Week 5 Assignment: Training and Teaching and Automating with ArcGIS Pro

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MSDS 674: Geographic Information Systems

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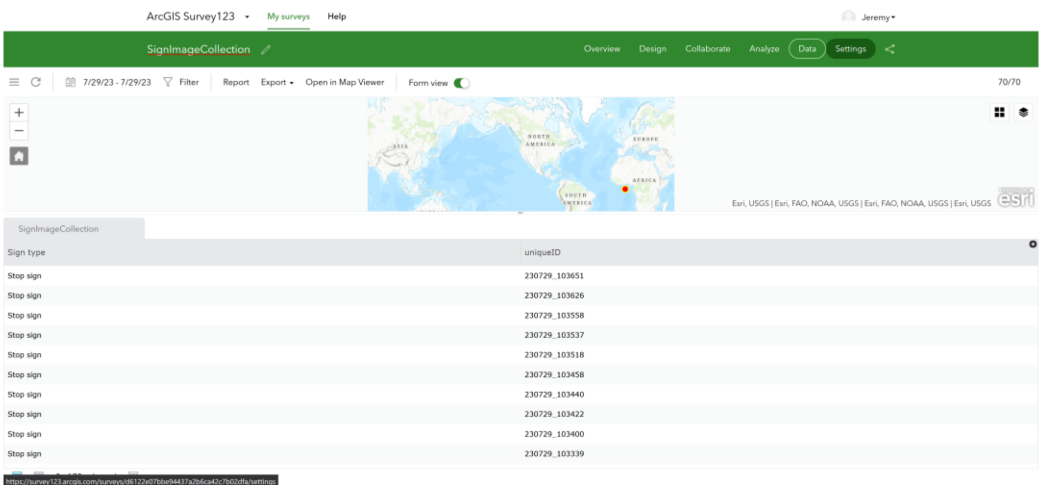
Week 5 Assignment: Training and Teaching and Automating with ArcGIS Pro

In this week's assignment, we explore two tutorials that cover model training and testing, as well as automation. The first tutorial (*Train a Model to Identify Street Signs*, n.d.) teaches us how to use survey data taken with a smartphone to train a model to distinguish between street signs. We end up with a smartphone app that can successfully predict whether a sign is a Stop sign or a Speed Limit sign, with a high degree of confidence. The second tutorial (*Schedule Automated Near Real-time Data Updates*, n.d.) explores how to automate a script to update a database with the most recent information concerning Texas GIS data. It also deals with updating the style of this data display so it has a specific color scale and size. Let's get started!

Train a Model to Identify Street Signs

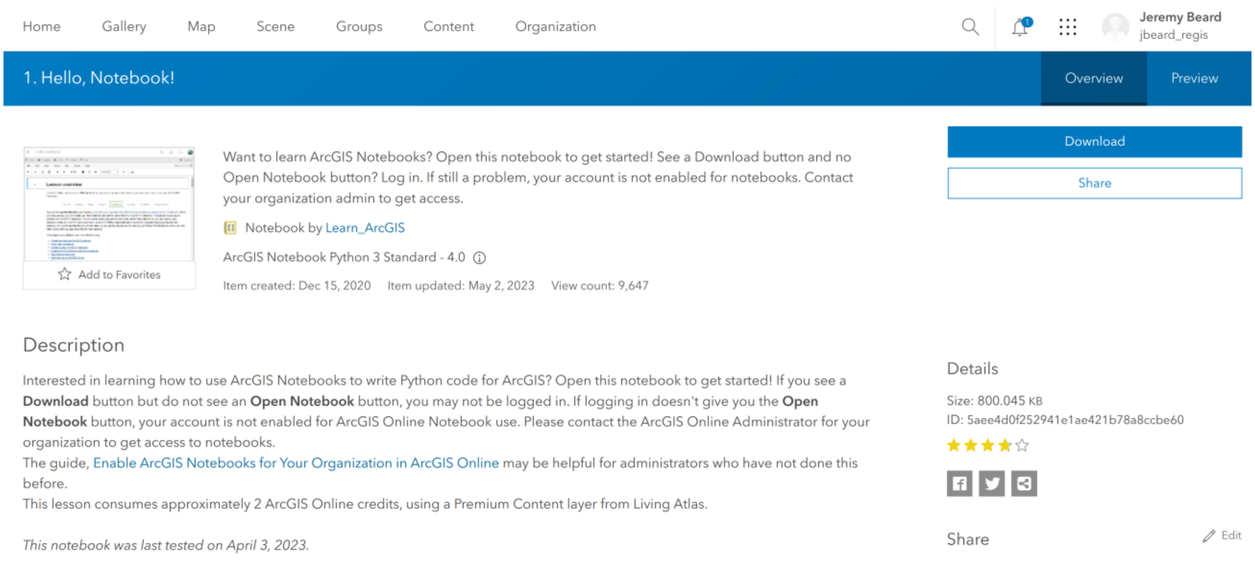
In the first section of the assignment, we follow a tutorial which teaches us how to train models with GIS data. We first import a survey from the tutorial, and then we add all related pictures to the Stop sign and Speed sign categories. This helps to train the model we will create. We used ArcGIS Survey123 for this effort as it made for easy integration across all the ArcGIS software packages. There were 70 example images to load in and train the model with. These were all imported into this survey object.



Sign type	uniqueID
Stop sign	230729_103651
Stop sign	230729_103626
Stop sign	230729_103558
Stop sign	230729_103537
Stop sign	230729_103518
Stop sign	230729_103458
Stop sign	230729_103440
Stop sign	230729_103422
Stop sign	230729_103400
Stop sign	230729_103339

https://survey123.arcgis.com/surveys/d6122e07bbe94437a2b6ca42c7b02dfa/settings

Figure 1: After loading all 70 images into ArcGIS Survey123 Connect



1. Hello, Notebook!

Want to learn ArcGIS Notebooks? Open this notebook to get started! See a Download button and no Open Notebook button? Log in. If still a problem, your account is not enabled for notebooks. Contact your organization admin to get access.

Notebook by Learn_ArcGIS

ArcGIS Notebook Python 3 Standard - 4.0

Item created: Dec 15, 2020 Item updated: May 2, 2023 View count: 9,647

Description

Interested in learning how to use ArcGIS Notebooks to write Python code for ArcGIS? Open this notebook to get started! If you see a **Download** button but do not see an **Open Notebook** button, you may not be logged in. If logging in doesn't give you the **Open Notebook** button, your account is not enabled for ArcGIS Online Notebook use. Please contact the ArcGIS Online Administrator for your organization to get access to notebooks.
The guide, Enable ArcGIS Notebooks for Your Organization in ArcGIS Online may be helpful for administrators who have not done this before.
This lesson consumes approximately 2 ArcGIS Online credits, using a Premium Content layer from Living Atlas.

This notebook was last tested on April 3, 2023.

