

# AI & Imagery

*2026 ESRI USER CONFERENCE AUSTRIA  
– powered by SynerGIS*

# AI & Imagery

09:00 – 10:30

1



**Clemens Naderer**

Überblick: AI-Tools & Models  
SynerGIS

2



**Dipl.-Ing. Victoria Achatz**

Detektion von Kühltürmen mit Deep Learning  
Land Salzburg

3



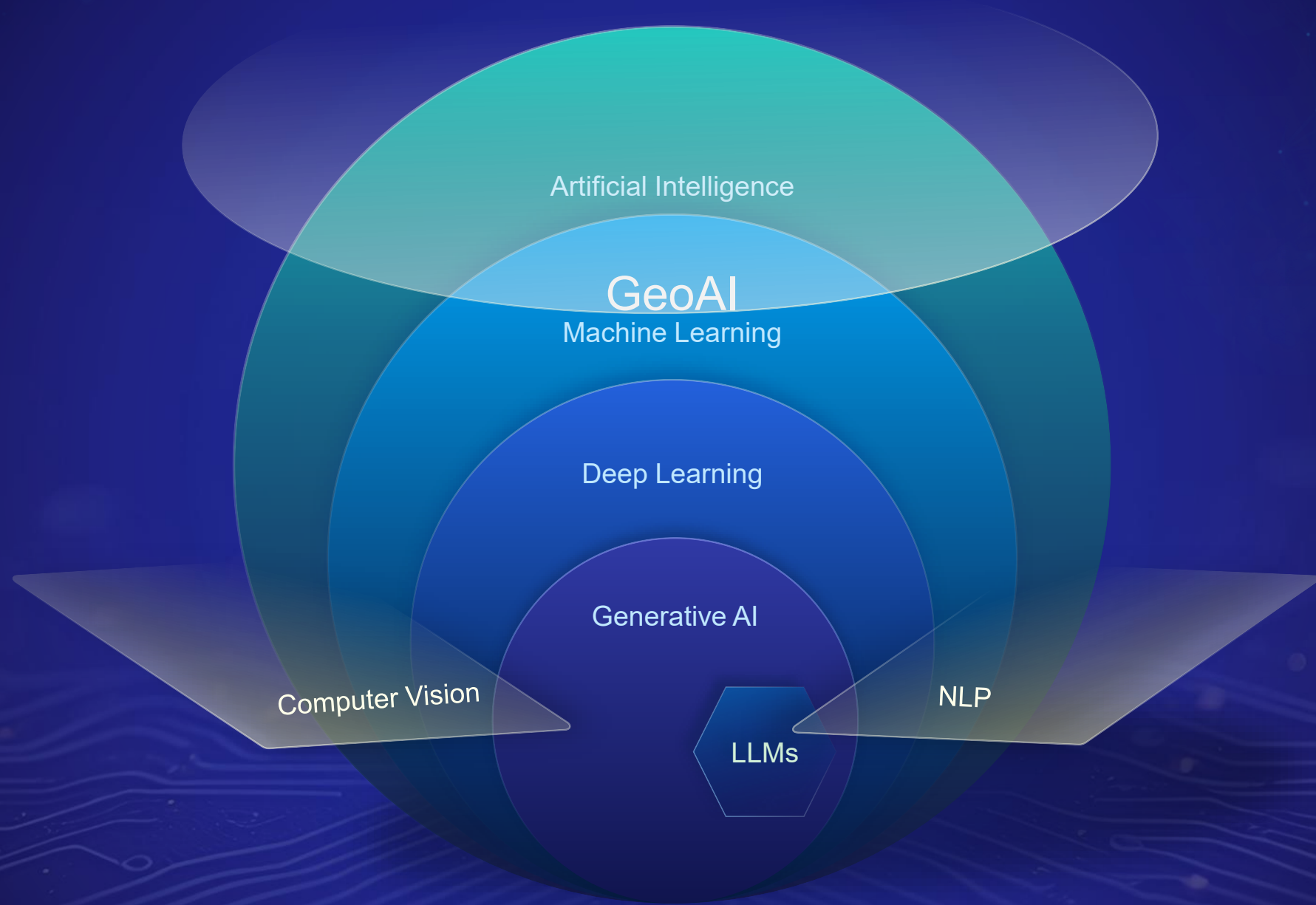
**Leslie Jessen**

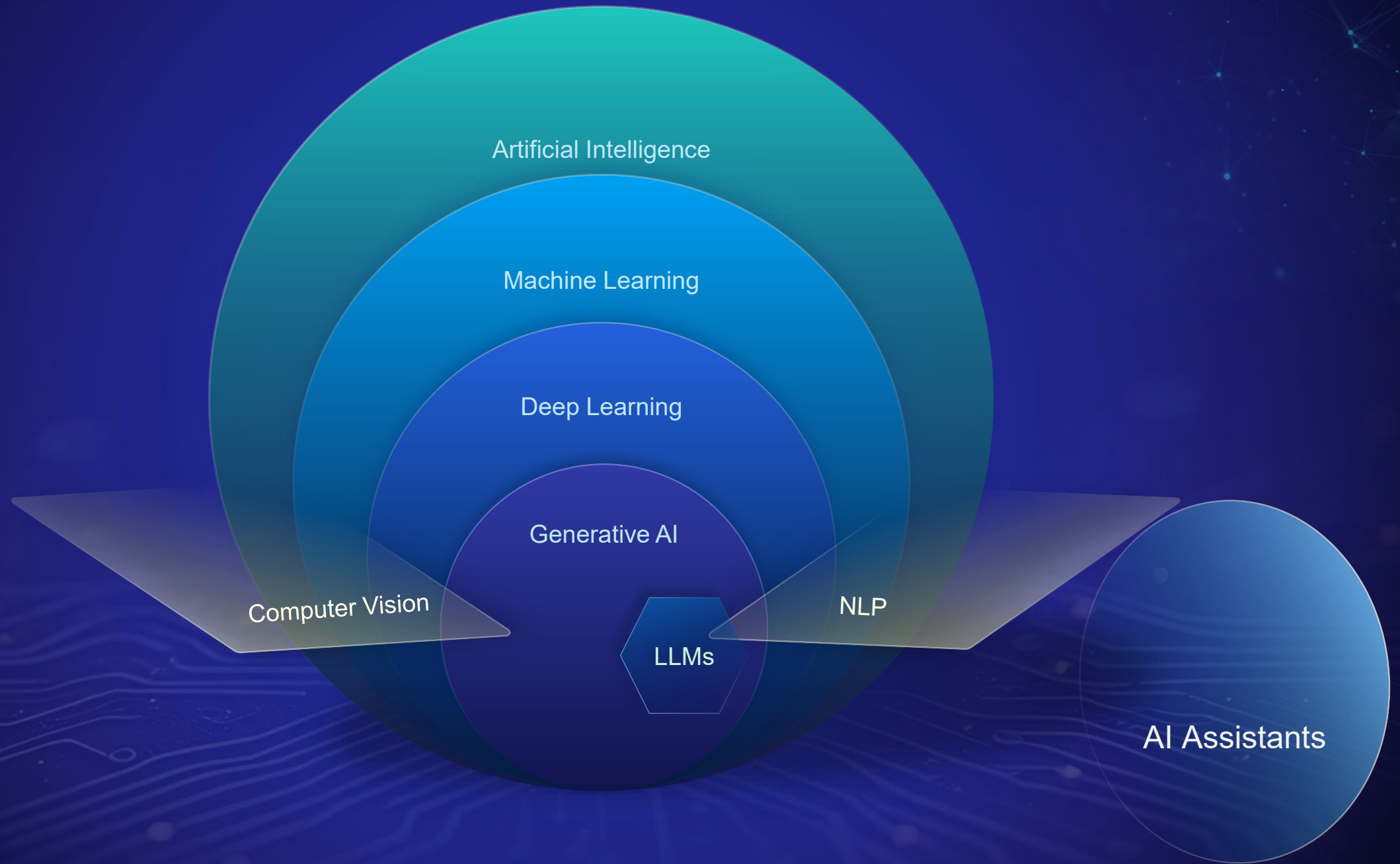
Hands-On: Pre-Trained Models & Embeddings  
SynerGIS

