Use the Building Footprint Extraction Model (USA) in ArcGIS Pro

Version 1.0

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Introduction

This document explains how to use the building footprint extraction (USA) deep learning model available within ArcGIS Living Atlas of the World.

If done manually, building footprint extraction is a complex and time-consuming task. You can use deep learning to significantly optimize and automate this task. This building footprint extraction deep learning package is a ready-to-use deep learning model that has been trained to extract building footprints from high-resolution aerial/satellite imagery. You can use this model as is or fine-tune it to adapt to your own data and geography. If you are interested in other ready-to-use models, see ArcGIS Living Atlas of the World.

For those experienced with deep learning and those with data resources to train their models, ArcGIS has all the tools built in to allow users to create their own deep learning models. Some of the workflows to train deep learning models can be found on the ArcGIS Developers site.

Licensing requirements

ArcGIS Desktop—ArcGIS Image Analyst and ArcGIS 3D Analyst for ArcGIS Pro. The model cannot be used in ArcMap. The ArcGIS 3D Analyst Extension is used for postprocessing by the Regularize Building Footprint tool to improve the results.
ArcGIS Enterprise—ArcGIS Enterprise Map Viewer and ArcGIS Image Server with raster analytics configured.
ArcGIS Online—Coming soon to ArcGIS Online Map Viewer using ArcGIS Online imagery.

Building Footprint USA Model notes

- Input—Raster datasets, raster products, mosaic datasets, or image services. You can find more details in the Imagery properties section of this document.
- Output—A feature class containing building footprints.
- Processing and compute—This workflow is compute intensive, and a GPU with optimum CUDA compute capability is recommended.
- Applicable geographies—This model is expected to work well in the United States.
- Architecture—This model uses the MaskRCNN model architecture implemented in ArcGIS API for Python.
- Accuracy metrics—This model has an average precision score of 79.1 percent.

Access the model

The model can be downloaded from ArcGIS Living Atlas and then used, accessed directly from ArcGIS Pro 2.7 and later, or used directly in ArcGIS Online Imagery (which currently is in beta).

ArcGIS Living Atlas of the World

To access the model in ArcGIS Living Atlas, do the following:

1. Browse to ArcGIS Living Atlas in a web browser.
2. Sign in with your ArcGIS Online ID.
3. Search for Building Footprint Extraction – USA and open the item page from the search results. Alternatively, you can use this direct link: http://www.arcgis.com/home/item.html?id=a6857359a1cd44839781a4f113cd5934
4. To download the model, click the **Download** button.

This downloads a DLPK file, which can be uploaded and used in ArcGIS Enterprise or in ArcGIS Pro.

Imagery properties

Use imagery with the following properties for optimum results:

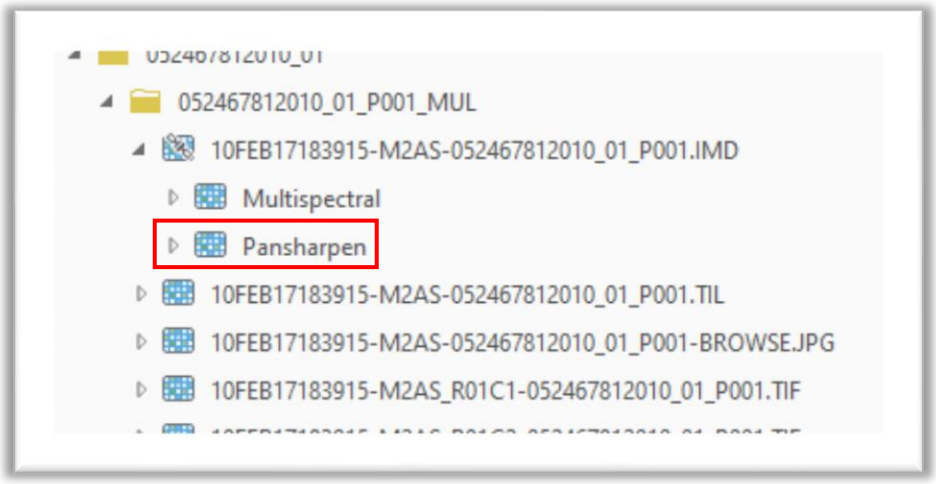
- Resolution—High-resolution aerial/satellite imagery 10–40 cm.
- Dynamic range—8 bit
- Bands—Three bands, for example, Red(1), Green (2), and Blue (3).
- Orthorectified imagery (on-the-fly or persisted ortho products).