Details

Size: 800.045 KB
ID: 5aee4d0f252941e1ae421b78a8ccbe60

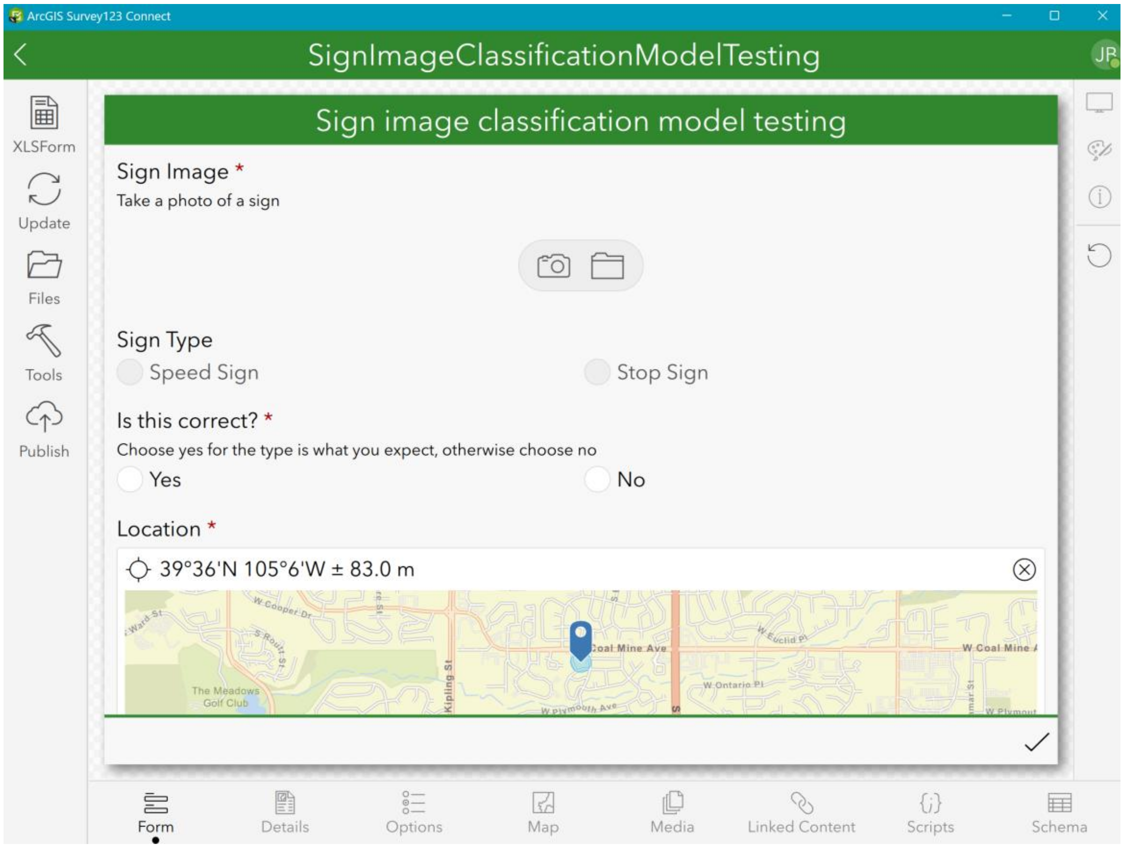
★★★★☆

Share

Edit

Figure 2: Showing account not enabled for ArcGIS Online Notebook use

In Figure 2 above, it is shown that our account is not enabled for ArcGIS Online Notebooks. Therefore, we will download the trained model as the instructions direct us to do in the event of not having Notebooks access. We then download a second survey which is the testing survey, now that the model is trained. Using this second survey, we can show that we have trained the model well enough to be able to predict whether a street sign is a Stop sign or a Speed sign. Our smartphone shows us a specific percentage confidence level when we predict each instance.



Sign image classification model testing

Sign Image *

Take a photo of a sign

Sign Type

○ Speed Sign ○ Stop Sign

Is this correct? *

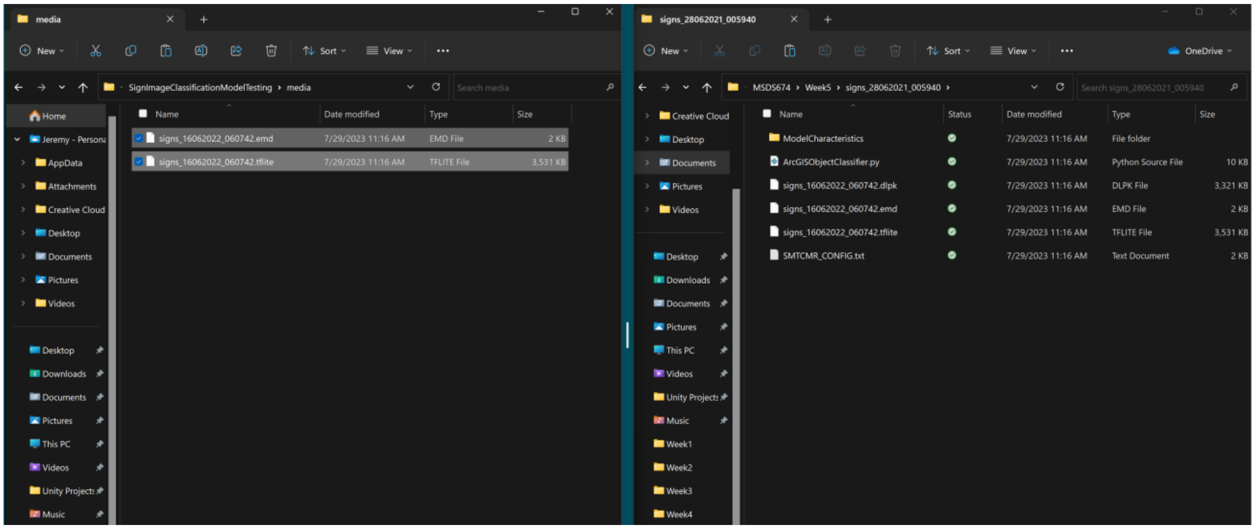
Choose yes for the type is what you expect, otherwise choose no

○ Yes ○ No

Location *

39°36'N 105°6'W ± 83.0 m

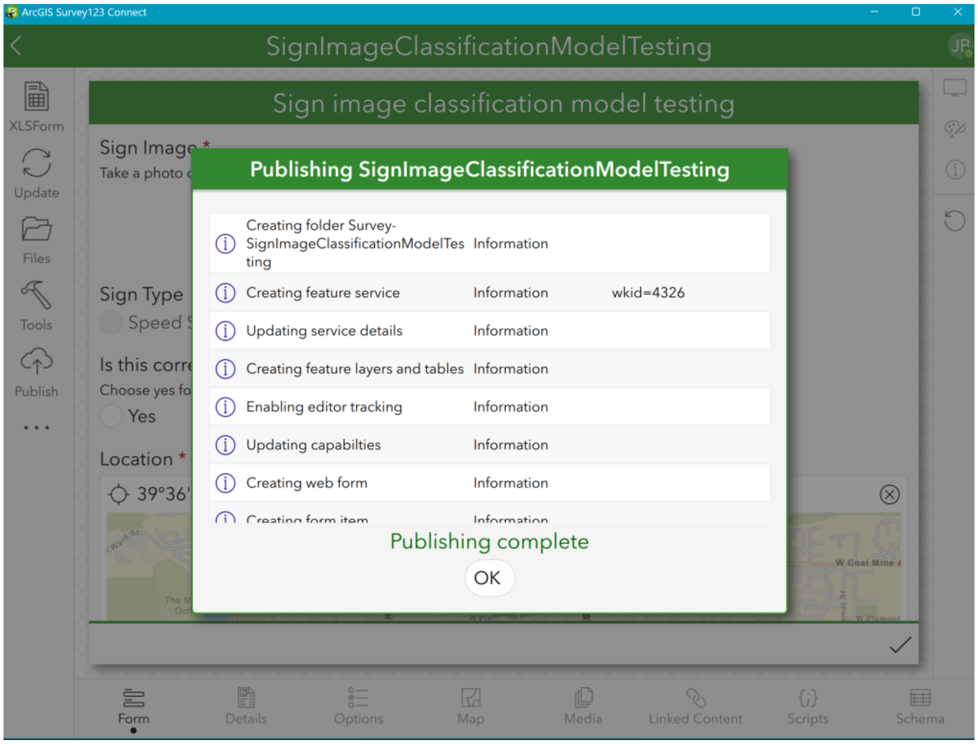
Figure 3: Importing the second survey



Name	Date modified	Type	Size
signs_16062022_060742.emd	7/29/2023 11:16 AM	EMD File	2 KB
signs_16062022_060742.tflite	7/29/2023 11:16 AM	TFLITE File	3,531 KB

Name	Status	Date modified	Type	Size
ModelCharacteristics	✓	7/29/2023 11:16 AM	File folder	
ArcGISObjectClassifier.py	✓	7/29/2023 11:16 AM	Python Source File	10 KB
signs_16062022_060742.dlpk	✓	7/29/2023 11:16 AM	DLPK File	3,321 KB
signs_16062022_060742.emd	✓	7/29/2023 11:16 AM	EMD File	2 KB
signs_16062022_060742.tflite	✓	7/29/2023 11:16 AM	TFLITE File	3,531 KB
SMTCMR_CONFIG.txt	✓	7/29/2023 11:16 AM	Text Document	2 KB

Figure 4: Copying 2 files from downloaded model to new survey directory



Publishing SignImageClassificationModelTesting

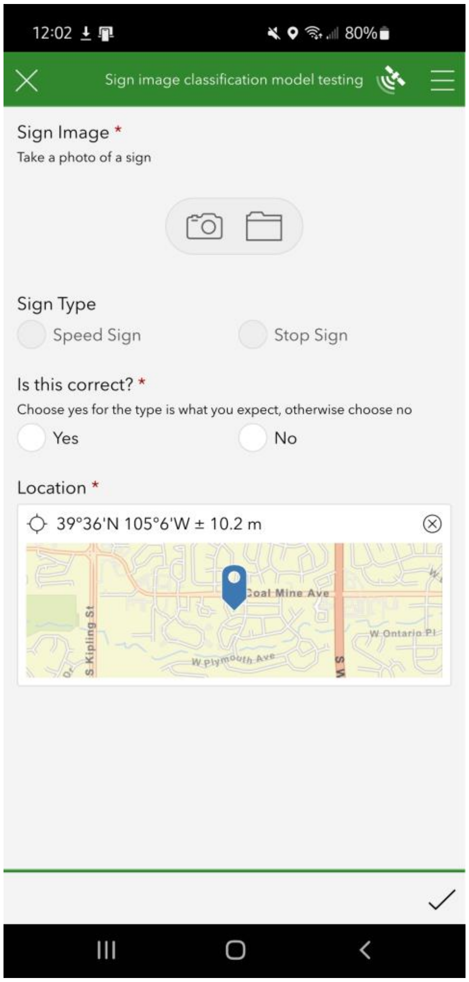
Creating folder Survey-SignImageClassificationModelTesting	Information	
Creating feature service	Information	wkid=4326
Updating service details	Information	
Creating feature layers and tables	Information	
Enabling editor tracking	Information	
Updating capabilties	Information	
Creating web form	Information	
Creating form item	Information	

Publishing complete

OK

Figure 5: Publishing the 2nd survey

After the 2nd survey is published, it's time to test it out. We download the survey on our phones via the Survey123 app. After we can access the survey on our phones, we take pictures with our phones to test the model. Notice the percentage values at the top of each image. These are the percentage confidence levels mentioned previously. It seems that the model is able to predict photo classification with a high degree of confidence! The confidence level is reduced slightly if the phone is moving a lot when taking the picture.