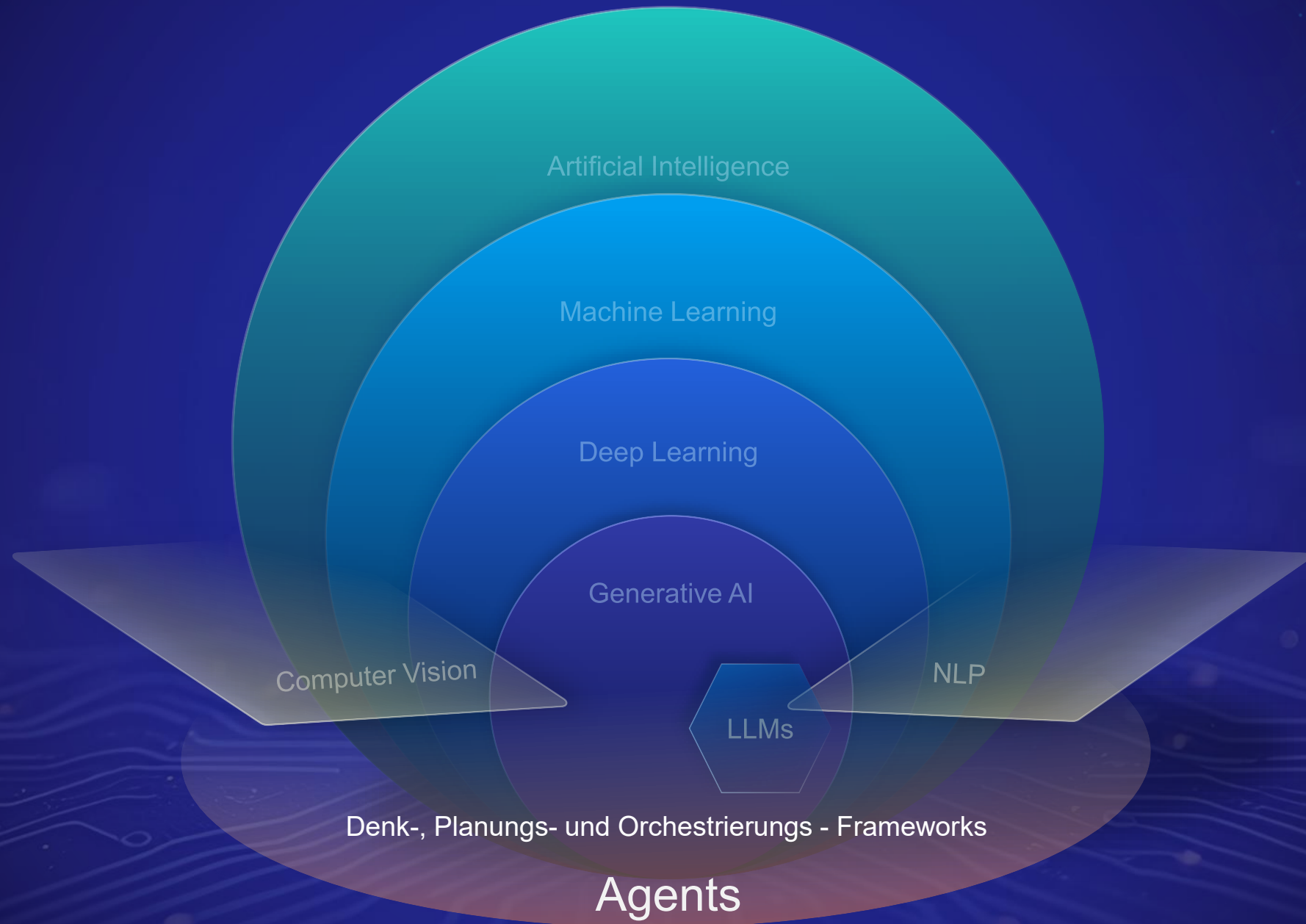
# Überblick: AI Tools und Models

Clemens Naderer

**2026 ESRI USER CONFERENCE AUSTRIA**  
– powered by SynerGIS



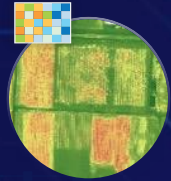




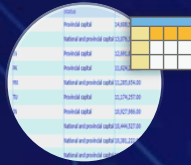
"AI is the most profound technology that humanity will ever develop and work on. It is even more profound than fire or electricity or the internet"

