**Lab Report 0**

Title: Comparing and contrasting buffering a network dataset in ArcGIS Pro, Jupyter Notebooks in ArcGIS Pro, and Jupyter Notebooks in ArcGIS Online.

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**Project Repository:**<https://github.com/tjjohnson1415/GIS5571>

**Time Spent:** 20 hours

**Abstract**

There are several ways that a network dataset can be buffered. ArcGIS Pro, Jupyter Notebooks within ArcGIS Pro, and Jupyter Notebooks in ArcGIS Online are all platforms capable of creating buffers around a dataset. Road centerline data from Lake County, Minnesota was used to show the different ways in which buffering is implemented on the three platforms. The differences between platforms are discussed and the results are verified by comparing the output of the three platforms. Of the three platforms, I found ArcGIS Pro to be the easiest and Jupyter Notebooks in ArcGIS Online the most challenging.

**Problem Statement**

A map of a large area with many roads

Description automatically generatedThere are multiple ways that a network dataset can be buffered. The map shows road centerlines for Lake County, Minnesota. A one-mile buffer will be created around the roads to determine which areas are close to or far from the nearest road. The road network will be buffered in three ways: directly using the geoprocessing tool in ArcGIS Pro, using Jupyter Notebooks within ArcGIS Pro, and using Jupyter Notebooks in ArcGIS Online.

Figure 1: Road centerlines of Lake County, Minnesota

Table 1: Necessary data.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **#** | **Requirement** | **Defined As** | **(Spatial) Data** | **Attribute Data** | **Dataset** | **Preparation** |
| 1 | Road network | Raw input dataset from Lake County, Minnesota | Road geometry |  | [Minnesota Geospatial Commons](https://gisdata.mn.gov/dataset/us-mn-co-lake-trans-road-centerlines) |  |

**Input Data**

The data used for this lab is the road centerlines for Lake County, Minnesota. This data was created by Lake County and retrieved from the Minnesota Geospatial Commons. It contains the geometry of the roads and many attributes including road names and numbers.

Table 2: Data

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Title** | **Purpose in Analysis** | **Link to Source** |
| 1 | Road Centerlines, Lake County, Minnesota | Raw input dataset for buffering. | [Minnesota Geospatial Commons](https://gisdata.mn.gov/dataset/us-mn-co-lake-trans-road-centerlines) |

**Methods**

ArcGIS Pro:

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Figure 2: Data flow diagram for buffering a dataset using ArcGIS Pro.

Buffering a network dataset is very simple with ArcGIS Pro. In the geoprocessing pane, search for and open either the buffer or pairwise buffer tool. Run the tool to create a buffer.

Jupyter Notebooks in ArcGIS Pro:

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Figure 3: Data flow diagram for buffering a dataset using Jupyter Notebooks within ArcGIS Pro.

To buffer a dataset using Jupyter Notebooks in ArcGIS Pro, call either the arcpy.analysis.Buffer or arcpy.analysis.PairwiseBuffer functions. It is helpful to use the Python Window within ArcGIS Pro to determine what parameters are needed for arcpy functions.

Jupyter Notebooks in ArcGIS Online:

*A screenshot of a diagram

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Figure 4: Data flow diagram for buffering a dataset using Jupyter Notebooks in ArcGIS Online.

To buffer a dataset using Jupyter Notebooks in ArcGIS Online, the data must first be uploaded to ArcGIS Online and then unzipped (which can be done by calling a function). Unlike in ArcGIS Pro, the arcpy module is not already imported, so that must happen before the buffering function is called. The same functions used with Jupyter Notebooks in ArcGIS Pro can be used in ArcGIS Online.

**Results**

A map of a large area with blue dots

Description automatically generatedThe map on the left shows the buffer created around the road network. All three methods produced the same map. From this map we can categorize areas in blue as close to the road (within 1 mile) or far from the nearest road (greater than 1 mile).

Figure 5: Buffer zone (blue) around the road network (orange).

Table 3: Comparison of the three platforms.

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| --- | --- | --- |
| **ArcGIS Pro** | **Jupyter Notebooks within ArcGIS Pro** | **Jupyter Notebooks in ArcGIS Online** |
| * Data stored locally * No coding required * Results automatically appear on map * Runs quickly | * Data stored locally * The required coding uses already imported modules * Results automatically appear on map * Runs quickly | * Data stored in ArcGIS Online * The required coding includes importing arcpy * Results do not automatically appear on map * Runs slowly |

**Results Verification**

Because the results are the same for all three platforms, they are likely correct. The results can also be verified by using the measure tool. As can be seen in the figure below, the distance between roads and the boundary of the buffer zone is 1 mile. Given

A map of a sea

Description automatically generated

Figure 6: The measure tool shows that the distance between the end of a road (orange) and the boundary of the buffer zone (blue) is 1 mile.

**Discussion and Conclusion**

*Github*

I found setting up Github relatively straight-forward. I found the data pipeline a little confusing when it comes to staging and pushing changes, but carefully going through the tutorial helped me figure out how to do these things.

*Buffering*

I found using ArcGIS Pro to buffer the dataset by far the easiest. I already have quite a bit of experience using ArcGIS Pro, so navigating the UI to buffer the road network was very simple. Using Jupyter Notebooks within ArcGIS Pro was more challenging. I don’t have very much experience using Python, so it took me longer to complete and I had a little bit of trouble figuring out how file pathing works, as that’s not something I’ve dealt with much before. I found using Jupyter Notebooks in ArcGIS Online the most challenging. It has been about four years since the last time I’ve used ArcGIS Online, and I don’t remember it very well. The coding required to buffer the dataset was more complex, and it took a significantly longer amount of time to run, which was frustrating because I wasn’t very sure that the results would be what I was looking for.

**References**

*Get started with notebooks*. Get started with notebooks-ArcGIS Online Help | Documentation. (n.d.). https://doc.arcgis.com/en/arcgis-online/get-started/components-of-the-notebook-editor.htm

*Notebooks in ArcGIS Pro*. Notebooks in ArcGIS Pro-ArcGIS Pro | Documentation. (n.d.). https://pro.arcgis.com/en/pro-app/latest/arcpy/get-started/pro-notebooks.htm

*Upload datasets to use with ArcPy*. Upload datasets to use with ArcPy-ArcGIS Online Help | Documentation. (n.d.). https://doc.arcgis.com/en/arcgis-online/create-maps/upload-datasets-to-use-with-arcpy.htm

**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 | **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 | **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 | **20** |
|  |  | 100 | **100** |