Sign image classification model testing

Sign Image *

Take a photo of a sign

Sign Type

○ Speed Sign ○ Stop Sign

Is this correct? *

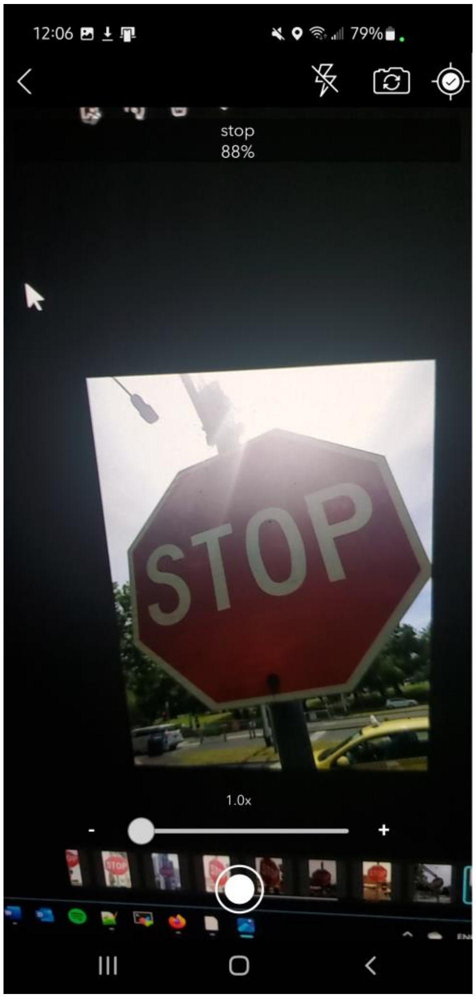
Choose yes for the type is what you expect, otherwise choose no

○ Yes ○ No

Location *

39°36'N 105°6'W ± 10.2 m

Figure 6: Phone interface of 2nd survey



stop
88%

Figure 7: Predicting stop sign image with 88% confidence

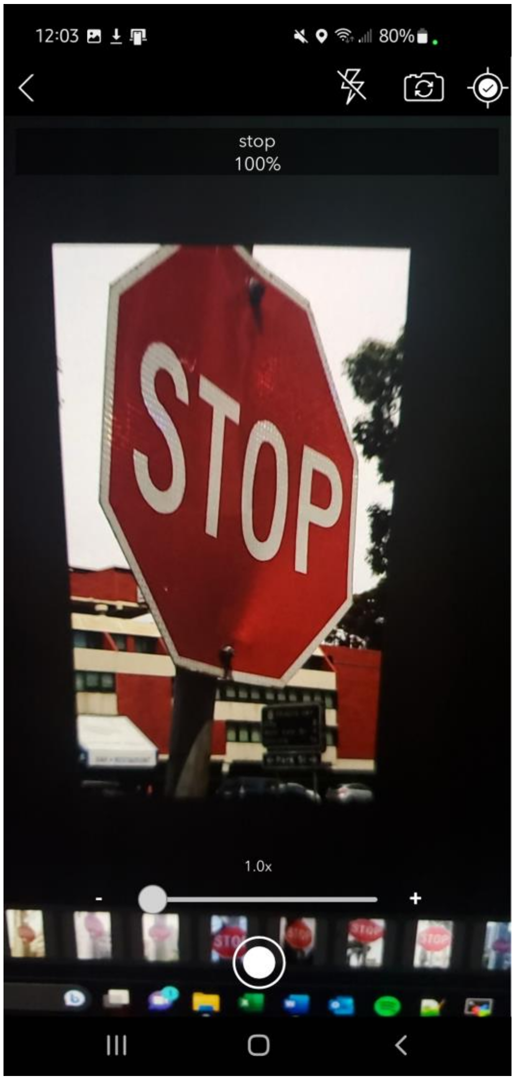
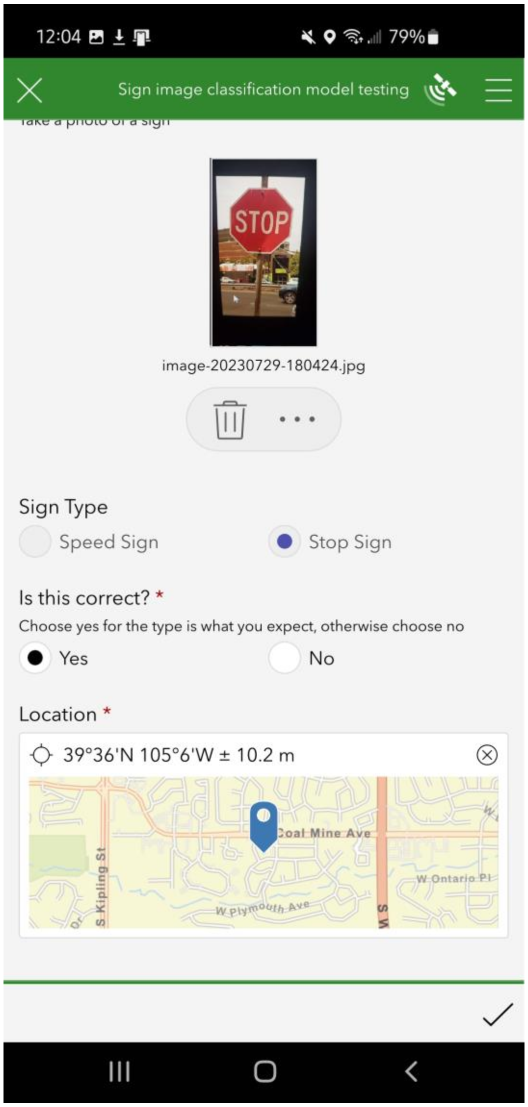


Figure 8: Predicting Stop sign with 100% confidence



Sign image classification model testing

Take a photo of a sign

image-20230729-180424.jpg

Sign Type

○ Speed Sign ● Stop Sign

Is this correct? *

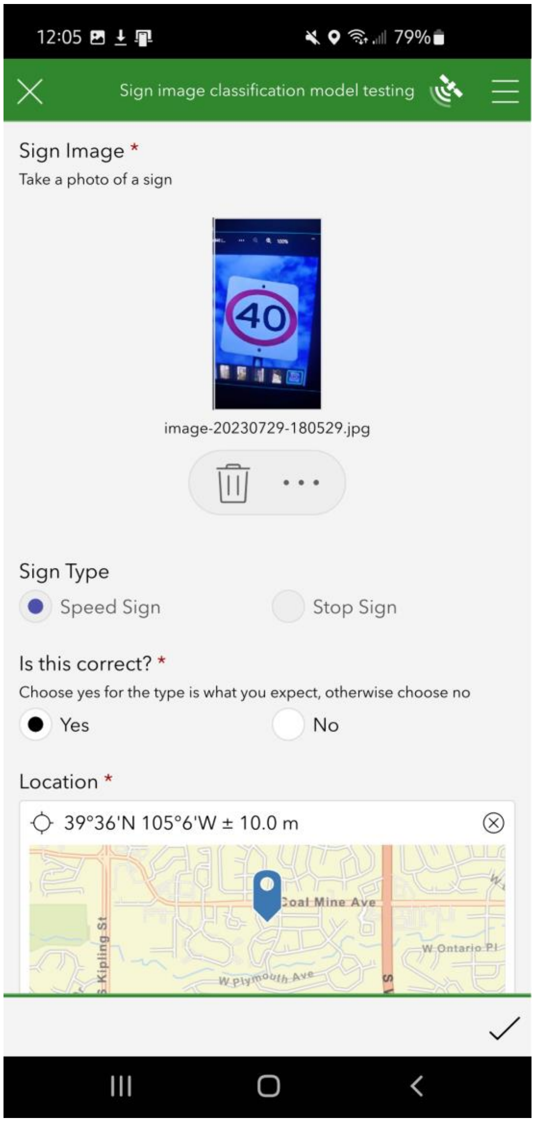
Choose yes for the type is what you expect, otherwise choose no