Off-nadir imagery or imagery with a high obliquity angle will not produce suitable results.

Example 1—Processing Worldview-2 imagery

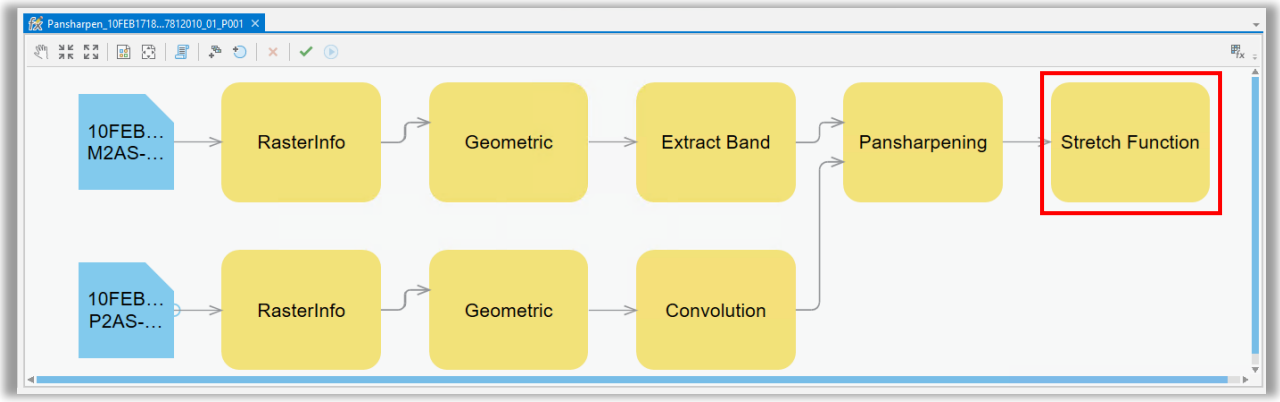
1. In ArcGIS Pro, browse to the image product in the **Contents** pane.