Sundar Pichai, Google CEO

# AI Tools & Modelle



Imagery



Tabular



Lidar / Point Cloud



Vector



Unstructured



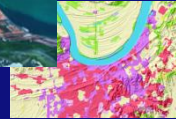
Full-Motion Video



3D



Building and Road Extraction



Land Cover Classification



3D Object Detection

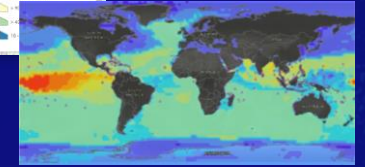
Point Cloud Classification



Regression & Classification



*Vorhersagen machen*

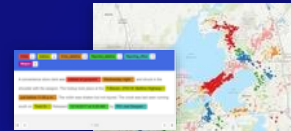


Climate Forecasting



Time Series Forecasting

*Daten gewinnen*

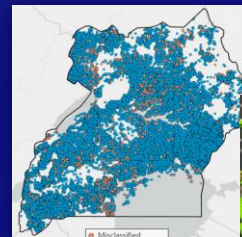


Entity Extraction

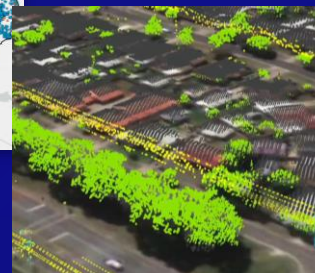


Data Extraction from PDFs

*Automatisierte Analyse*

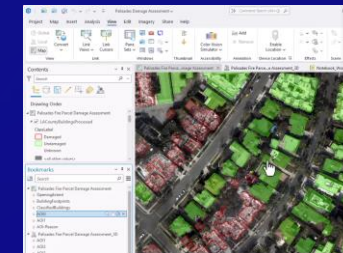


AutoML & AutoDL



Vegetation Encroachment Analysis

*Erkenntnisse ableiten*

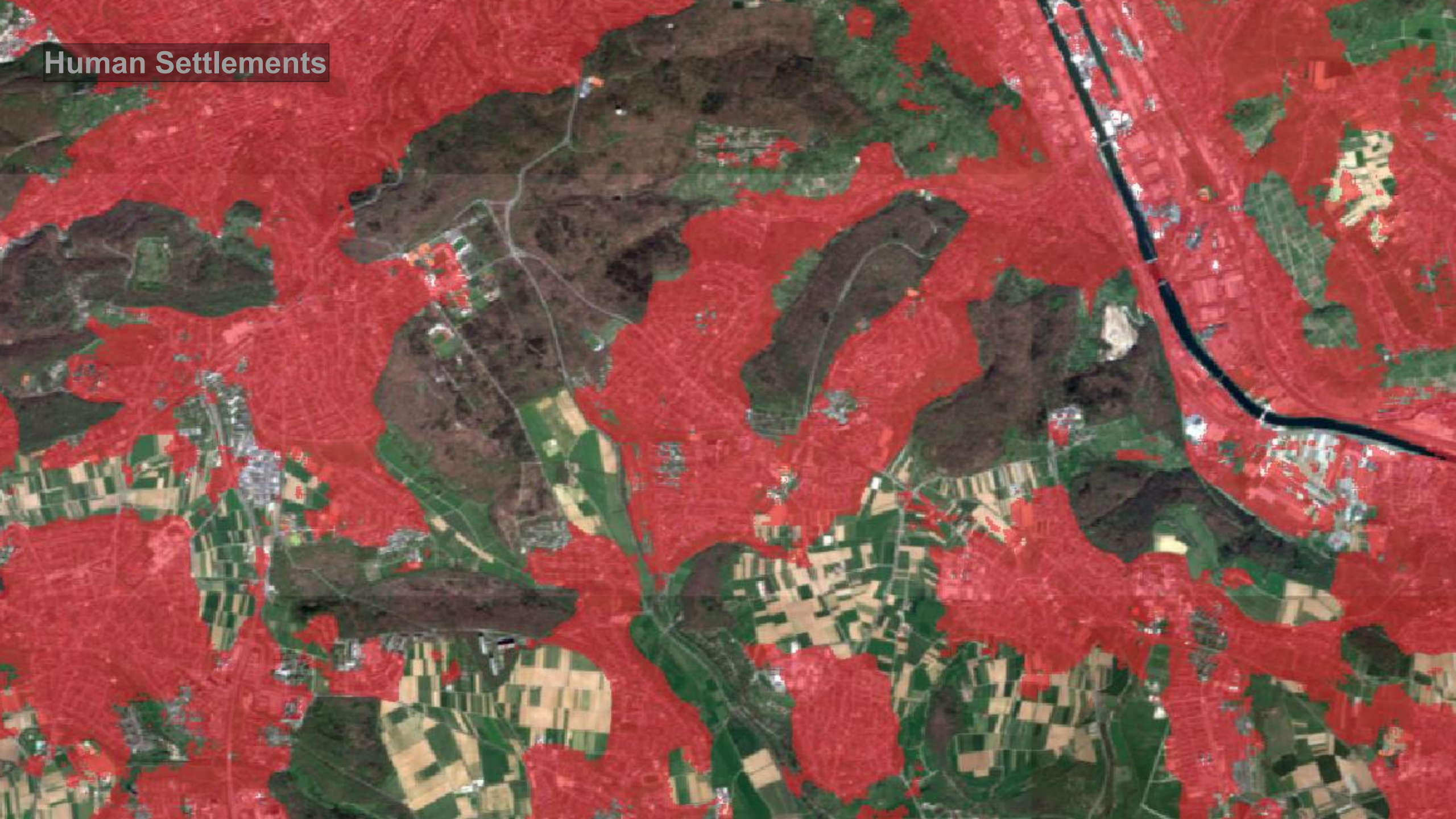


Damage Assessment

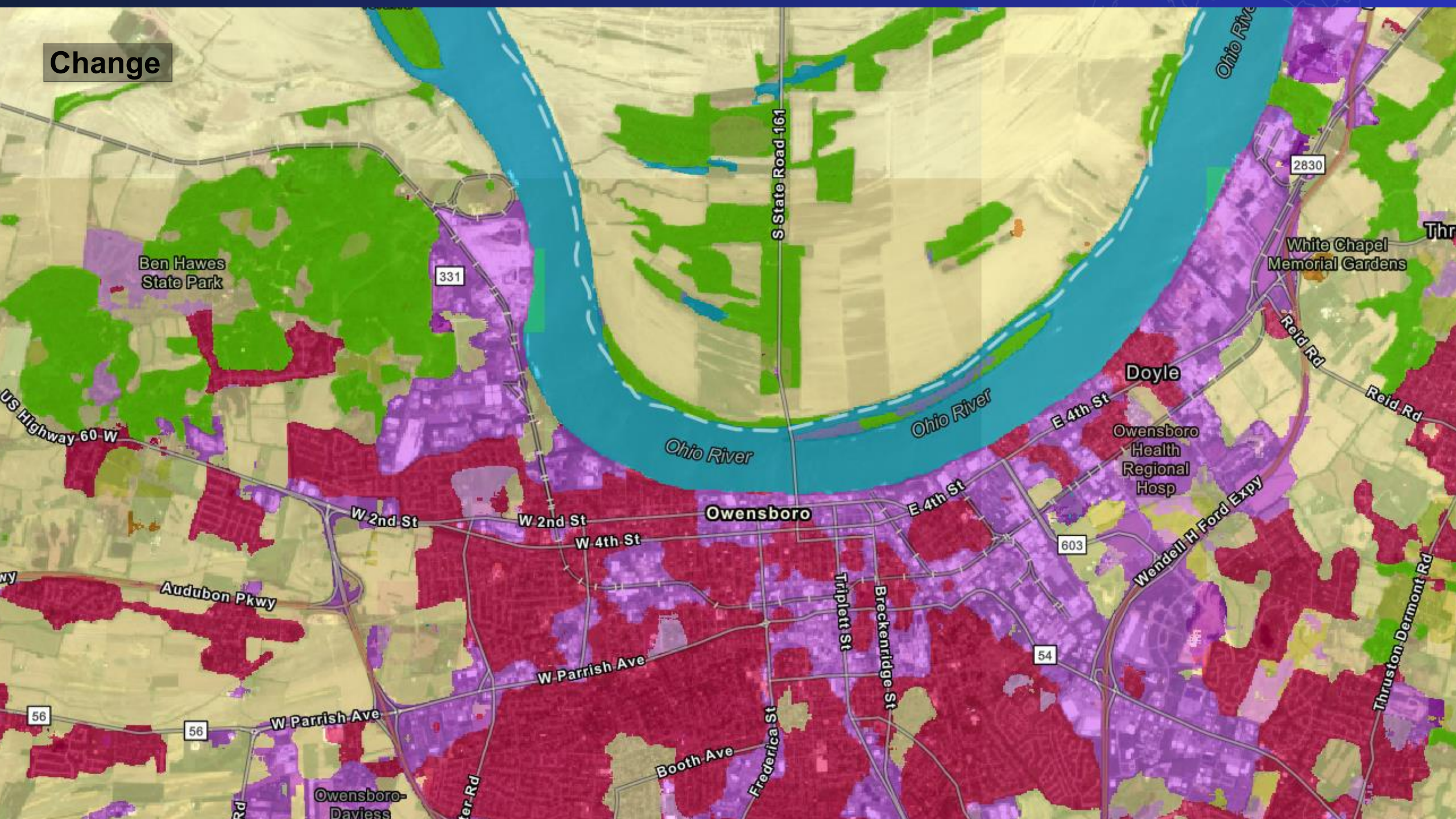


Change Detection

## Human Settlements



Change

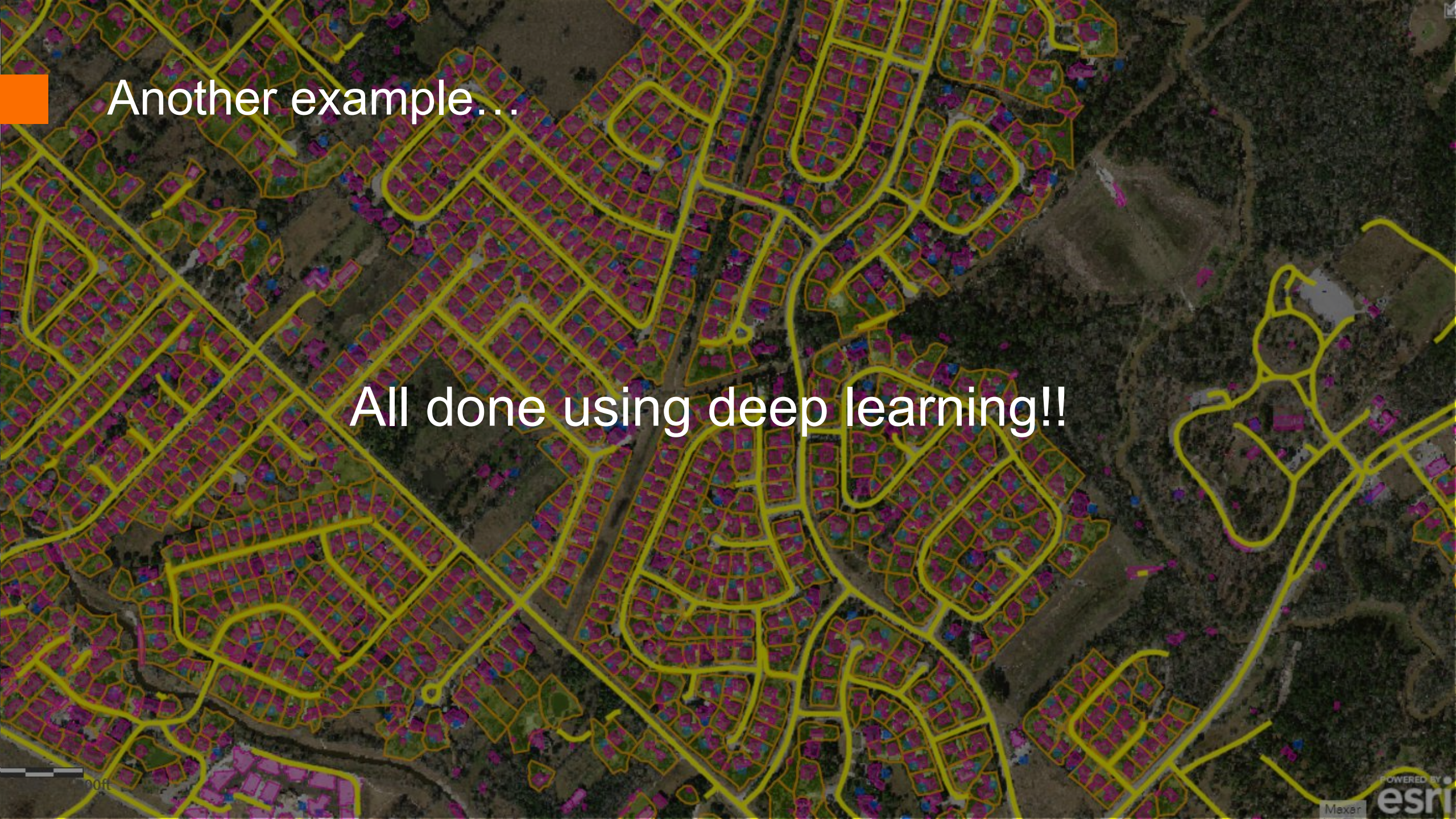


New structures



Infrastructure planning



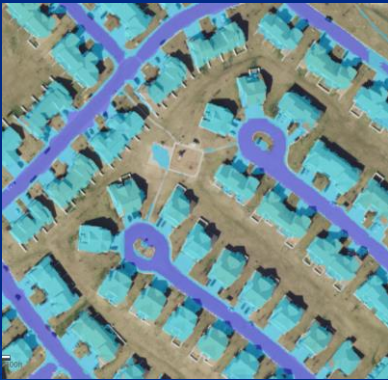
An aerial photograph of a suburban neighborhood with a grid-like street pattern. Yellow lines trace the streets, and purple polygons represent individual building footprints. The text "Another example..." is overlaid in the top left corner.