● Yes ○ No

Location *

39°36'N 105°6'W ± 10.2 m

Figure 9: Stop sign prediction validation screen



12:05 79%

Sign image classification model testing

Sign Image *

Take a photo of a sign

image-20230729-180529.jpg

Sign Type

● Speed Sign ○ Stop Sign

Is this correct? *

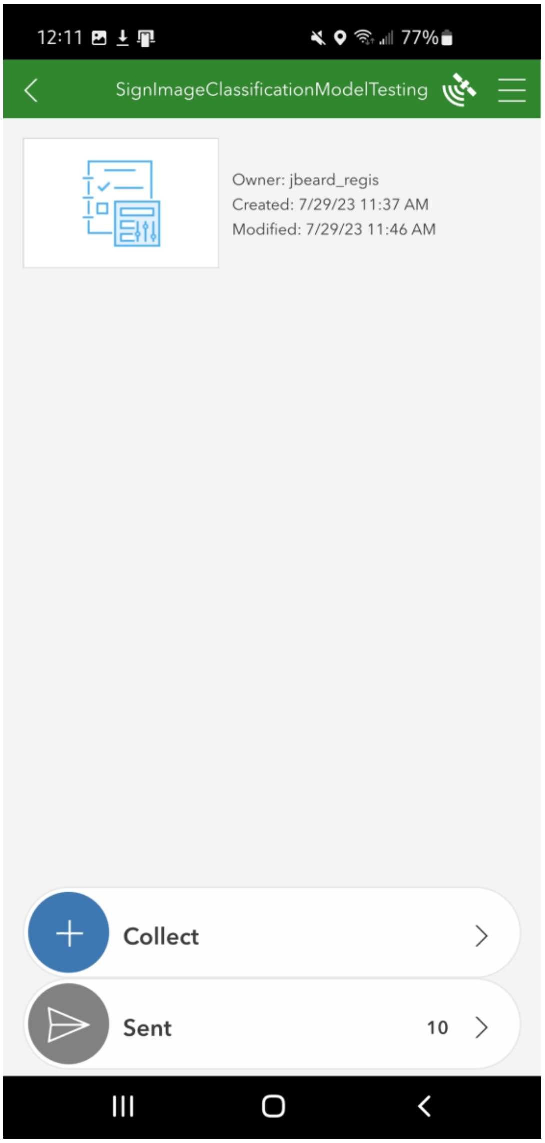
Choose yes for the type is what you expect, otherwise choose no

● Yes ○ No

Location *

39°36'N 105°6'W ± 10.0 m

Figure 10: Speed sign prediction validation screen



Owner: jbeard_regis
Created: 7/29/23 11:37 AM
Modified: 7/29/23 11:46 AM

Figure 11: Validation of 10 images

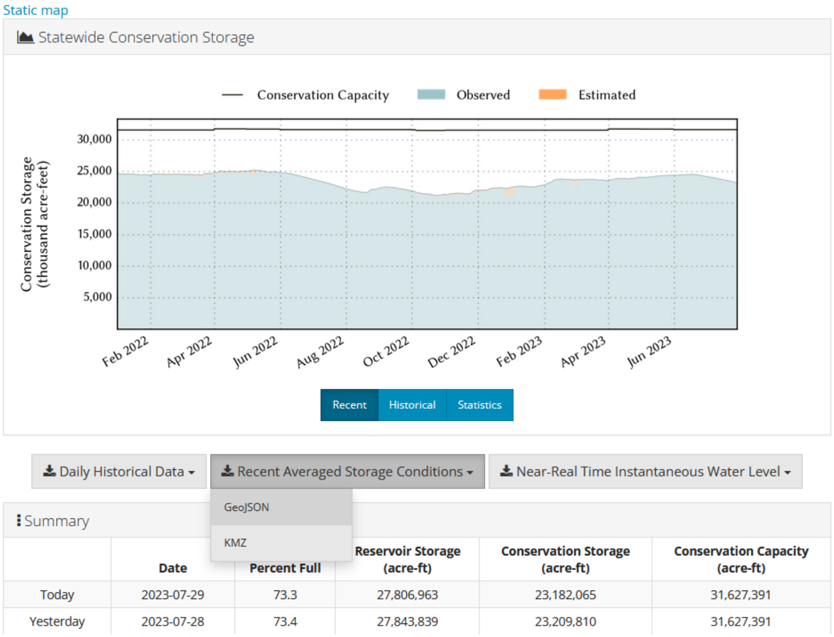
Figures 6 through 11 show us how the model is able to predict whether an image shows a Stop sign or Speed sign, with a shown degree of confidence. Usually the percentage confidence shown is quite high. This has to do with what specific images were used to train the model vs. test the model. This completes the first section of the assignment for this week!

Schedule Automated Near Real-Time Data Updates

In the next part of the assignment, we explore a dataset that is centered around reservoir water levels in Texas. This specific section was labeled as “Teach with ArcGIS Notebooks” in both the Assignment section and Discussion section of WorldClass, and referenced Traffic Collision data in these two WorldClass sections. This was inconsistent with the information and content actually found in the hyperlink and as a result, the hyperlink was followed. Please advise if this is incorrect.

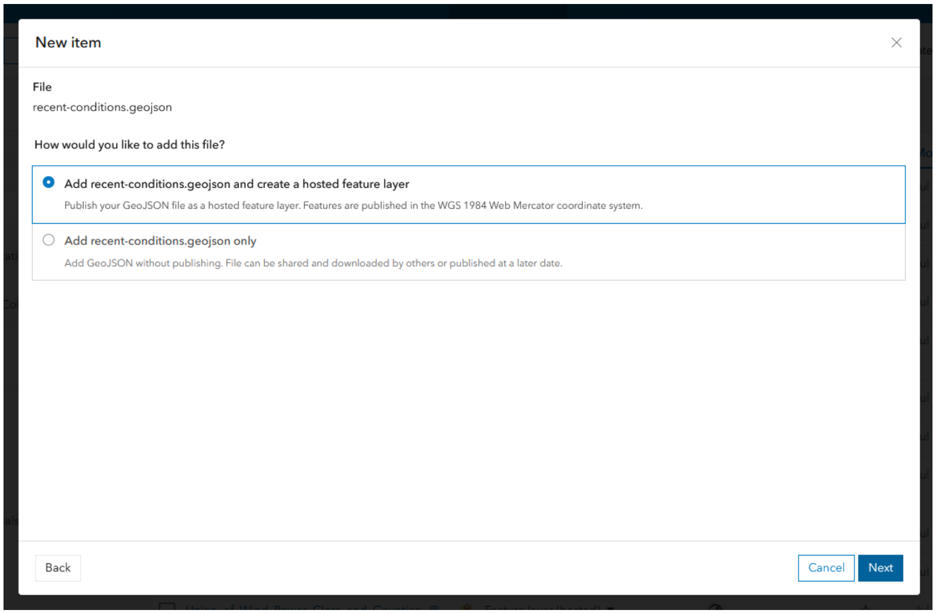
Publish a Feature Service

The first step of this tutorial is to download the specific GeoJSON data. A link was given and proper instructions to find the download link. The file downloaded was a simple JSON file giving us different reservoir lat-lon data as well as other parameters. This GeoJSON file was then added as a feature layer to the content available.



	Date	Percent Full	Reservoir Storage (acre-ft)	Conservation Storage (acre-ft)	Conservation Capacity (acre-ft)
Today	2023-07-29	73.3	27,806,963	23,182,065	31,627,391
Yesterday	2023-07-28	73.4	27,843,839	23,209,810	31,627,391

Figure 12: Downloading Texas GeoJSON data



New item

File

recent-conditions.geojson

How would you like to add this file?

● Add recent-conditions.geojson and create a hosted feature layer

Publish your GeoJSON file as a hosted feature layer. Features are published in the WGS 1984 Web Mercator coordinate system.