2. Expand the product (.IMD file) and add Pansharpen layer to the map.

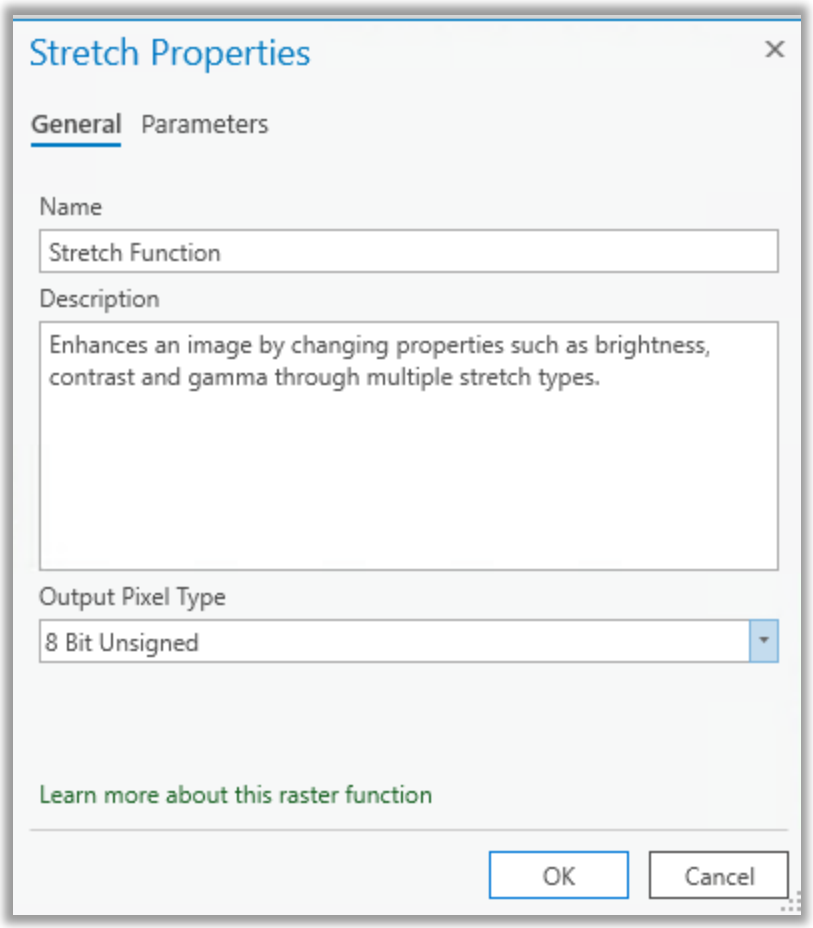


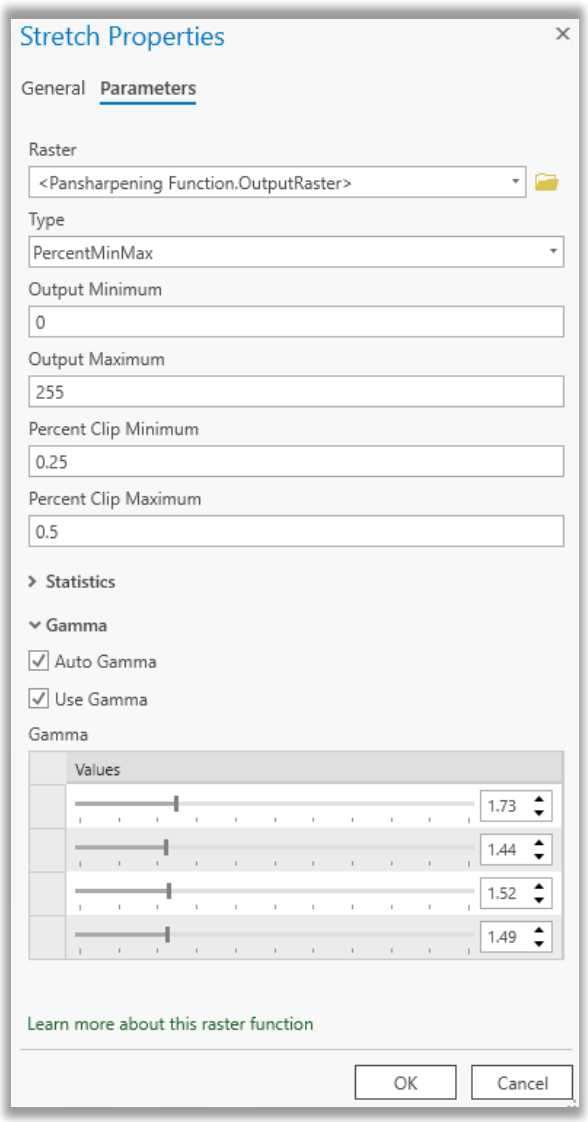
3. Right-click the newly added layer and select **Edit Function Chain**.
   This opens the function chain window,

