So You've Trained a Deep Learning Model – Now What? (The Dev Edition)

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2021 ESRI
DEVELOPER SUMMIT

THINGS ~~THEY~~ WE DON'T TEACH YOU ~~IN CLASS~~

Why is Deep Learning so popular these days?

- Increased data quantity
- Higher data variety
- More computing power
- Cheaper data storage

Beeldmateriaal, Beeldmateriaal.nl, Maxar, Microsoft | Land NRW, Kadaster, Esri, HERE, Garmin, INCREMENT P, Intermap, USGS, METI/NASA
POWERED BY
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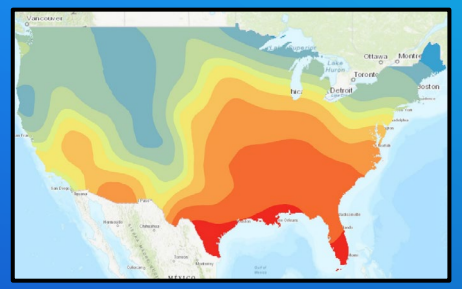
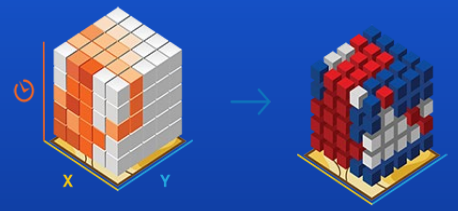
ArcGIS API for Python

Where does that come in?





GeoAI

Machine Learning

Prediction

Clustering

Classification

Deep Learning

arcgis.learn

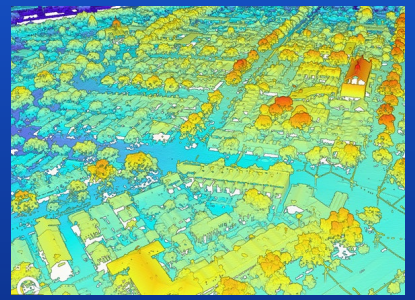
Deep Learning in ArcGIS

arcgis.learn module

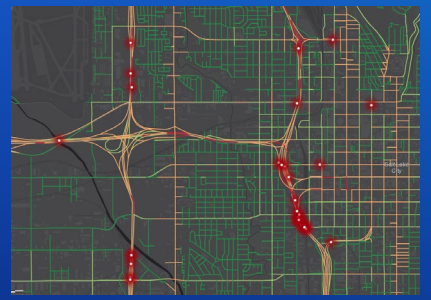
Object Classification

Pixel Classification

3D



Tabular & Feature Data



Object Detection

Image Translation

Scanned

Unstructured Text

And more…

Prepare Training Data
Train Model
Inferencing
Take Action

Deep Learning Package
Inferencing
Take Action

You need a DLPK

How do you get one?

Deep Learning Package

Deep Learning Package

Esri Model Definition

Trained Model

(optional) Python Raster Function

ArcGIS Living Atlas of the World is the foremost collection of geographic information from around the globe. It includes maps, apps, and data layers to support your work.

Search Living Atlas for maps, apps, and more

What's new

Explore items recently added to ArcGIS Living Atlas of the World, learn about GIS events, and discover ways to use content.

New version of Live Stream Gauges in Living Atlas

The live feed for networks of global stream gauges in ArcGIS Living Atlas of the World has been upgraded to a new version, along with several enhancements. Update and upgrade your maps today!

Esri is monitoring global activity of the coronavirus disease 2019 (COVID-19) and supporting resources for community preparedness. View the COVID-19 GIS Hub

GeoreferenceHeerenveen - Map - ArcGIS Pro

Project | Map | Insert | Analysis | View | Edit | Imagery | Share

jagt_esrinederland (Esri Nederland)

New Workspace | Georeference | Raster Functions | Function Editor | Change Detection | Classification Wizard | Classification Tools | Point | Distance | Area | Results | Process | Indices | Pixel Editor | Image Information | Video Search

Ortho Mapping | Alignment | Analysis | Image Classification | Mensuration | Tools | Motion Imagery