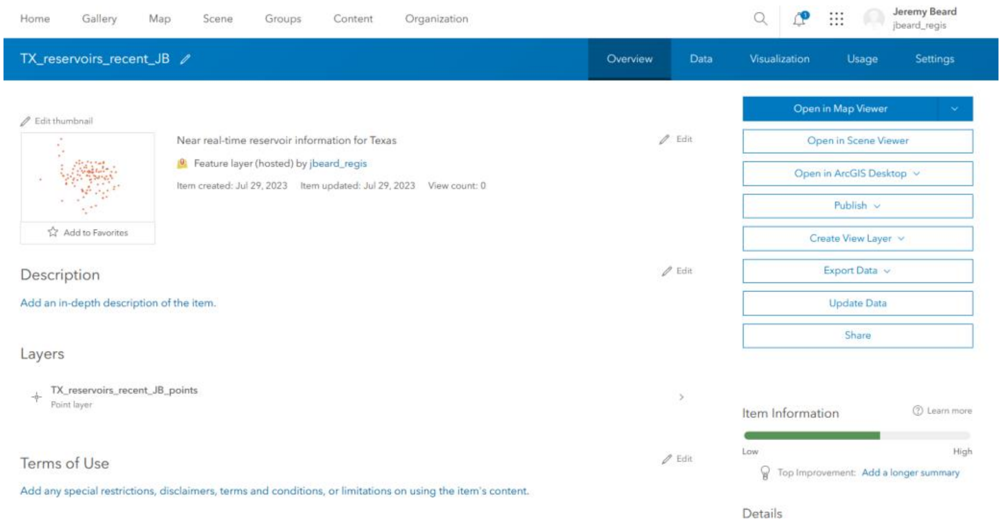
○ Add recent-conditions.geojson only

Add GeoJSON without publishing. File can be shared and downloaded by others or published at a later date.

Figure 13: Adding the recent-conditions.geojson file to the ArcGIS Online content

Create a Hosted Feature Layer View

After the Texas GeoJSON data is downloaded and added to the ArcGIS Online content, we then create a layer with this data contained within. We click “Create View Layer” and follow the instructions provided.



Near real-time reservoir information for Texas

Feature layer (hosted) by jbeard_regis

Item created: Jul 29, 2023 Item updated: Jul 29, 2023 View count: 0

Description

Add an in-depth description of the item.

Layers

TX_reservoirs_recent_JB_points
Point layer

Terms of Use

Add any special restrictions, disclaimers, terms and conditions, or limitations on using the item's content.

Item Information

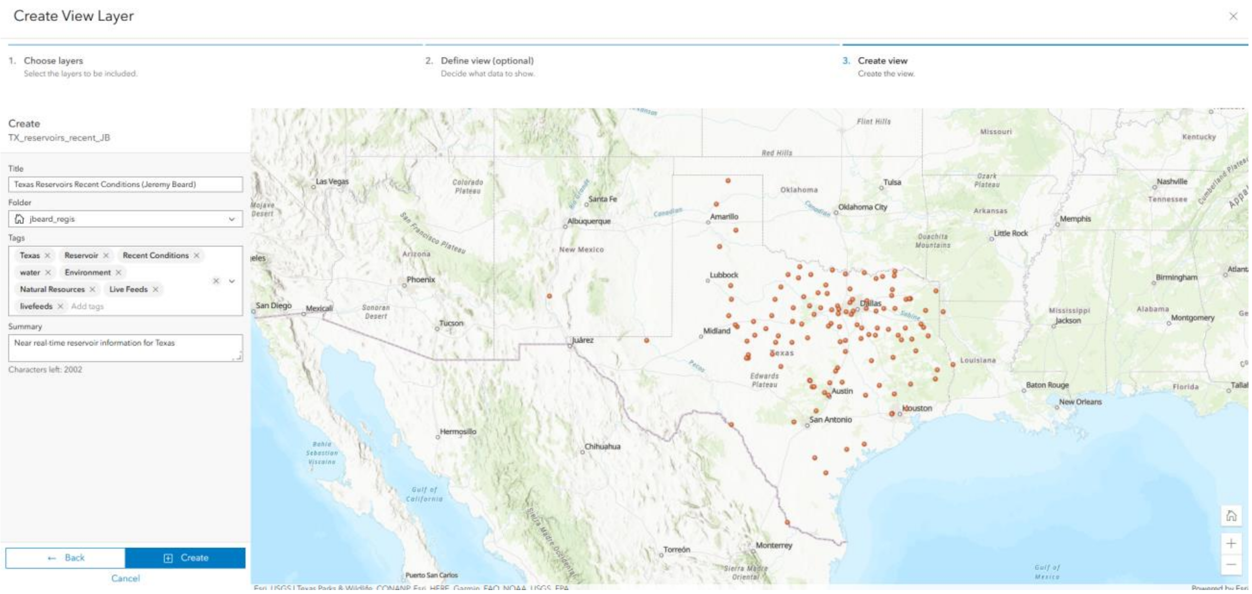
Learn more

Low High

Top Improvement: Add a longer summary

Details

Figure 14: After creating and saving the TX_reservoirs_recent_JB item



Create View Layer

1. Choose layers
   Select the layers to be included.
2. Define view (optional)
   Decide what data to show.
3. Create view
   Create the view.

Create
TX_reservoirs_recent_JB

Title: Texas Reservoirs Recent Conditions (Jeremy Beard)

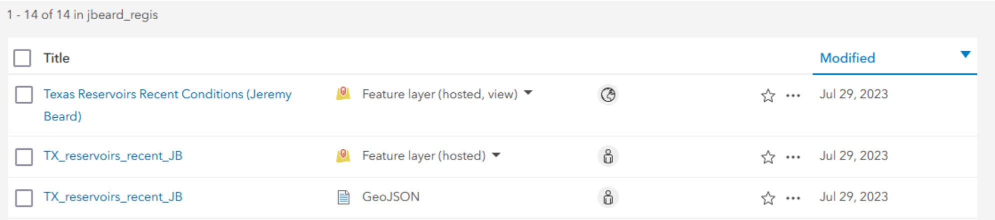
Folder: jbeard_regis

Tags: Texas, Reservoir, Recent Conditions, water, Environment, Natural Resources, Live Feeds, livefeeds

Summary: Near real-time reservoir information for Texas

Characters left: 2002

Figure 15: Creating a view layer using the Texas data



1 - 14 of 14 in jbeard_regis

□ Title			Modified
□ Texas Reservoirs Recent Conditions (Jeremy Beard)	Feature layer (hosted, view)		Jul 29, 2023
□ TX_reservoirs_recent_JB	Feature layer (hosted)		Jul 29, 2023
□ TX_reservoirs_recent_JB	GeoJSON		Jul 29, 2023

Figure 16: Relevant content in ArcGIS Online

Figure 16 shows us what relevant content we should have in our library after the steps previously were followed. After creating this content, we open the newly created Texas Reservoirs Recent Conditions layer and configure it to have a specific color scale as well as size. We also change the basemap to be a gray color and add a convenient pop-up to tell the user how full each reservoir is, as well as its name and date updated. These operations are all shown in Figures 17 through 20. Figure 20 shows the final style configuration.

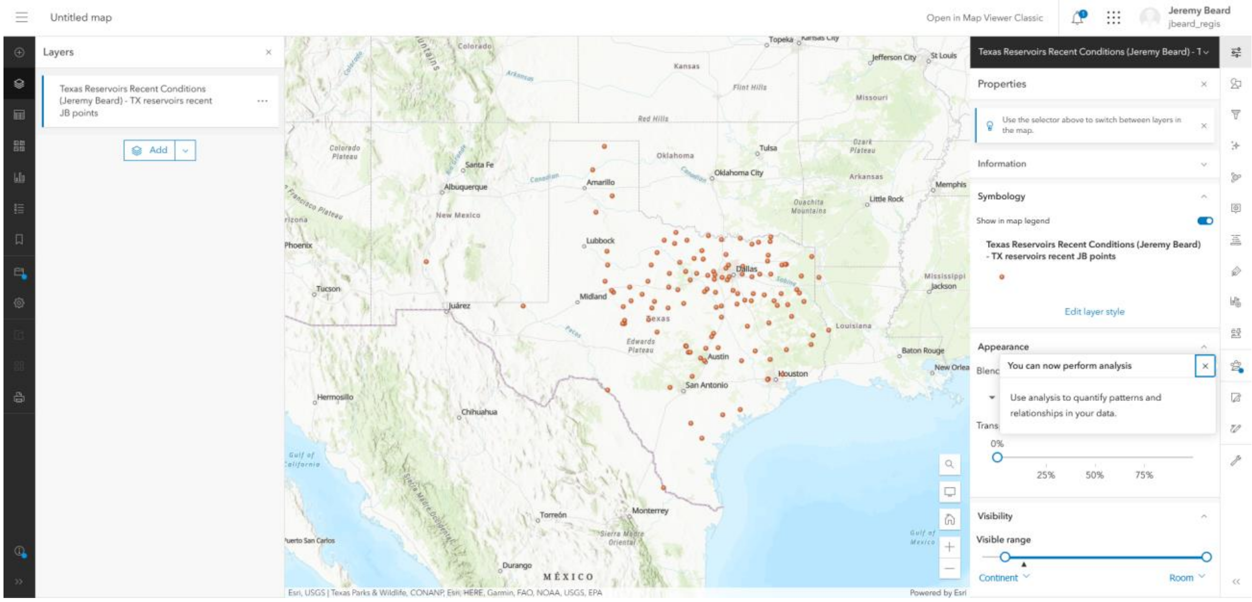

Untitled map
Open in Map Viewer Classic
Jeremy Beard
jbeard_regis
Layers
Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points
Add
Texas Reservoirs Recent Conditions (Jeremy Beard) - T
Properties
Use the selector above to switch between layers in the map.
Information
Symbology
Show in map legend
Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points
Edit layer style
Appearance
You can now perform analysis
Use analysis to quantify patterns and relationships in your data.
Blenc
Trans
0%
25%
50%
75%
Visibility
Visible range
Continent
Room
Esri, USGS | Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
Powered by Esri