4. Click the **Stretch Function** button to edit stretch properties:

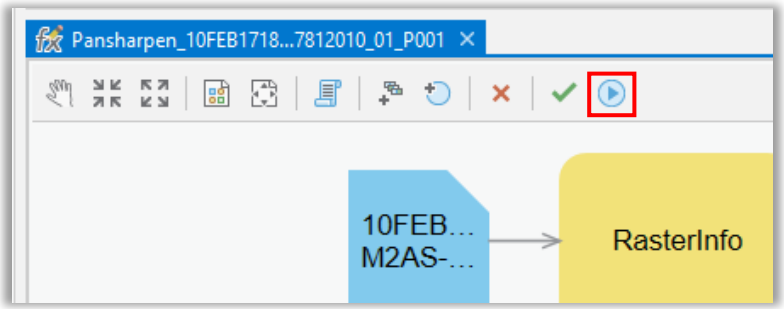


5. In the **Stretch Properties** dialog box, set **Output Pixel Type** to **8 Bit Unsigned**:





6. Click the **Apply** button to apply the changes:

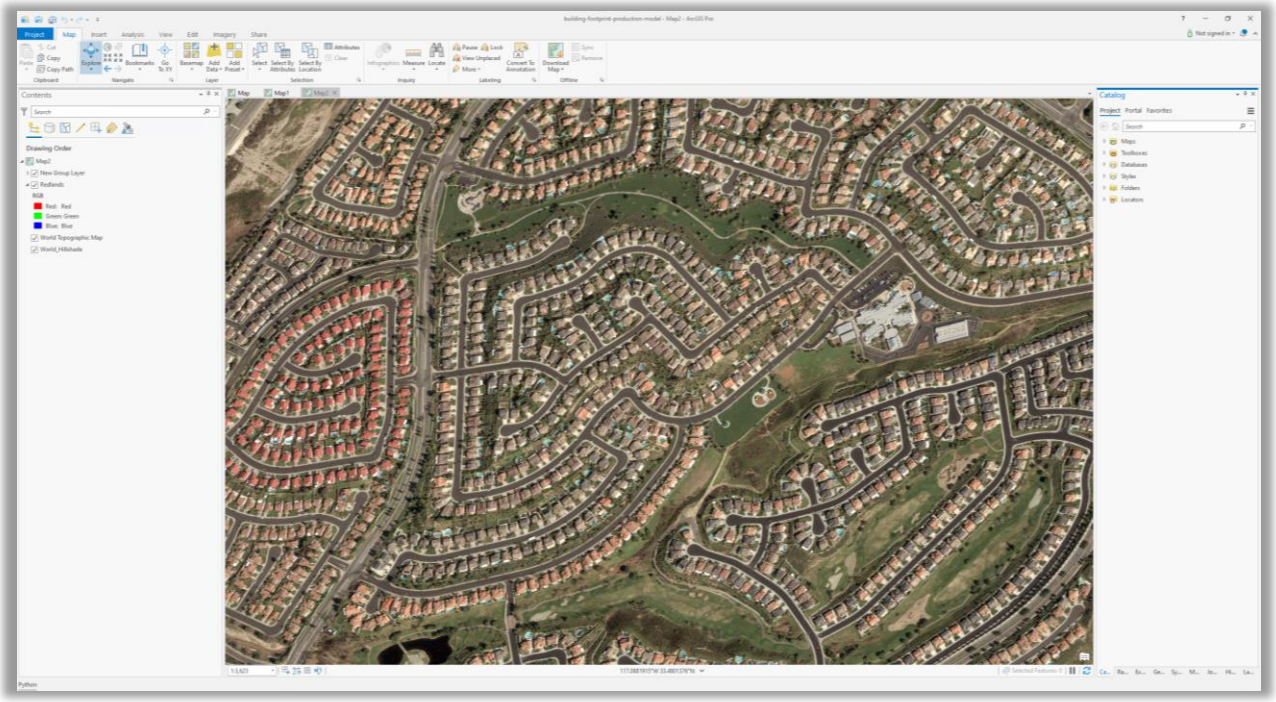


Use the model to extract building footprint features in ArcGIS Pro