Map

1:3,095 | 5.9484474°E 52.9453280°N | Selected Features: 0

Geoprocessing

Find Tools

Favorites | Toolboxes | Portal

- Geostatistical Analyst Tools
- Image Analyst Tools
  - Change Detection
  - Deep Learning
    - Classify Objects Using Deep Learning
    - Classify Pixels Using Deep Learning
    - Compute Accuracy For Object Detection
    - Detect Objects Using Deep Learning
    - Export Training Data For Deep Learning
    - Non Maximum Suppression
    - Train Deep Learning Model
  - Extraction
  - Map Algebra
  - Math
  - Motion Imagery
  - Multidimensional Analysis

Catalog | Geoprocessing | Symbology | History | Export Raster

Part 2 - Model training

If you've already done part 1, you should already have the training chips. Please change the path to your own export training data folder that contains "images" and "labels" folder.

In [15]:
```
training_data = gis.content.get('14f3f9421c6b4aa3bf224479c0eaa4f9')
training_data
```

Out[15]:

feature_categorization_using_satellite_imagery_and_deep_learning1
Image Collection by api_data_owner
Last Modified: December 10, 2020
0 comments, 10 views

In [16]:
```
filepath = training_data.download(file_name=training_data.name)
```

In [17]:
```
import zipfile
with zipfile.ZipFile(filepath, 'r') as zip_ref:
    zip_ref.extractall(Path(filepath).parent)
```

In [18]:
```
data_path = Path(os.path.join(os.path.splitext(filepath)[0]))
```

In [19]:
```
data = prepare_data(data_path, {1:'Damaged', 2:'Undamaged'}, chip_size=600, batch_size=16)
```

Visualize training data

To get a sense of what the training data looks like, `arcgis.learn.show_batch()` method randomly picks a few training chips and visualize them.

Zebracrossings - Map - ArcGIS Pro

Layer

Project | Map | Insert | Analysis | View | Edit | Imagery | Share | Appearance

Maartje (ArcGIS Enterprise for the EsriNL Devteam)