Figure 17: Opening the Texas Reservoirs Recent Conditions layer

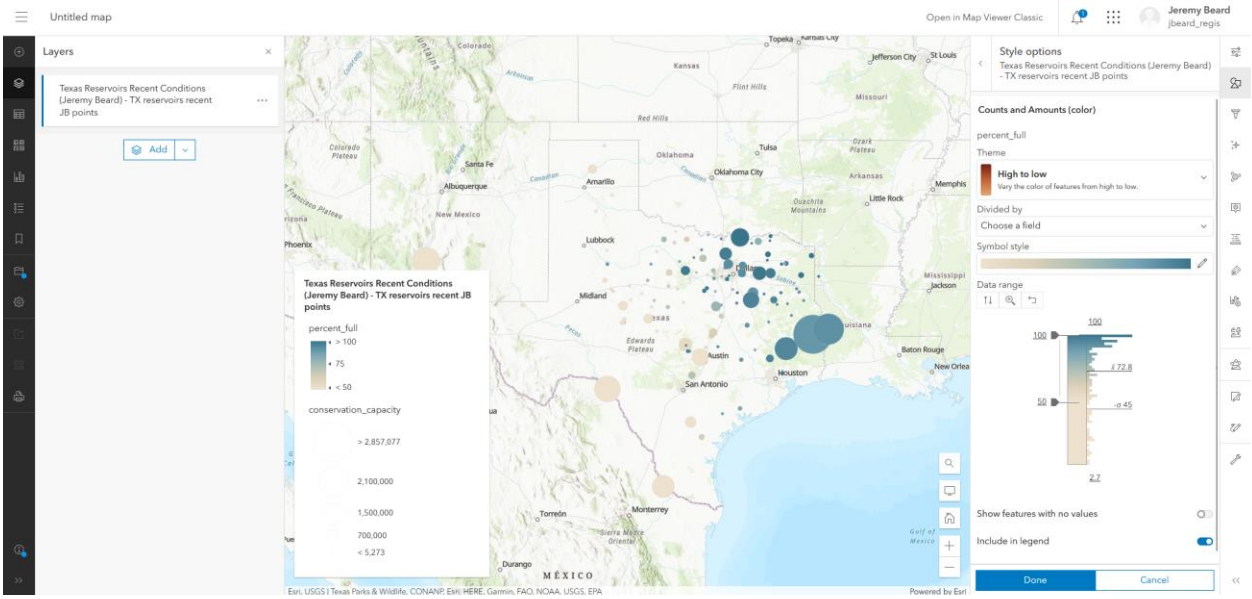
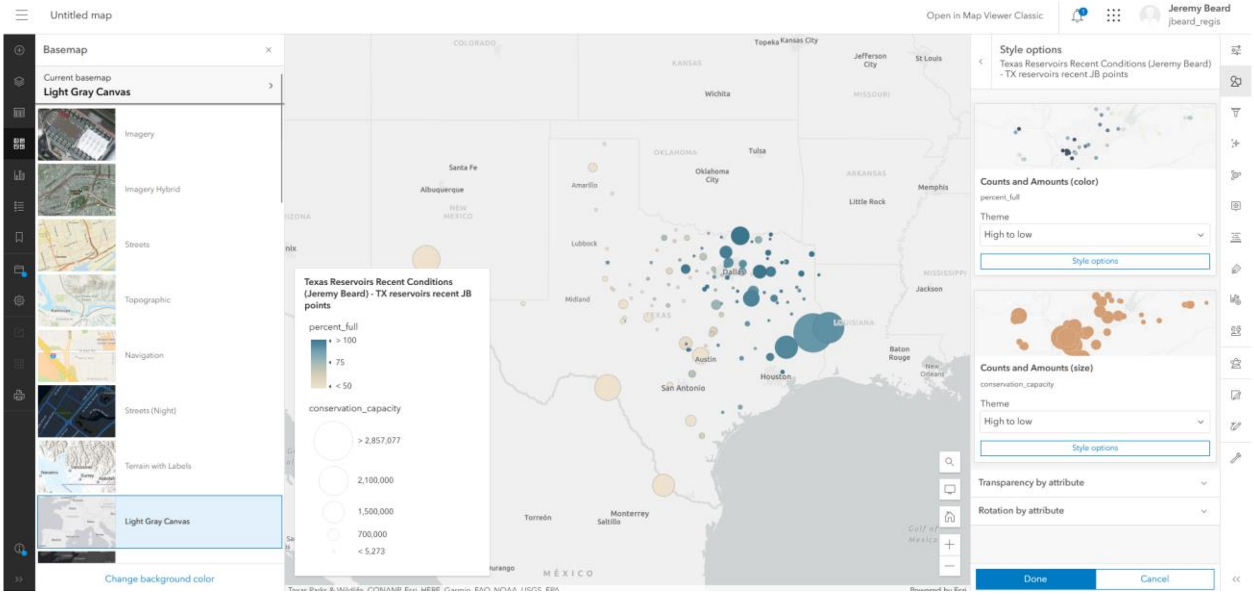

Untitled map
Open in Map Viewer Classic
Jeremy Beard
jbeard_regis
Layers
Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points
Add
Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points
percent_full
> 100
75
< 50
conservation_capacity
> 2,857,077
2,100,000
1,500,000
700,000
< 5,273
Style options
Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points
Counts and Amounts (color)
percent_full
Theme
High to low
Vary the color of features from high to low.
Divided by
Choose a field
Symbol style
Data range
100
100
x̄ 72.8
50
-σ 45
2.7
Show features with no values
Include in legend
Done
Cancel
Esri, USGS | Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA
Powered by Esri

Figure 18: Configuring the “Counts and Amounts (color)” fields


Basemap

Current basemap: Light Gray Canvas

Style options: Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points

Counts and Amounts (color): percent_full, Theme: High to low

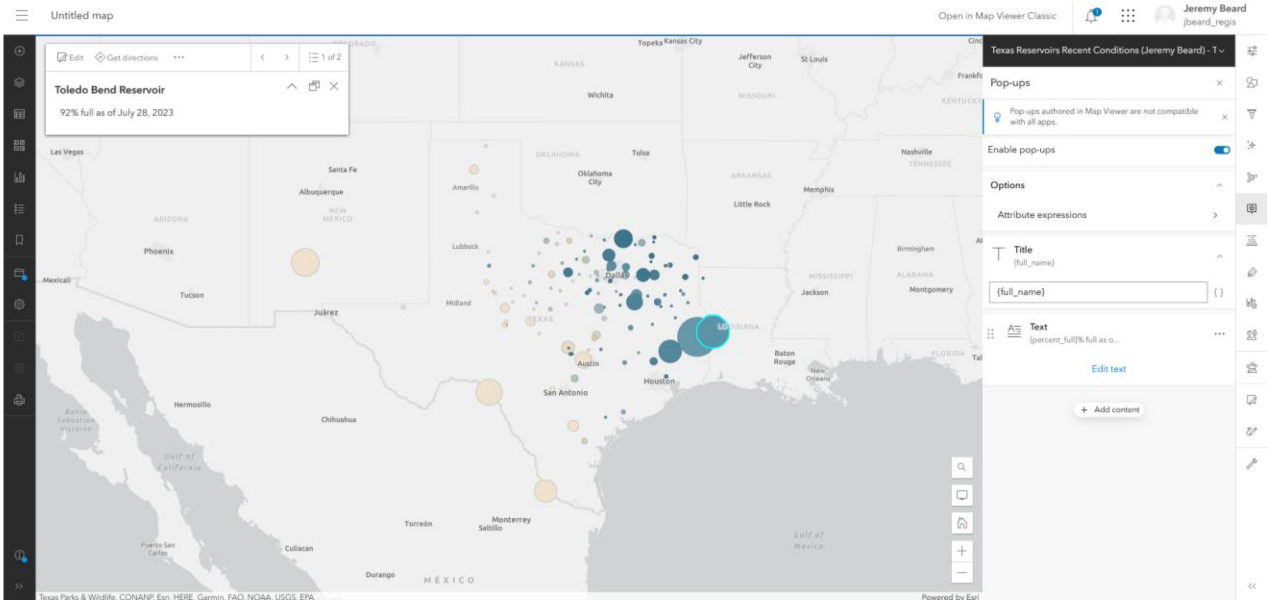
Counts and Amounts (size): conservation_capacity, Theme: High to low

Texas Reservoirs Recent Conditions (Jeremy Beard) - TX reservoirs recent JB points

percent_full: > 100, 75, < 50

conservation_capacity: > 2,857,077; 2,100,000; 1,500,000; 700,000; < 5,273

Figure 19: Selecting the “Light Gray Canvas” basemap


Toledo Bend Reservoir

92% full as of July 28, 2023

Texas Reservoirs Recent Conditions (Jeremy Beard) - T

Pop-ups

Pop-ups authored in Map Viewer are not compatible with all apps.