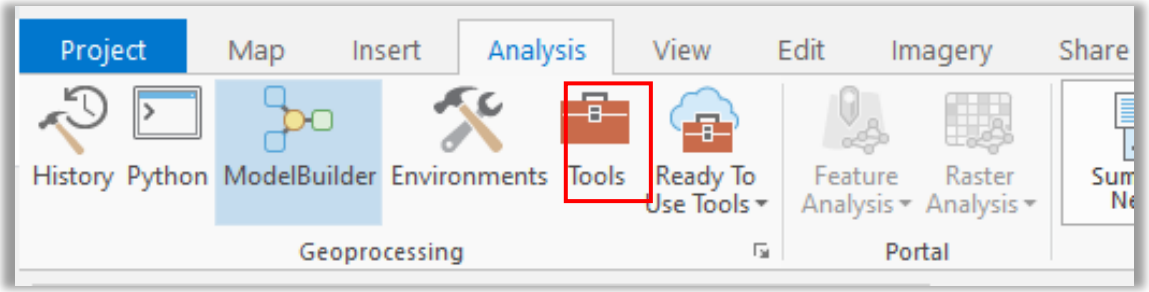
To extract building footprints from the imagery, follow these steps:

1. Make sure you have downloaded the model and added the imagery layer in ArcGIS Pro.

2. Zoom to an area of interest.

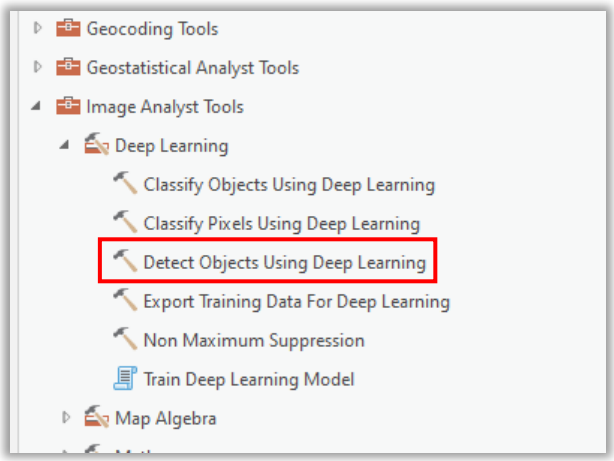


3. Browse to **Analysis > Tools**.

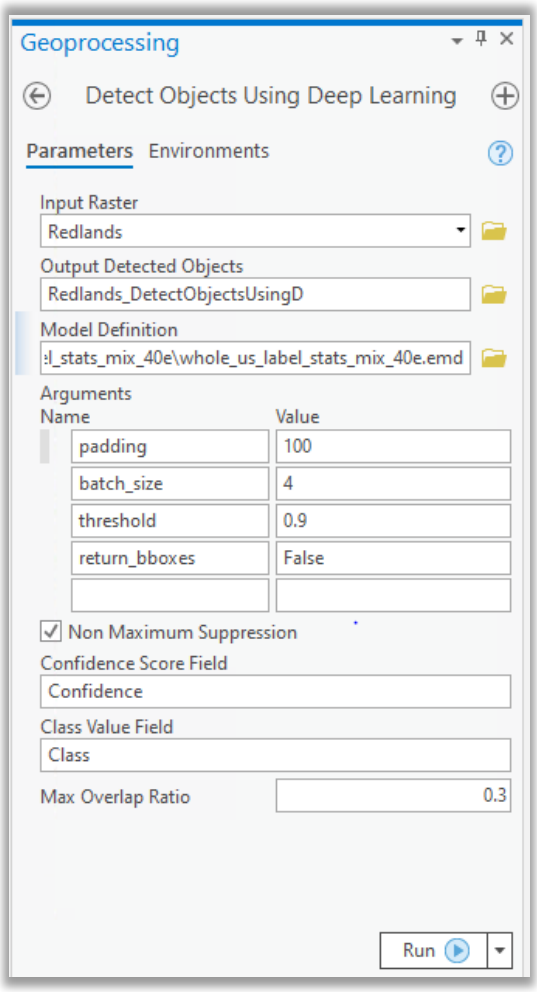


The **Geoprocessing** pane appears.