Project | Map | Mobile Map | Layer | Geoprocessing | Deep Learning — Package

Web Map | Web Layer | Web Style | Locator | Web Tool — Share As

Jobs — Status

Save Web Map | Replace Web Layer | Data Stores — Manage

Project Template | Map File | Layer File | Task Item — Save As

Map — Print

Map — Export

Contents

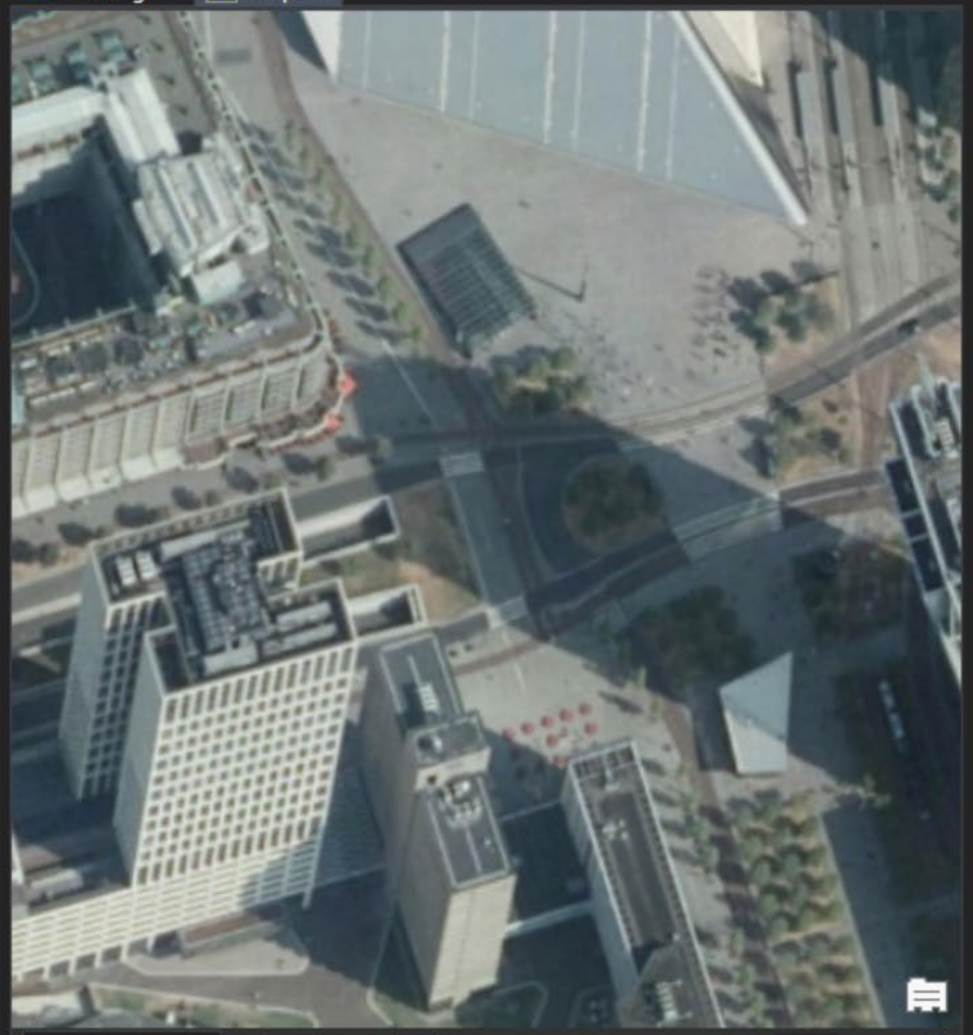
Search

Drawing Order

Map

World Imagery

Catalog | Map



1:1,505 | 4712253°E 51.9247552°N

Package Deep Learning Model

Share As Deep Learning Package

Package

Start Packaging

- (•) Upload package to Online account
- ( ) Save package to file

Item Details

Name

Zebra crossings

Summary

Deep Learning model to detect pedestrian crossings in aerial imagery.

Tags

DL ✕ Add Tag(s)

Location

Finish Packaging

Analyze | Package | Jobs

Catalog | Geoprocessing | Symbology | History | Package Deep Learning Model

You have a DLPK

Now what?!

4 ways to use a Deep Learning Package

- ArcGIS Pro
- Mapviewer
- Script (manual and automated)
- From a web application

GeoreferenceHeerenveen - Map - ArcGIS Pro

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Catalog | Geoprocessing | Symbology | History | Export Raster