Enable pop-ups: on

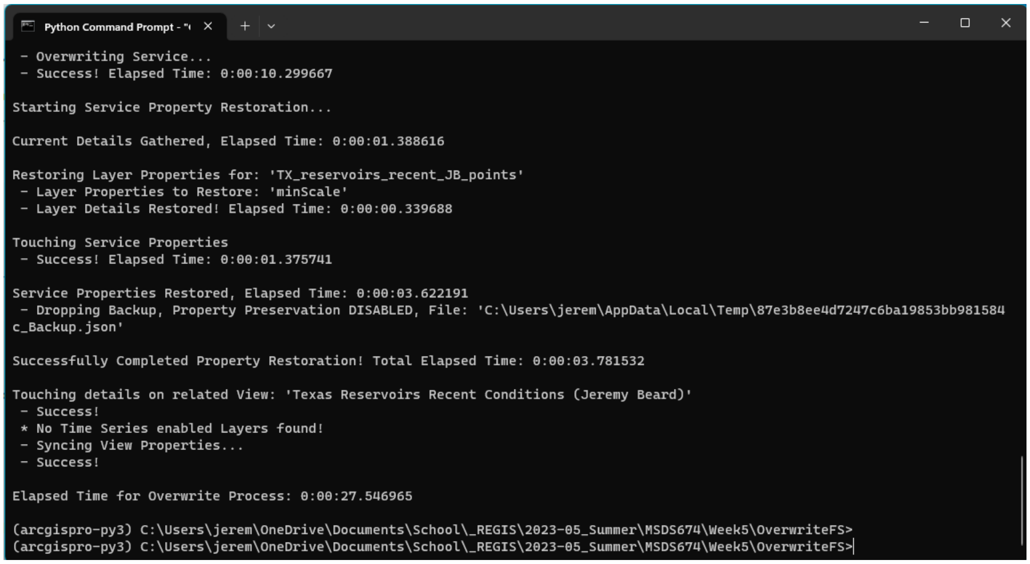
Title: {full_name}

Text: {percent_full}% full as o...

Figure 20: After configuring the feature pop-up title and text

Update a Hosted Feature Layer

Next, we run a pre-created script to update this layer of Texas reservoir data. Using this script, we will begin to automate the process of updating our reservoir data. Figure 21 shows this Update/Overwrite script in action.



```
 - Overwriting Service...
 - Success! Elapsed Time: 0:00:10.299667

Starting Service Property Restoration...

Current Details Gathered, Elapsed Time: 0:00:01.388616

Restoring Layer Properties for: 'TX_reservoirs_recent_JB_points'
 - Layer Properties to Restore: 'minScale'
 - Layer Details Restored! Elapsed Time: 0:00:00.339688

Touching Service Properties
 - Success! Elapsed Time: 0:00:01.375741

Service Properties Restored, Elapsed Time: 0:00:03.622191
 - Dropping Backup, Property Preservation DISABLED, File: 'C:\Users\jerem\AppData\Local\Temp\87e3b8ee4d7247c6ba19853bb981584
c_Backup.json'

Successfully Completed Property Restoration! Total Elapsed Time: 0:00:03.781532

Touching details on related View: 'Texas Reservoirs Recent Conditions (Jeremy Beard)'
 - Success!
 * No Time Series enabled Layers found!
 - Syncing View Properties...
 - Success!

Elapsed Time for Overwrite Process: 0:00:27.546965

(arcgispro-py3) C:\Users\jerem\OneDrive\Documents\School\_REGIS\2023-05_Summer\MSDS674\Week5\OverwriteFS>
(arcgispro-py3) C:\Users\jerem\OneDrive\Documents\School\_REGIS\2023-05_Summer\MSDS674\Week5\OverwriteFS>
```

Figure 21: Running the OverwriteFS.py script

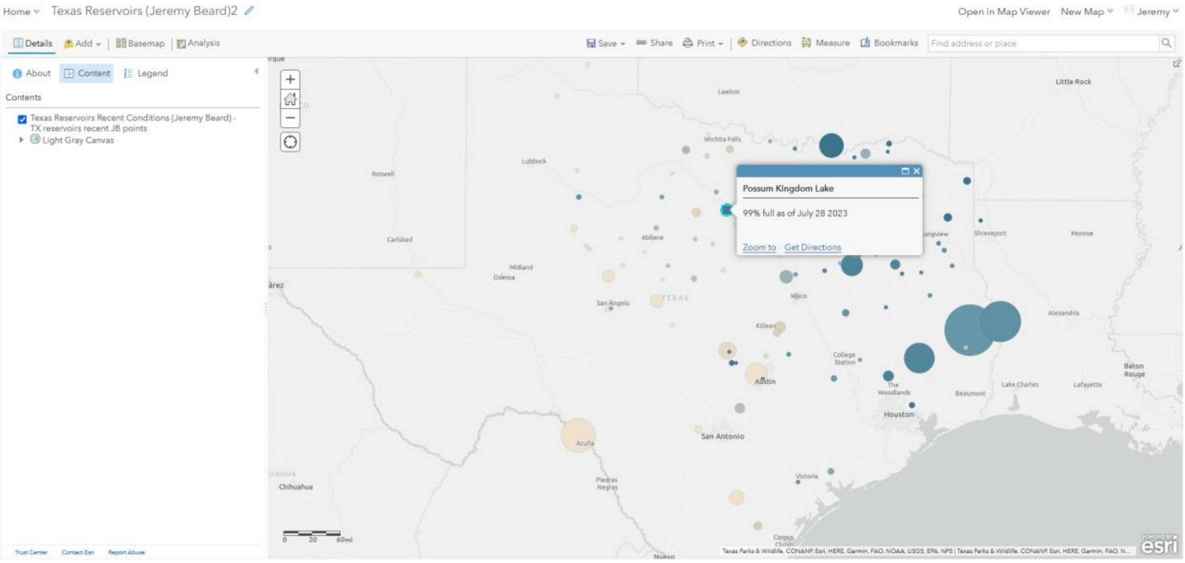
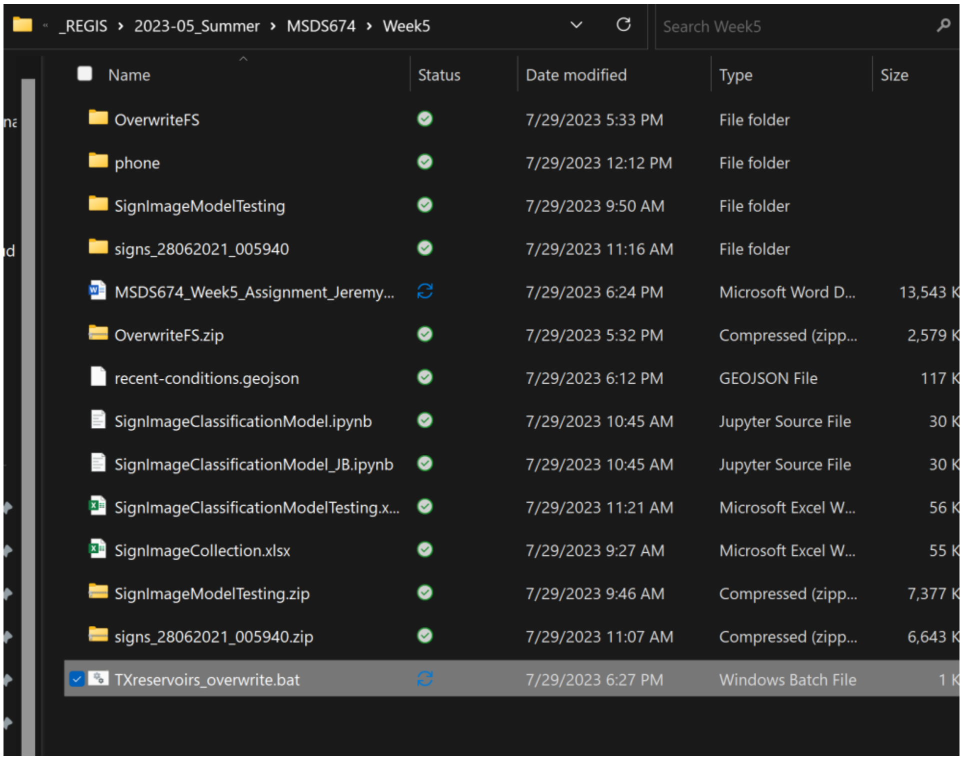


Figure 22: Showing the final Texas map with its pop-up

Create and Schedule a Task

Finally, we will use the Windows Task Scheduler to run a batch file every 24 hours. This batch file is a simple script to run the Update/Overwrite script shown in Figure 21 above. Using Windows Task Scheduler and this batch file, we will be able to automate our data to update every 24 hours.