4. Click **Toolboxes > Image Analyst Tools > Deep Learning >** [Detect Objects Using Deep Learning].

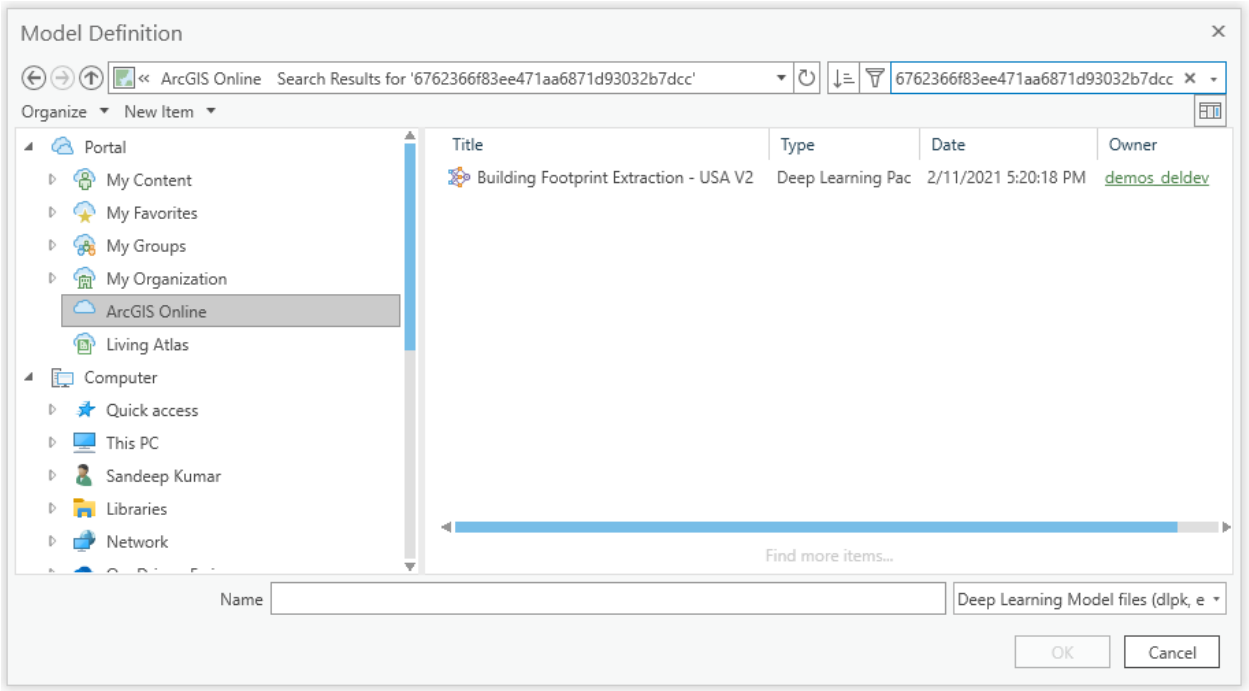


5. Point to imagery and model to corresponding values and change the parameters as below.



With ArcGIS Pro 2.7 and later, you can search the model from ArcGIS Living Atlas.

Click the **Model Definition** browse button. Search for the model using item ID in the browse window as shown :

