notes are provided for reference.

Load packages and dataset

```
# Connect to ArcGIS Online
from arcgis.gis import GIS
gis = GIS("home")
from arcgis.features import FeatureLayer
from arcgis.features.analysis import create_buffers
```

```
# Load Strategic_Highways_MN Feature Layer
Strategic_Highways_MN = FeatureLayer("https://services.arcgis.com/8df8p0NlLFEShl0r/arcgis/rest/serv
```

Make Map & add Strategic_Highways_MN

```
# Map centered on Minnesota
map1 = gis.map('Minnesota')
map1.zoom = 6
map1.height = '500px'
map1.width = '50%'

#Test the map
#map1
```

```
# Add the Strategic_Highways_MN layer to the map
map1.add_layer(Strategic_Highways_MN)

#Test the map
#map1
```

```
# Add the Strategic_Highways_MN layer to the map
map1.add_layer(Strategic_Highways_MN)

#Test the map
#map1
```

Make buffer & add to map

```
# 5-mile buffer around the Strategic_Highways_MN polyline
input_layer = Strategic_Highways_MN

buffer_result = create_buffers(
    input_layer=input_layer,
    distances=[5],
    units="Miles",
    dissolve_type="Dissolve"
)
```

```
# add the buffer to the map
map1.add_layer(buffer_result)
```

Diaplay & save map

```
# Display the map
map1
```

```
# Save the map to ArcOnline
webmap_item = map1.save({
    'title': 'Buffer Map of Strategic Highways MN',
    'tags': 'buffers, strategic highways, Minnesota',
    'snippet': 'A 5-mile buffer around the Strategic Highways in Minnesota',
    'description': 'This map shows a 5-mile buffer around strategic highways in Minnesota.',
    'folder': None
})

# Print the web map URL
print(f"Map saved. You can view it here: {webmap_item.homepage}")
```

```
Map saved. You can view it here: https://www.arcgis.com/home/item.html?id=290ae745fa4040d4881a7c34
```

Return to ArcOnline to view and analyze

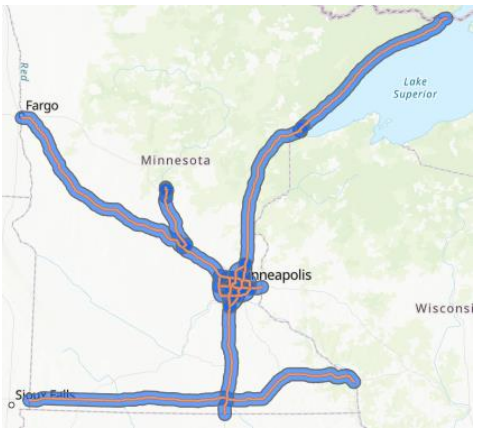
Map: https://www.arcgis.com/home/item.html?id=290ae745fa4040d4881a7c342e2f4c34

(results shown and discussed below)

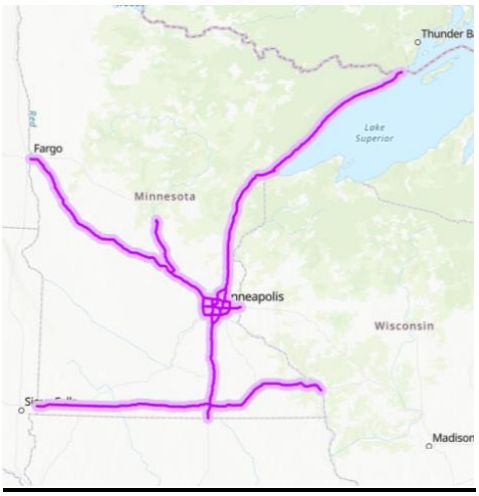
Results

The project involved the buffering of a shapefile titled “Strategic Highway Network in Minnesota” using three different GIS platforms. This section displays the maps produced:

ArcPro



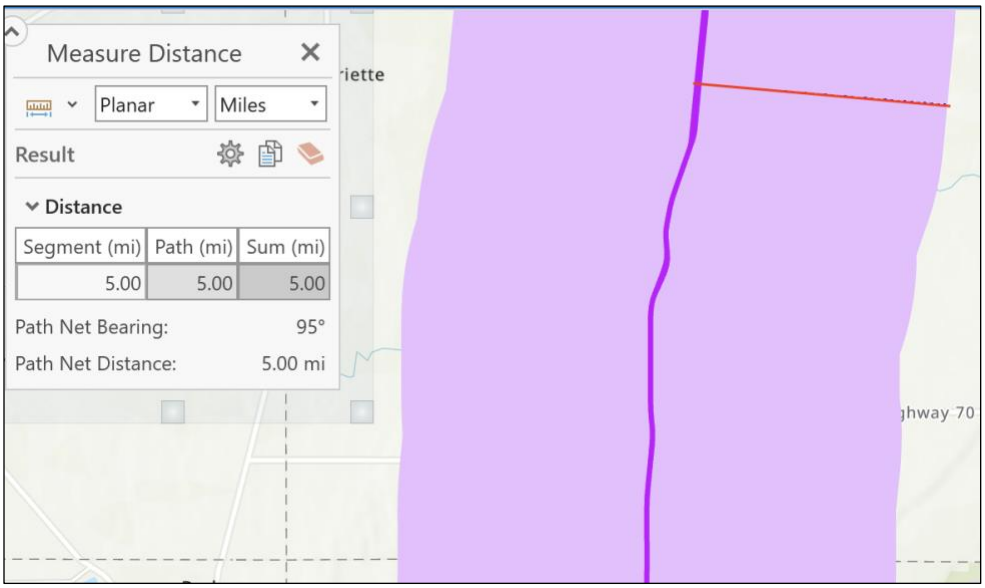
Jupyter Notebooks in ArcPro



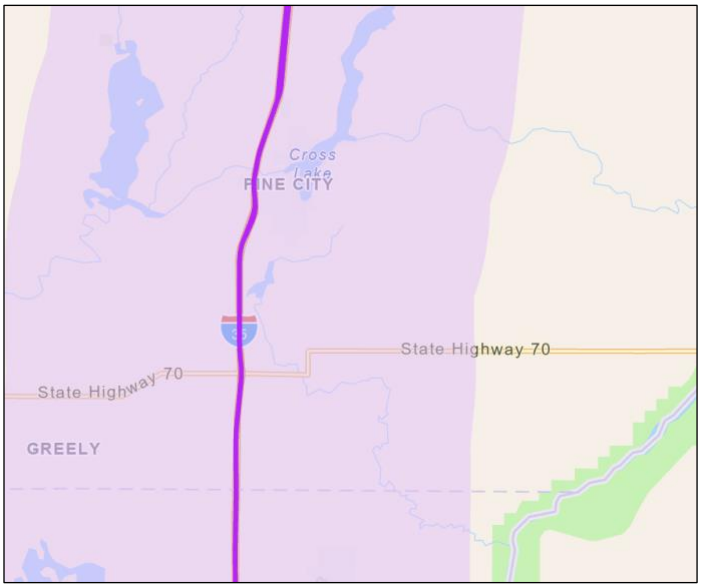
Jupyter Notebooks in ArcOnline

Results Verification
It is expected that the three platforms will produce similar data if all methods are followed correctly.

To demonstrate accuracy of the buffer, the following shows verification of a 5-mile distance from the road centerline.



Finally, the following shows that the centerline is indeed correctly drawn on the appropriate road, in this case I-35 near Pine City.



Discussion and Conclusion

- **GitHub**

  This course is my first experience with GitHub, therefore I do have to look at documentation and external sources in order to get certain tasks completed in GitHub. I am familiar with coding and can navigate various UIs with easy. I do not anticipate GitHub will be a challenge for me after I become familiar with the terms, the organization of tools and the features. Specifically, I will need to become more accustomed to the manual pushing synced data from my local drive to GitHub.

  My GitHub repository for this class can be found at: https://github.com/kylejsmith4/GIS5571

- **ArcPro**

  I am most familiar with ArcPro as I have used it for other classes and for a recent internship. I have a prior 12-year career in the city planning sector where I certainly wish I had more experience with ArcPro, and ESRI products in general, however what our office had available was limited due to funds. Today, I am able to access ArcPro from my Mac, usually at home, through Parallels Desktop. While there can be some connectivity and network issues using this set up, those are rare. For this project I was familiar with how to import a shapefile from a .zip path, how to buffer the polylines, and show the resulting map. I did not need to refer to any documentation.

- **Jupyter Notebooks in ArcPro**

  While I am familiar with ArcPro and how to navigate the various sections, this project was my first use of Notebooks within ArcPro. I did, however, gain a good baseline understanding of Python through the Geocomputing class.

  The Python package arcpy is used here. Creating a 5-mile buffer of a road (polyline) using arcpy is fairly straight forward. The coding shown in the methods section of this report contain more comments in the markups. I did refer to a few ESRI websites for assistance, as listed below.

- **Jupyter Notebooks in ArcOnline**

  I spent the most time on this section as I have little familiarity with Jupyter Notebooks in ArcOnline. I needed to reach out to Luke for help uploading the dataset to Notebooks. I was initially using a path to an externally hosted dataset, which caused reoccurring permission problems. Luke was helpful in identifying that I need to upload a zipped shapefile directly to ArcOnline and use the hosted path in the code.

  After a few false starts before I learned that ArcOnline does not use arcpy, and after referencing documentation for the arcgis.gis package, I was making progress. After a basic understanding, creating a 5-mile buffer of a road (polyline) using arcgis.gis is similariy straight forward. This exercise was helpful in getting experience in Jupyter Notebooks in ArcOnline, and will hopefully be beneficial for the next project. The coding shown in the methods section of this report contain more comments in the markups.

In conclusion, this project shows a simple activity - buffering a network dataset - using three different tools: ArcPro, Jupyter Notebooks in ArcPro, Jupyter Notebooks in ArcOnline. While each of these platforms are different and include their own challenges through different methods, this project brings the Esri ecosystem together to demonstrate similar functions.

References

Esri. (2024). *arcgis.gis module.* Esri. https://developers.arcgis.com/python/api-reference/arcgis.gis.toc.html

Esri. (2024). *Get started with notebooks*. Esri. https://doc.arcgis.com/en/arcgis-online/get-started/components-of-the-notebook-editor.htm

Esri. (2024). *Notebooks in ArcGIS Pro*. Esri. https://pro.arcgis.com/en/pro-app/latest/arcpy/get-started/pro-notebooks.htm

Esri. (2024). *What is ArcPy?*. Esri. https://pro.arcgis.com/en/pro-app/latest/arcpy/get-started/what-is-arcpy-.htm

Minnesota Department of Transportation. (2019). *STRAHNET and STRAHNET connectors*. Minnesota Department of Transportation. https://gisdata.mn.gov/dataset/trans-federal-routes

Self-score

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	**25**
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	**20**
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	**25**
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	**20**
		100	**90**