Another example...

All done using deep learning!!

# Key Imagery Tasks

Pixel (semantic)  
Classification



UNetClassifier  
PSPNetClassifier  
DeepLab  
BDCNEdgeDetector  
HEDEdgeDetector  
MultiTaskRoadExtractor  
ChangeDetector

Object Detection



FasterRCNN  
RetinaNet  
YOLOv3  
SingleShotDetector

Instance Segmentation



MaskRCNN

Image Classification



FeatureClassifier

Image Translation

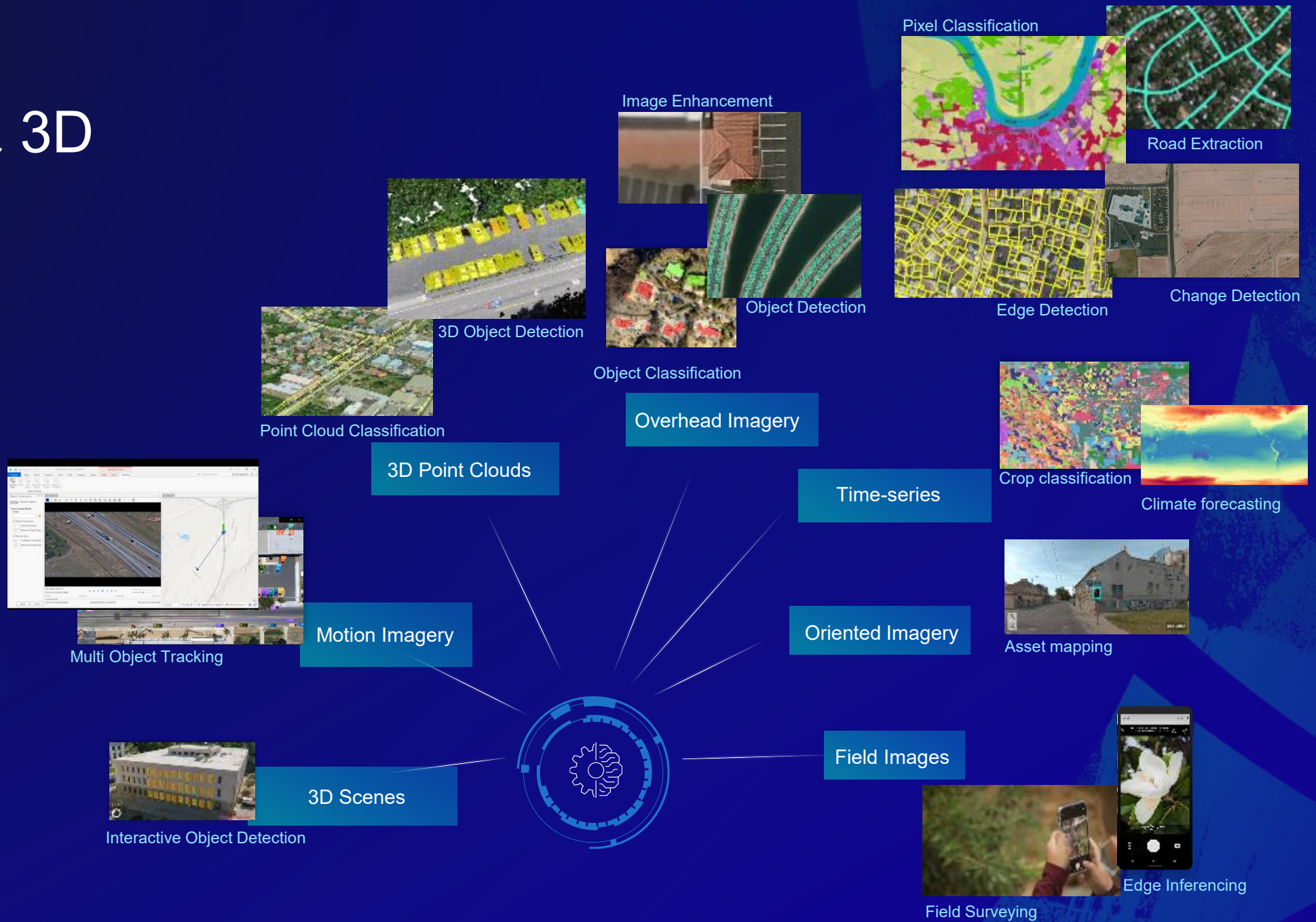


CycleGAN  
Pix2Pix  
SuperResolution  
ImageCaptioner

# Imagery & 3D

## Neu & Verbessert

- Model training wizard
- AutoDL
- Multi feature extraction
- Attachments
- Time-series
- SuperRes New Model (Pro)
- SAMLoRA fine-tune (Pro)
- Prithvi fine-tune (Pro)
- Text prompts for labelling
- Multi-GPU inferencing
- 3D Object Detection



# AI Modelle

Pretrained & Ready-to-Use

## Aufgabenspezifische Modelle

- Agricultural Fields
- Buildings
- Cars
- Cloud Masks
- Common Objects
- Cooling Towers
- Crowd Counting
- Face Blurring
- Humans
- Insulator Defects
- Land Cover
- License Plates
- Mangroves
- Map Simplification
- Object Tracking
- Oil Spills
- Oil Tanks
- OCR
- Palm Trees
- Parcels
- Parking Lots
- Pavement Cracks
- Pedestrian Infrastructure
- Plant Leaf Disease
- Swimming Pools
- Power Lines
- Pylons
- Roads
- Scene Text Parsing
- Ships / Shipwrecks
- Solar Panels / Parks
- Trees
- Water Bodies
- Well Pads
- Wildfires
- Wind Turbines

## Foundation-Modelle **new**

- CLIP Zero-Shot Classifier
- Depth Anything
- GroundingDINO
- Prithvi
- Prompt-Based Segmentation
- Segment Anything Model (SAM)
- Text SAM
- Time Series Forecasting (Time-MoE)
- DINOv3

## Integration

### Hugging Face

- Image Inpainting
- Object Classification & Detection
- Pixel Classification
- Text Classification & Translation
- Text & Visual QA

### Cloud AI Services

- Image Interrogation
- Vision Language Context-Based Classification

Land Cover



Trees



SAM3 (Esri NZ)



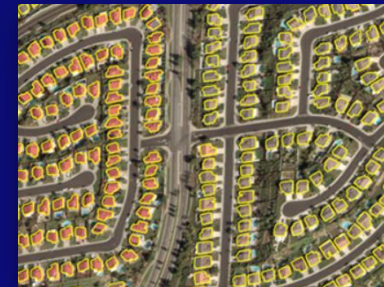
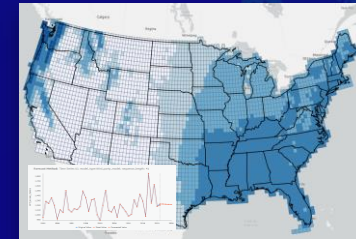
Pedestrian Infrastructure Classification



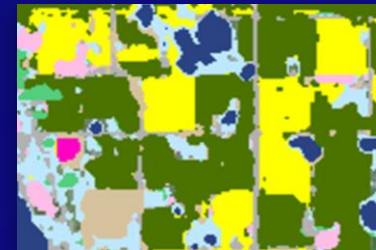
Cars (Text SAM)



Time-MoE



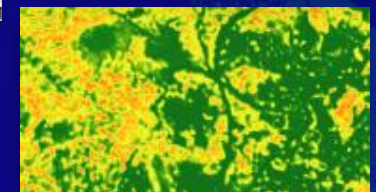
Building Footprints



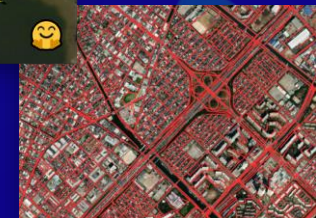
Crop Classification (Prithvi)



HF Visual Question Answering



Canopy Height Estimation (Meta)

