**Lab Report**

Title: Lab 0

Notice: Dr. Bryan Runck

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**Project Repository:**https://github.com/mgisselbeck/GIS5571

**Google Drive Link:**

**Time Spent:** 10 hours

**Abstract**

The Ersi environment gives their users the opportunity to work in different interfaces to complete a task that reach the same result. The object of this lab was to compare the buffer analysis tool through Jupyter Notebooks in ArcGIS Online, Jupyter Notebooks in ArcGIS Pro, and ModelBuilder in ArcGIS Pro. Using a road network dataset, we created a buffer through the different Ersi tools. The most user-friendly tool that required little to no coding or ArcGIS experience was ModelBuilder in ArcGIS Pro. Using Jupyter Notebooks in ArcGIS Online and ArcGIS Pro were comparable in terms of difficulty but required the coding knowledge for each of different tools.

**Problem Statement**

The Esri ecosystem has many ways a user can access the same underlying functionality i.e., analysis tools. The objective is to compare and contrast the different tools: ModelBuilder in ArcGIS Pro, Jupyter Notebooks in ArcGIS Pro, Jupyter Notebooks in ArcGIS Online performing a simple activity of buffering a network dataset.

*Table 1. Required Data*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **#** | **Requirement** | **Defined As** | **(Spatial) Data** | **Attribute Data** | **Dataset** | **Preparation** |
| 1 | Road network | Raw input dataset from Minnesota Department of Transportation | Road geometry |  | [Minnesota Geospatial Commons](https://gisdata.mn.gov/dataset/trans-federal-routes) | None |

**Input Data**

The National Highway System (NHS) consists of roadways important to the nation's economy, defense, and mobility, and was developed by the Department of Transportation in cooperation with the states, local officials, and metropolitan planning organizations. NHS was developed to fill a need at Minnesota Department of Transportation for a continuous, statewide GIS base map of the NHS throughout the State.

*Table 2. Input Data*

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Title** | **Purpose in Analysis** | **Link to Source** |
| 1 | National Highway System, Truck Network, and Strategic Highway Network | Raw input dataset for routing analysis from Minnesota Department of Transportation | [Minnesota Geospatial Commons](https://gisdata.mn.gov/dataset/trans-federal-routes) |

**Methods**

*Figure 1. Data Flow Diagram*

*Timeline

Description automatically generated with medium confidence*

*A picture containing diagram

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*Chart, bubble chart

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**Results**

*Map 1. Buffer Analysis in Jupyter Notebooks via ArcGIS Pro*

Using Jupyter Notebooks in ArcGIS Pro was like using ModelBuilder but had more flexibility in how you could manipulate the data. For beginners, this tool is easy to use because you can copy the Python code from the Buffer tool in ArcGIS Pro. There were only two inputs I had to write and run to create this buffer. I also think it’s important to mention the ease of the tool directly putting the output as layer after you run it so you can know that it was successfully and view it directly.

Map

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*Map 2. Buffer Analysis in Jupyter Notebooks via ArcGIS Online*

Using Jupyter Notebooks in ArcGIS Online felt slightly more complicated than using it in ArcGIS Pro mainly because of ArcGIS Pro using ArcPy. In ArcGIS Online there were more steps to code and to visualize the results within the same document.

*Map

Description automatically generated*

*Map 3. Buffer Analysis in ModelBuilder via ArcGIS Pro*

The ModelBuilder interface within ArcGIS Pro is the most user-friendly out of the three. This tool doesn’t require users to have previous knowledge of writing Python code within ArcGIS products. In addition, there is a high level of documentation of how to use ModelBuilder and using a Buffer with ModelBuilder. This process helps you to visually understand how ArcGIS is calculating this equation. The downside of ModelBuilder could be the lack of personalize and complexity in regard to data manipulation.

*Map

Description automatically generated* **Graphical user interface, text, application, chat or text message

Description automatically generated**

**Results Verification**

The qualitative verification was completed by looking at each of the highways generally and seeing if the buffer seemed about 5 miles wide on each side. Using the measure tool, I measured the distance from the line to the end of the buffer on each side of the highway line. The measure tool confirmed that the analysis was correct.

**Discussion and Conclusion**

Using Jupyter Notebooks in ArcGIS Pro and ArcGIS Online was a first for me. I was able to learn a lot on how to interpret and write Python code in ArcGIS Pro and ArcGIS Online. Since the Ersi ecosystem has many different system branches, this experience allowed to have a better understanding of what tool to use depending on what type of analysis I want to conduct, the level of manipulation, and also the time I have to complete the task.

**GitHub**

The process of setting up GitHub and creating a repository went smoothly. The instructions given by GitHub can be confusing to follow if you aren’t familiar with GitHub or the terminology they use.

**References**

1. Minnesota Department of Transportation (MnDOT). National Highway System, Truck Network, and Strategic Highway Network. 2019.

<https://resources.gisdata.mn.gov/pub/gdrs/data/pub/us_mn_state_dot/trans_federal_routes/metadata/metadata.html>

**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 | **24** |
| **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 | **24** |
| **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 | **94** |