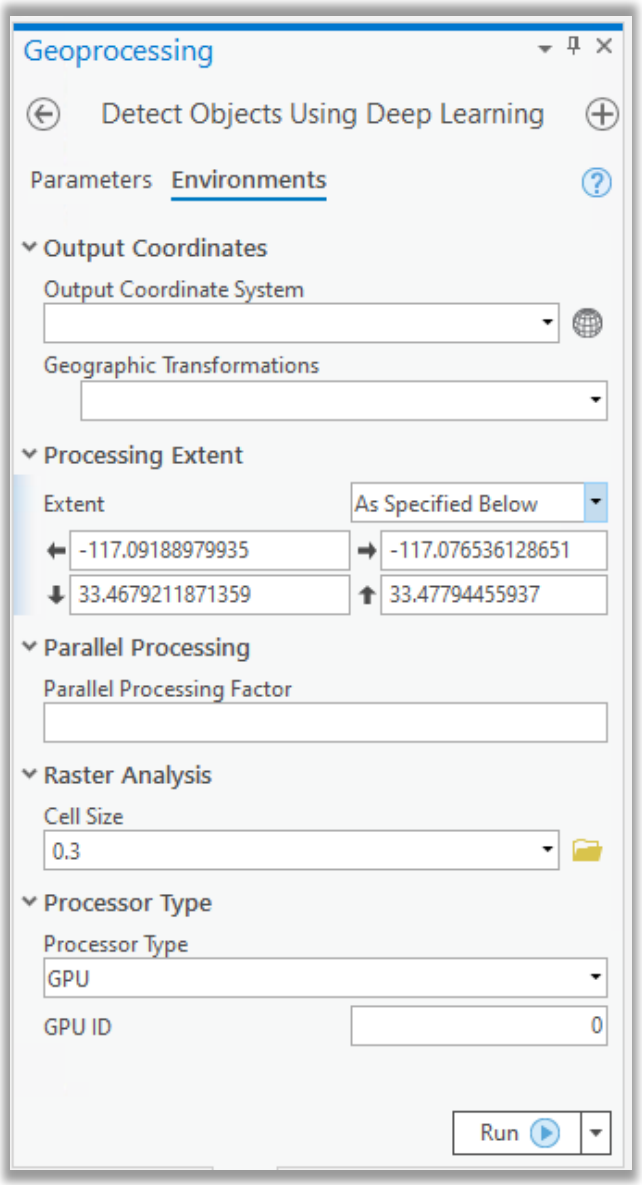

Model Definition
ArcGIS Online Search Results for '6762366f83ee471aa6871d93032b7dcc'
6762366f83ee471aa6871d93032b7dcc
Organize
New Item
Portal
My Content
My Favorites
My Groups
My Organization
ArcGIS Online
Living Atlas
Computer
Quick access
This PC
Sandeep Kumar
Libraries
Network
Title
Type
Date
Owner
Building Footprint Extraction - USA V2
Deep Learning Pac
2/11/2021 5:20:18 PM
demos_deldev
Find more items...
Name
Deep Learning Model files (dlpk, e
OK
Cancel

6. Set the **Environments** variables as shown:

   a Set **Cell Size** to **0.3** (required). 0.3 is the raster resolution.

   a. Set **Processing Extent** to the current display extent.

   b. Set **Processor Type** to **GPU** if available.



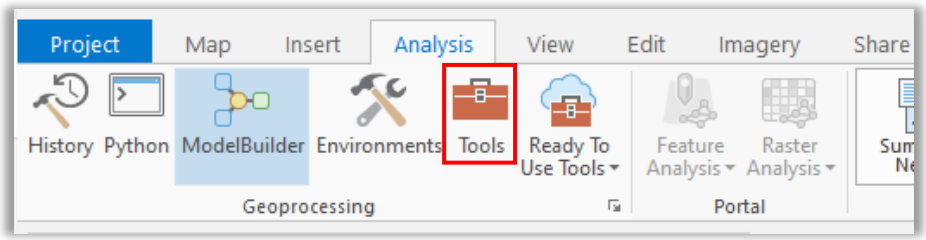
7. Click **Run** to execute.

Once processing is complete, the layer is added to the map.