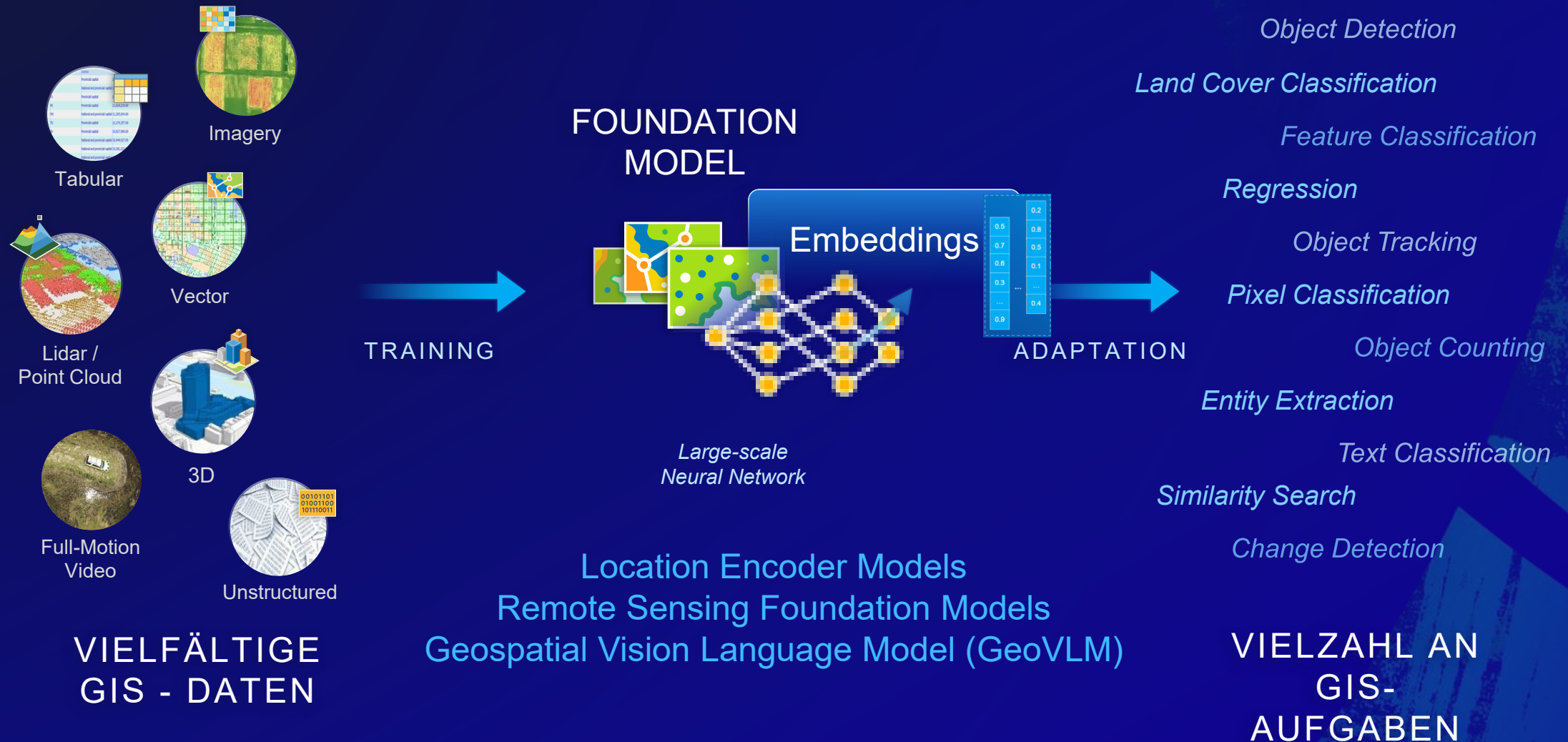
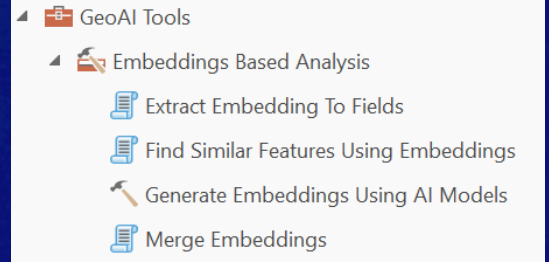


Global Roads

... Verfügbar als Deep-Learning-Pakete über den Living Atlas

new

# Geospatial Foundation Models

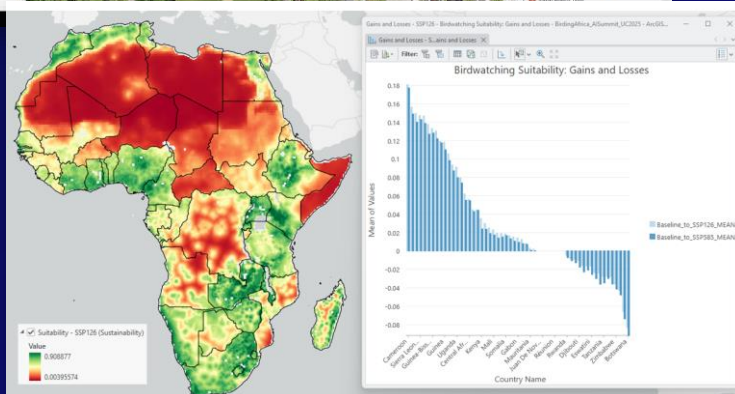
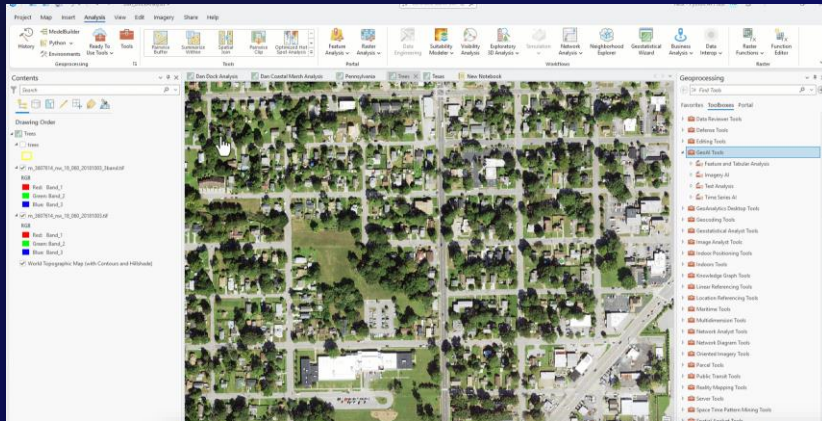