Home My Map

New Map admin

Details Add Basemap Analysis

Save Share Print Measure Bookmarks Find address or place

Raster Analysis /
Detect Objects Using Deep Learning

1 Choose image used to detect objects

World Imagery

2 Choose deep learning model used to detect objects

usa_building_footprints

3 Specify deep learning model arguments

Name	Value
padding	100
batch_size	4
threshold	0.9
return_bboxes	False

4 Remove duplicate features from the output (optional)

☑ Non maximum suppression

Options

Confidence score field: Confidence

Class value field: Class

Maximum overlap ratio: 0.3

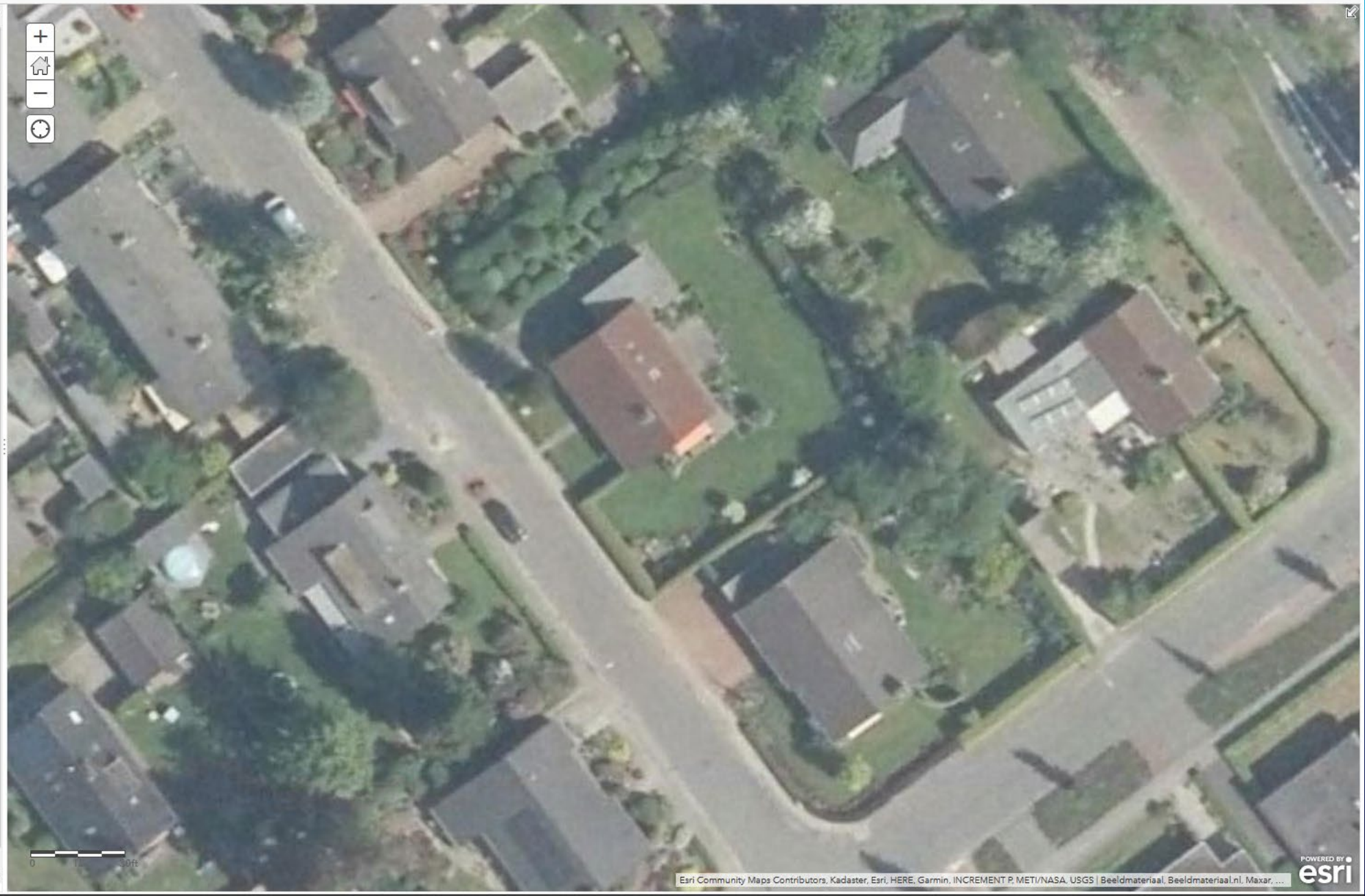
5 Result layer name

World Imagery_detected

Save result in admin

☑ Use current map extent

RUN ANALYSIS



File Edit Selection View Go Run Terminal Help detectObjectsPythonAPI.py - DevSummit - Visual Studio Code

detectObjectsPythonAPI.py

detectObjectsPythonAPI.py > ...

```python
modelObject = gis.content.get("054c037f7c1c47a99561410d5efe7b65")
model = arcgis.learn.Model(modelObject)
model.install()

## Set Model arguments
modelArguments = {
    "padding": 100,
    "batch_size": 4,
    "threshold": 0.9,
    "return_bboxes": False
}
context = {
    "cellSize": 0.3,
    "processorType" : "CPU"
}

## Inferencing
outputFL = arcgis.learn.detect_objects(
    rasterClip,
    model,
    model_arguments=modelArguments,
    run_nms=True,
    confidence_score_field="Confidence",
    class_value_field="Class",
    max_overlap_ratio=0.3,
    context=context,
    gis=gis)

## Append new features to existing Feature Service
featureService = arcgis.features.FeatureLayer("https://pada.ad.local/server/rest/services/Hosted/DetectObjects_test2/FeatureServer/0", gis=
featureService.edit_features(adds=outputFL.layers[0].query(where="1=1"))
```

Python 3.6.10 64-bit ⊗ 0 ⚠ 0 Ln 8, Col 93 Spaces: 4 UTF-8 CRLF Python

Now you know what to do

Once you get a DLPK

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