Postprocessing

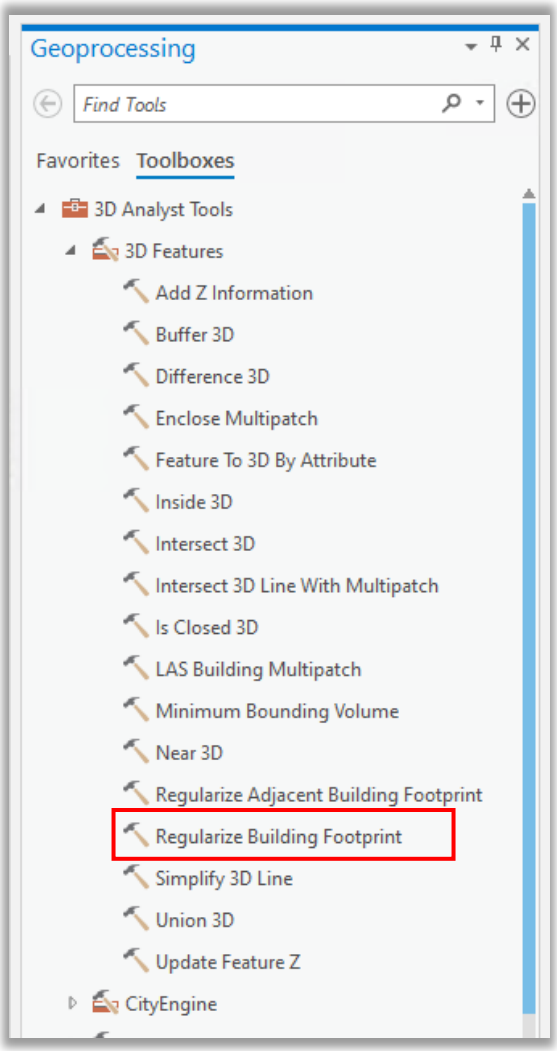
To improve the visual appearance of the building footprint features, follow these steps:

1. Browse to **Analysis > Tools**.



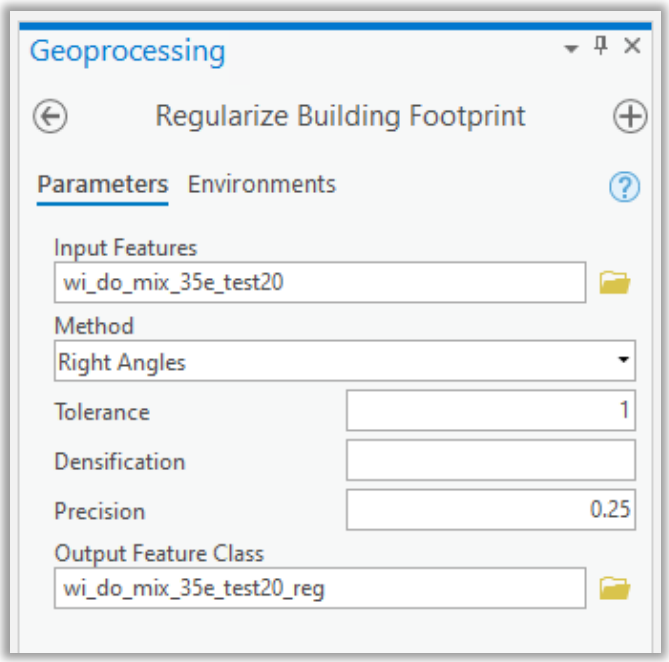
   The **Geoprocessing** pane appears.

2. Browse to **Toolboxes > 3D Analyst Tools >** [Regularize Building Footprints](#).



The input is the building footprint features that were detected by the inferencing tool.

3. Modify the parameters to match the screenshot.


Geoprocessing
Regularize Building Footprint
Parameters
Environments
Input Features
wi_do_mix_35e_test20
Method
Right Angles
Tolerance
1
Densification
Precision
0.25
Output Feature Class
wi_do_mix_35e_test20_reg

4. Click **Run**.

References

[Detect Objects Using Deep Learning]

ArcGIS API for Python Samples [Regularize Building Footprint]