# AI Tools

Trainieren und nutzen Sie AI-Modelle

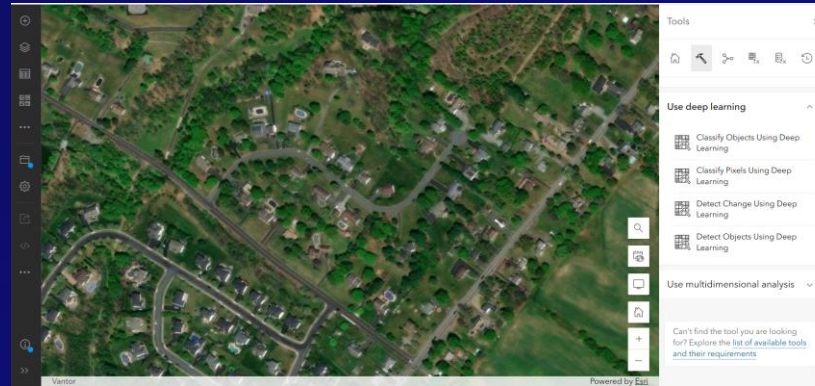
## ArcGIS Pro

GeoAI Toolbox / Image Analyst

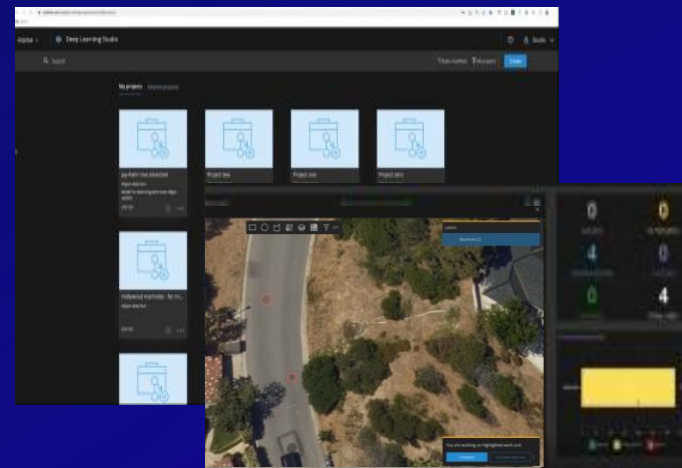


## ArcGIS Online ArcGIS Enterprise

Map Viewer

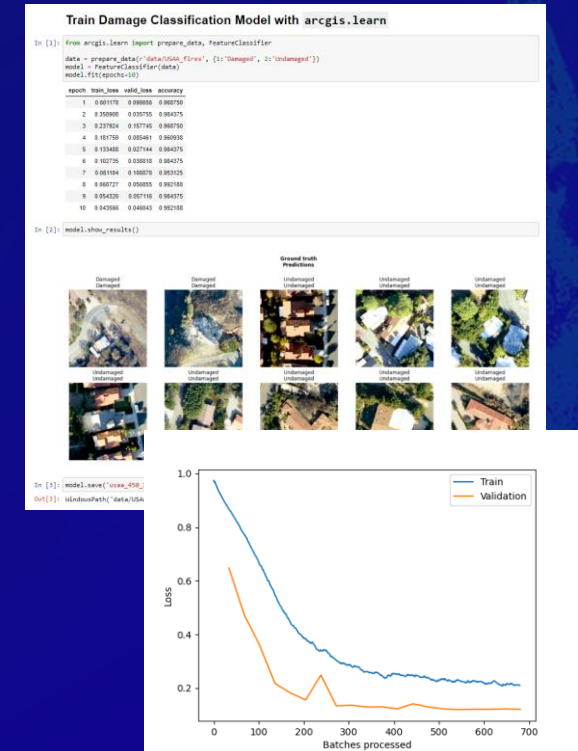


Deep Learning Studio



## ArcGIS API for Python ArcGIS Notebooks

arcgis.learn



# Living Atlas - Foundation Models

## Download und Beschreibung

 ArcGIS Living Atlas

HomeBrowseAppsBlogContributeMy Favorites

foundation models

×

🔍

Search Examples

All

Trending ▾

Basemaps ▾

Imagery ▾

Boundaries ▾

People ▾

Infrastructure ▾

Environment ▾

Deep Learning Package ×

All time ▾

All regions ▾

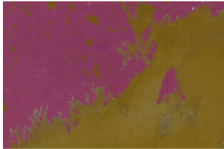
☐ Esri-only content

☐ Authoritative-only content

Sort by: Relevance ▾

14 Results



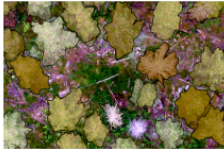
Clay (Large)

 Deep Learning Package By [esri\\_analytics](#)

Wavelength-aware deep learning model to generate semantic geospatial embeddings from multisensor satellite imagery and enable efficient fine-tuning for downstream applications.

 Subscriber



Segment Anything Model (SAM)

 Deep Learning Package By [esri\\_analytics](#)

Meta's Segment Anything Model (SAM) for segmenting objects in any imagery.

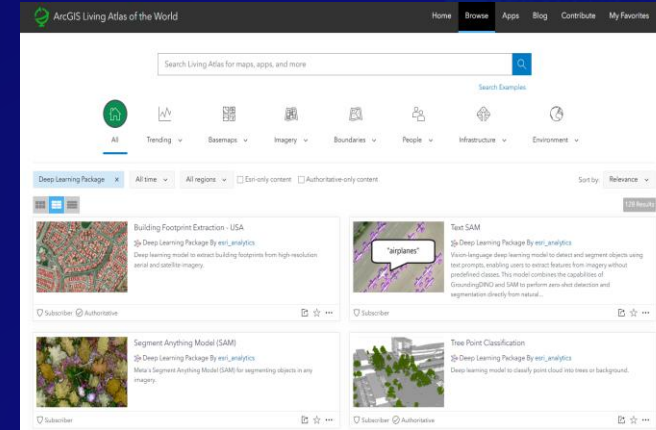
 Subscriber

# Pre-Trained Models von Esri

## Quelle und Anforderungen

- Sind über den Living Atlas verfügbar.
- Beschreibung jeweils mit
  - Guide für Nutzung des DLPKs
  - Erforderliches Format des Inputs
  - Möglichkeit des Fine-Tuning vorhanden?
  - Welches Model steckt dahinter?
  - Durchschnittliche Genauigkeit des Modells
  - Beispiel für Output



Building footprint layers are useful in preparing base maps and analysis workflows for urban planning and development. They also have use in insurance, taxation, change detection, infrastructure planning, and a variety of other applications. Digitizing building footprints from imagery is a time-consuming task and is commonly done by digitizing features manually. Deep learning models are highly capable of learning these complex semantics and can produce superior results. Use this deep learning model to automate the tedious manual process of extracting building footprints, reducing time and effort required significantly.

### Using the model

Follow the [guide](#) to use the model. Before using this model, ensure that the supported deep learning libraries are installed. For more details, check [Deep Learning Libraries Installer for ArcGIS](#).

### Fine-tuning the model

This model can be fine-tuned using the Train Deep Learning Model tool. Follow the [guide](#) to fine-tune this model.

### Input

8-bit, 3-band high-resolution (10-40 cm) imagery. If you need to acquire such imagery, you can discover and order aerial and satellite imagery through the [Content Store for ArcGIS](#).

### Output

Feature class containing building footprints.

### Applicable geographies

The model is expected to work well in the United States.

### Model architecture

The model uses the [MaskRCNN](#) model architecture implemented using ArcGIS API for Python.

### Accuracy metrics

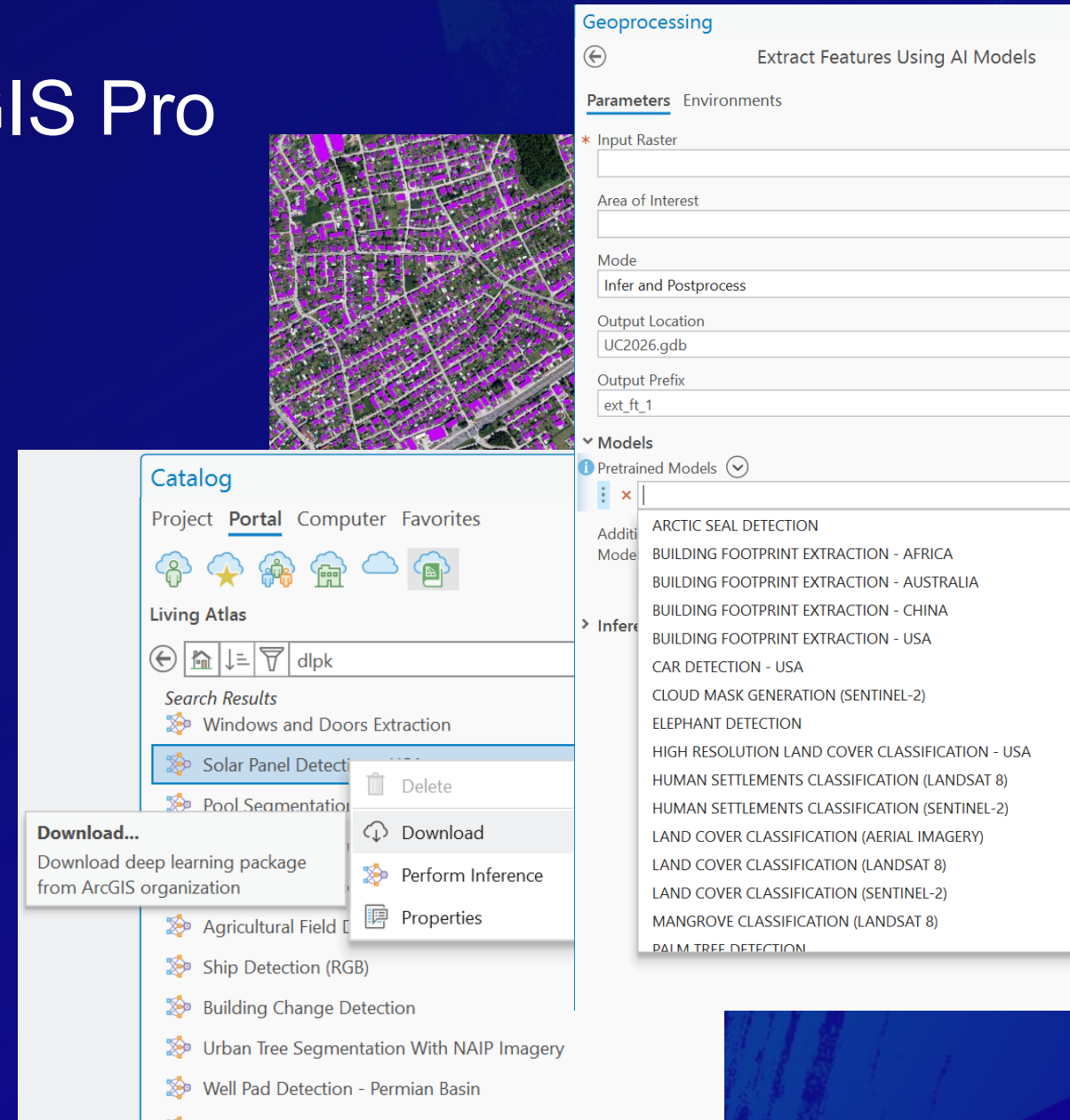
The model has an average precision score of 0.718.

### Sample results

Here are a few results from the model. To view more, see this [story](#).