_REGIS › 2023-05_Summer › MSDS674 › Week5

Search Week5

Name	Status	Date modified	Type	Size
OverwriteFS	✓	7/29/2023 5:33 PM	File folder	
phone	✓	7/29/2023 12:12 PM	File folder	
SignImageModelTesting	✓	7/29/2023 9:50 AM	File folder	
signs_28062021_005940	✓	7/29/2023 11:16 AM	File folder	
MSDS674_Week5_Assignment_Jeremy...	↻	7/29/2023 6:24 PM	Microsoft Word D...	13,543 K
OverwriteFS.zip	✓	7/29/2023 5:32 PM	Compressed (zipp...	2,579 K
recent-conditions.geojson	✓	7/29/2023 6:12 PM	GEOJSON File	117 K
SignImageClassificationModel.ipynb	✓	7/29/2023 10:45 AM	Jupyter Source File	30 K
SignImageClassificationModel_JB.ipynb	✓	7/29/2023 10:45 AM	Jupyter Source File	30 K
SignImageClassificationModelTesting.x...	✓	7/29/2023 11:21 AM	Microsoft Excel W...	56 K
SignImageCollection.xlsx	✓	7/29/2023 9:27 AM	Microsoft Excel W...	55 K
SignImageModelTesting.zip	✓	7/29/2023 9:46 AM	Compressed (zipp...	7,377 K
signs_28062021_005940.zip	✓	7/29/2023 11:07 AM	Compressed (zipp...	6,643 K
☑ TXreservoirs_overwrite.bat	↻	7/29/2023 6:27 PM	Windows Batch File	1 K

Figure 23: Newly created batch file

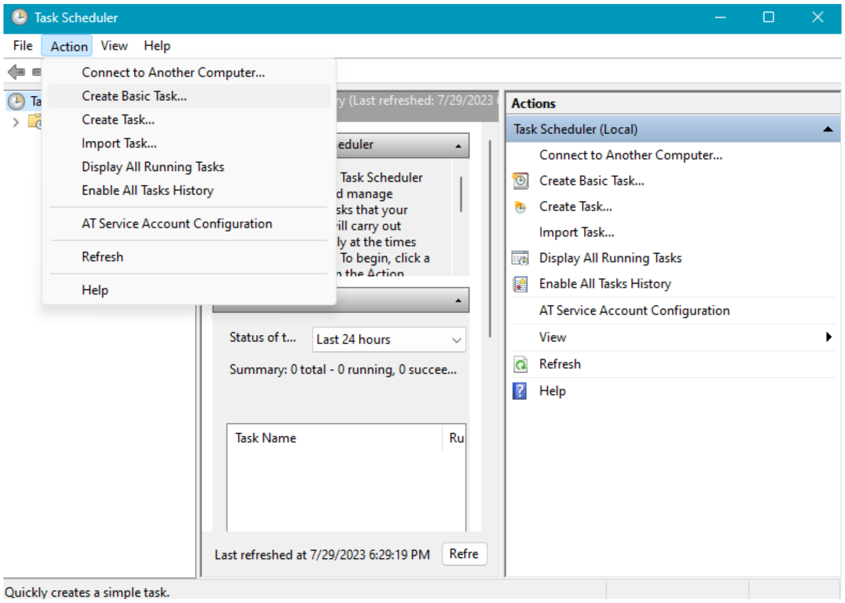
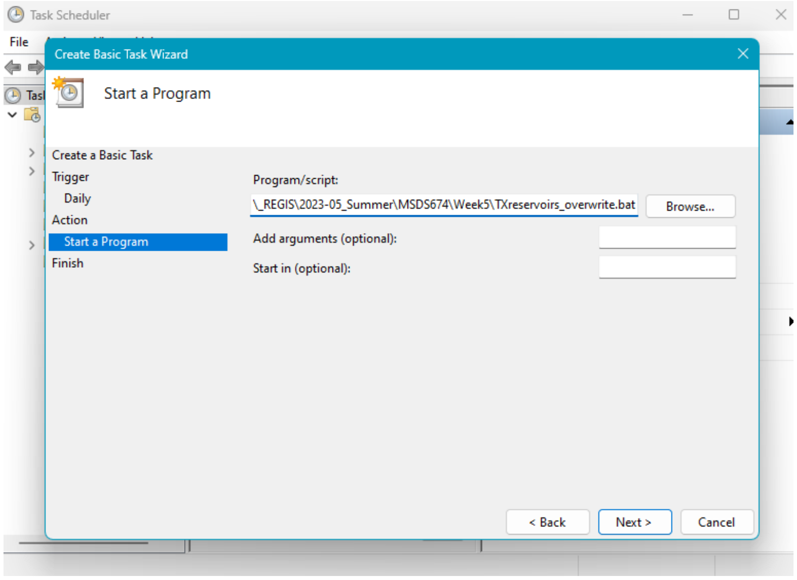

Task Scheduler
File
Action
View
Help
Connect to Another Computer...
Create Basic Task...
Create Task...
Import Task...
Display All Running Tasks
Enable All Tasks History
AT Service Account Configuration
Refresh
Help
Actions
Task Scheduler (Local)
Connect to Another Computer...
Create Basic Task...
Create Task...
Import Task...
Display All Running Tasks
Enable All Tasks History
AT Service Account Configuration
View
Refresh
Help
Status of t...
Last 24 hours
Summary: 0 total - 0 running, 0 succee...
Task Name
Ru
Last refreshed at 7/29/2023 6:29:19 PM
Refre
Quickly creates a simple task.

Figure 24: Creating a scheduled task



Program/script: _REGIS\2023-05_Summer\MSDS674\Week5\TXreservoirs_overwrite.bat

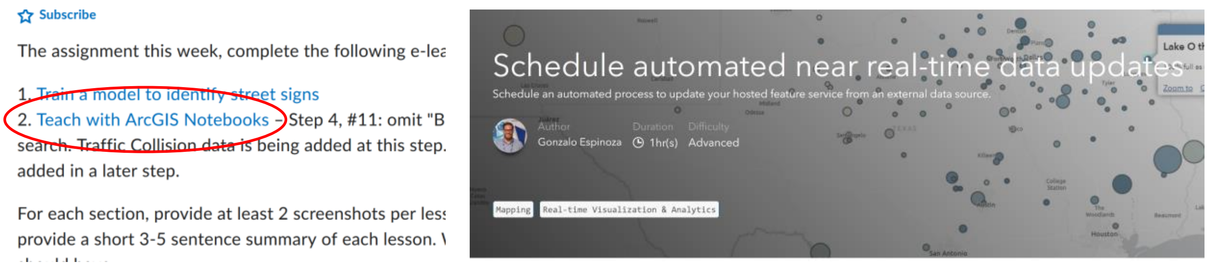
Add arguments (optional):

Start in (optional):

Figure 25: Configuring scheduled task

Conclusion

These tutorials in ArcGIS Pro taught us how to begin to work with ground-level GIS data, like picture of street signs, in order to train a model to be able to distinguish between these signs in the future. We successfully trained our model such that all tested photos were predicted successfully. These tutorials also taught us how to automate data updates in Windows and show these as view layers in ArcGIS Online. The second half of these week's assignment was a bit confusing because the title we were given "Teach with ArcGIS Notebooks" was different that what we were given a link to. This may be a bit misleading and led me to believe I may be completing the wrong tutorial. Please advise if this is the case. Otherwise, thank you!



The assignment this week, complete the following e-lea

1. Train a model to identify street signs
2. Teach with ArcGIS Notebooks – Step 4, #11: omit "B search. Traffic Collision data is being added at this step. added in a later step.

For each section, provide at least 2 screenshots per less provide a short 3-5 sentence summary of each lesson. \

Schedule automated near real-time data updates

Schedule an automated process to update your hosted feature service from an external data source.

Author Gonzalo Espinoza

Duration 1hr(s)

Difficulty Advanced

Figure 26: Discrepancy between title of #2 assignment section, and title of actual link

References

Schedule automated near real-time data updates. (n.d.). Learn ArcGIS. https://learn.arcgis.com/en/projects/schedule-automated-near-real-time-data-updates/

Train a model to identify street signs. (n.d.). Learn ArcGIS. https://learn.arcgis.com/en/projects/train-a-model-to-identify-street-signs/