# NEU - Direkte Nutzung in ArcGIS Pro

- Download direkt über das Katalog – Panel
- Direkte Auswahl des Modells im Tool „Extract Features using AI Models“
  - Mehrere Modelle können in einem Tool automatisiert auf einen Datensatz angewendet werden



# Living Atlas - Bilddaten

Bilddaten direkt aus dem Living Atlas nutzen

- Satellitenbilddaten können direkt mit KI Modellen genutzt werden, z.B.:
  - Land Cover Klassifizierung mit Sentinel Daten
  - Analysis - Optimized

## World Imagery



This layer presents low-resolution satellite imagery for the world and high-resolution satellite and aerial imagery, typically within 3-5 years of currency, for most of the world.

 Tile layer |  Verlässlich |  Living Atlas

Element aktualisiert: 7. Aug. 2026 ▼

### Beschreibung

World Imagery provides one meter or better satellite and aerial imagery for most of the world's landmass and lower resolution satellite imagery worldwide. The map is currently comprised of the following sources:

- Worldwide 15-m resolution TerraColor imagery at small and medium map scales.
- Vantor imagery basemap products around the world: Vivid Premium at 15-cm HD resolution for select metropolitan areas, Vivid Advanced 30-cm HD for more than 1,000 metropolitan areas, and Vivid Standard from 1.2-m to 0.6-cm resolution for the most of the world, with 30-cm HD across the United States and parts of Western Europe. More information on the Vantor products is included below.
- High-resolution aerial photography contributed by the GIS User Community. This imagery ranges from 30-cm to 3-cm resolution. You can contribute your imagery to this map and have it served by Esri via the [Community Maps Program](#).

## Sentinel-2 Level-2A

Overview



Global imagery layer optimized for analysis. Includes Sentinel-2 Level-2A multispectral and multitemporal atmospherically corrected imagery sourced from the Microsoft Planetary Computer and is updated daily with the latest available imagery.

 Imagery layer (collection) |  Authoritative |  Living Atlas |  Subscriber

Item updated: Jun 9, 2026 ▼

### Description

The Copernicus Sentinel-2 mission provides optical imagery for a wide range of applications including land, water and atmospheric monitoring. Beginning in 2015, the mission is based on a constellation of identical satellites working in tandem to cover Earth's land and coastal waters every five days. Each satellite carries a multispectral sensor that generates optical images in the visible, near-infrared and shortwave-infrared part of the electromagnetic spectrum at spatial resolutions of 10, 20, and 60-meters.

This imagery layer provides the full archive of Sentinel-2 Level-2A imagery. It is time enabled and includes a number of predefined processing templates for visualization and analysis.

### Key Properties

**Geographic Coverage:** Global Landmasses - [More...](#)  
**Temporal Coverage:** 2015 - Present  
**Spatial Resolution:** 10, 20, and 60-meter (see Multispectral Bands table for more information)  
**Revisit Time\*:** ~5-days  
**Product Level:** Level-2A Surface Reflectance  
**Source Data Coordinate System:** Universal Transverse Mercator (UTM) WGS84  
**Service Coordinate System:** Web Mercator Auxiliary Sphere WGS84 (EPSG:3857)  
**Analysis:** [Analysis-Optimized](#)  
**Multispectral Bands:**

| Band | Description | Wavelength (um) | Spatial Resolution (m) |
|------|-------------|-----------------|------------------------|
|------|-------------|-----------------|------------------------|

### Owner

 Esri  
esri\_imagery

### Details

View count  
1,189,739

Source  
[Image service](#) (Image Collection)

URL  
  

### Image properties

Source type  
Generic

Pixel type  
Float

Number of bands

# Grundlagen - AI und Imagery

## Hardware & Software

- GPU: graphics processing unit
  - CPU: central processing unit
  - CUDA: Compute Unified Device Architecture
  - DLPK: ArcGIS Pro deep learning model package
- 
- Für Deep Learning in ArcGIS wird mindestens eine GPU mit CUDA Version 6.1 und aktuellem Nvidia Treiber empfohlen. Der Grafikspeicher der Karte sollte mindestens 6GB sein, idealerweise 16GB.
  - Die erweiterten Rechenkapazitäten der GPU können auch in einigen Tools der Spatial Analyst Erweiterung eingesetzt werden.

# ArcGIS - Deep Learning Framework

- Installation des Deep Learning Frameworks nötig.
- Download über MyEsri
- Downloads verfügbar für ArcGIS Pro, ArcGIS Server, ArcGIS Allsource, ArcGIS Drone2Map und ArcGIS Reality Studio
- Immer für die jeweils installierte ArcGIS Version
- Backbones zur Offline Nutzung über Github erhältlich



| PRODUCT COMPONENTS                                             |                                                                                                                                                        |                               |  |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--|
| Select the items below that you want to download.              |                                                                                                                                                        |                               |  |
| Files                                                          | File Size                                                                                                                                              | Action                        |  |
| + ArcGIS Pro<br>ArcGIS Pro                                     | 3.21 GB                                                                                                                                                | <a href="#">Download</a>      |  |
| + ArcGIS Pro 3.7 Patch 1 (3.7.1)<br>ArcGIS Pro                 | 292.43 MB                                                                                                                                              | <a href="#">Download</a>      |  |
| + ArcGIS Data Interoperability for ArcGIS Pro<br>ArcGIS Pro    | 1.83 GB                                                                                                                                                | <a href="#">Download</a>      |  |
| - Deep Learning Libraries for ArcGIS Pro<br>ArcGIS Pro         | 5.96 GB                                                                                                                                                | <a href="#">Download</a>      |  |
| Checksum                                                       | Description                                                                                                                                            | Reference                     |  |
| 1771d1535cec61abda681e190118576baf65b8b74bab68179e492f000a53de | Includes tools to use AI and Deep Learning to solve geospatial problems, such as feature extraction, pixel classification, and feature categorization. | <a href="#">Install guide</a> |  |
| + DJI Camera Support for ArcGIS Pro<br>ArcGIS Pro              | 4.71 MB                                                                                                                                                | <a href="#">Download</a>      |  |

The background of the slide is split into two main sections. The upper section is a solid dark blue color, overlaid with a pattern of thin, white, irregular contour lines that resemble a topographic map. The lower section, separated by a curved white line, shows a photograph of a sunset or sunrise. The sky is a mix of orange, yellow, and purple, with dark, silhouetted clouds. The overall composition is modern and abstract.

# Fragen?

# Detektion von Kühltürmen mit Deep Learning

17.09.2026

Referat Geodateninfrastruktur

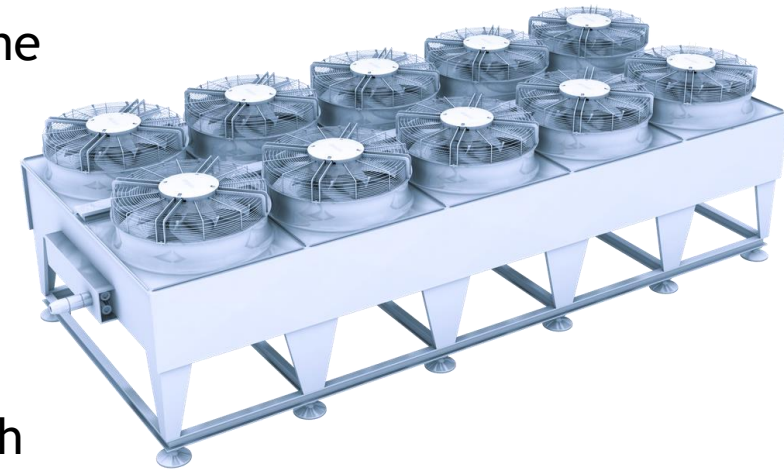
DI(FH) Victoria Achatz

## Ausgangslage

- Legionellose: Bakterielle Lungenerkrankung, Erreger werden durch Aerosol übertragen (Wohnung, Beherbergungsbetrieb, ggf. Quellen im Freien - Verdunstungsrückkühlanlagen)
- Statistische auffällige regionale und zeitliche Häufung von Krankheitsfällen
- Gesundheitsbehörde bittet um Amtshilfe bei der Detektion von Kühltürmen (Kein amtliches Anlagenverzeichnis in Österreich)

## Kühlturm (Verdunstungsrückkühlanlage)

- Technische Einrichtung, die überschüssige Prozesswärme mittels Verdunstung in einen offenen Kreislauf an die Umgebungsluft abführt
- Befindet sich am Dach
- Bei mangelnder Wartung bakterielle Besiedlung möglich
- Windverfrachtung bis zu 5 km beschrieben



Ähnliches Erscheinungsbild  
anderer technischer Anlagen  
(zB.: Klimaanlage)

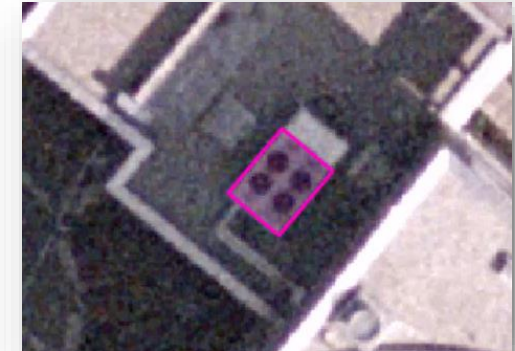
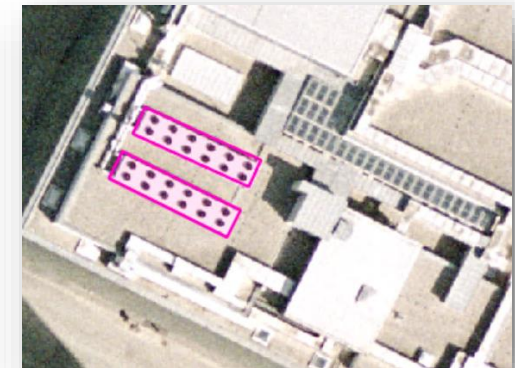
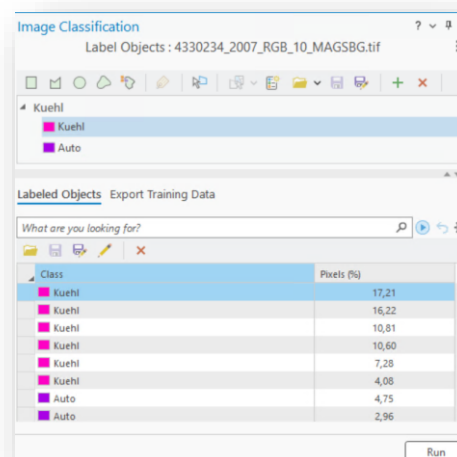


## Trainings Daten



- Versch. Formen führen zu besseren Ergebnissen
- Kleine Trainingsflächen bzw Schatten können Ergebnisse verfälschen
- 2.Klasse einführen, um Ergebnisse zu konkretisieren
- Grundlagendaten

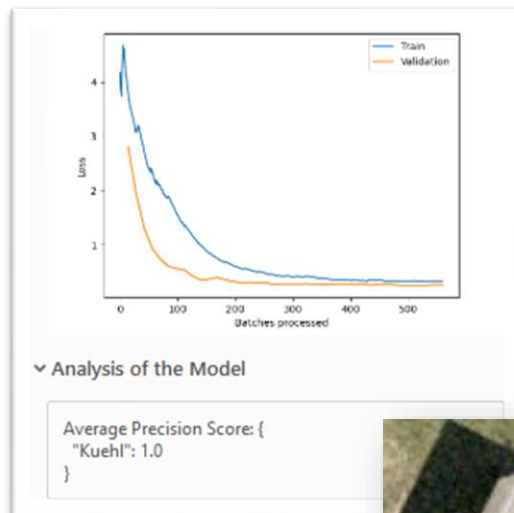
Orthofoto  
Auflösung 10, 20cm



## Auswahl des Training Models



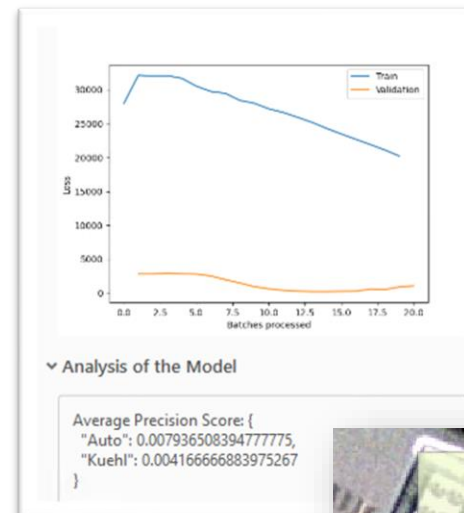
### MaskRCNN Resnet50



Objekt



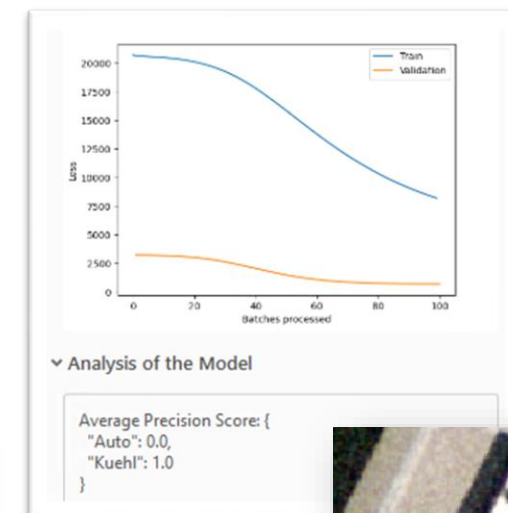
### YOLOv3 DarkNet53



BoundingBox



### Single Shot Detection Resnet50



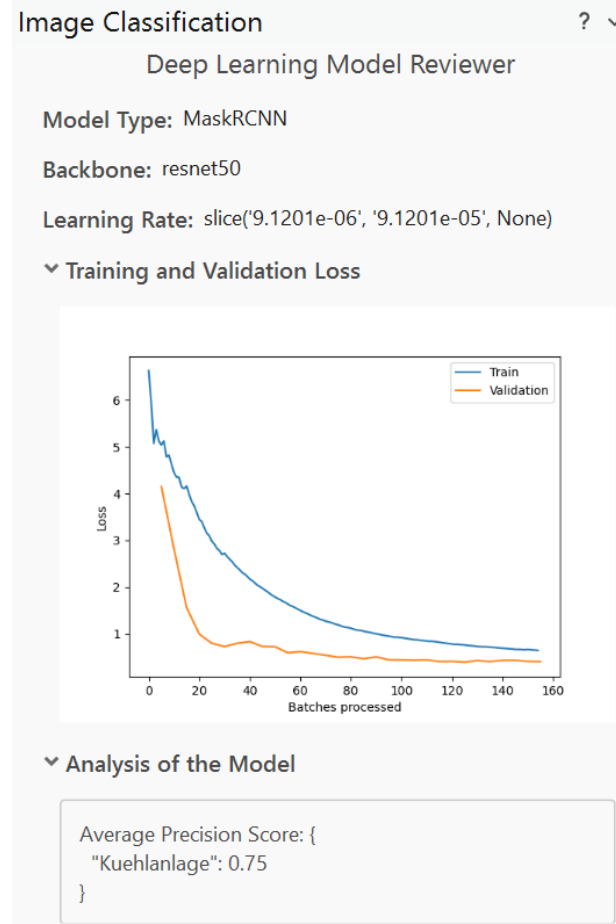
BoundingBox



## Training Model Mask RCNN

- Backbone: Resnet50
- Max Epochs: 100
- Batch Size: 32
- Chip Size: 256/128
- Freeze Model deaktiviert

Orthofoto  
Auflösung 20cm



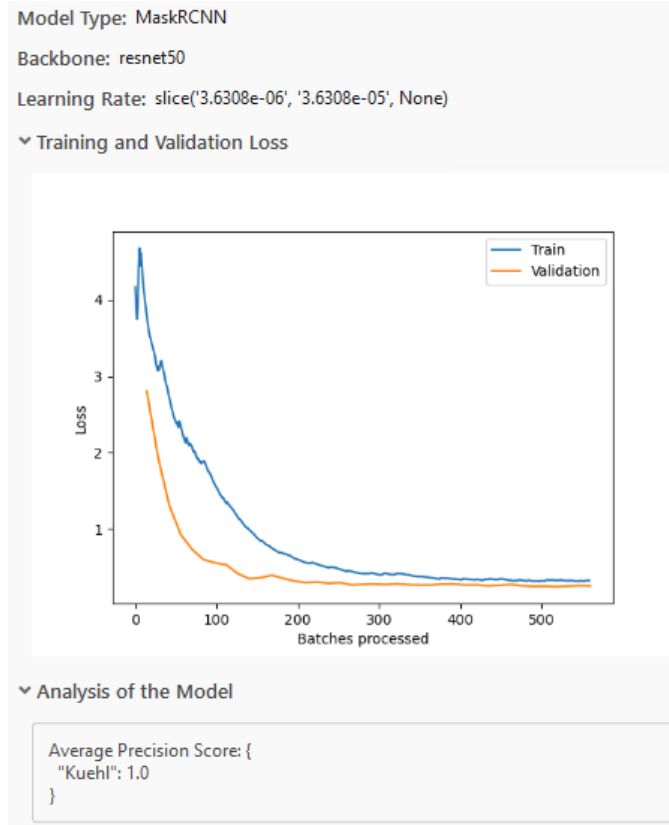
Ground Truth / Predictions



## Training Model Mask RCNN

- Backbone: Resnet50
- Max Epochs: 100
- Batch Size: 32
- Chip Size: 256/128
- Freeze Model deaktiviert

Orthofoto  
Auflösung 10cm



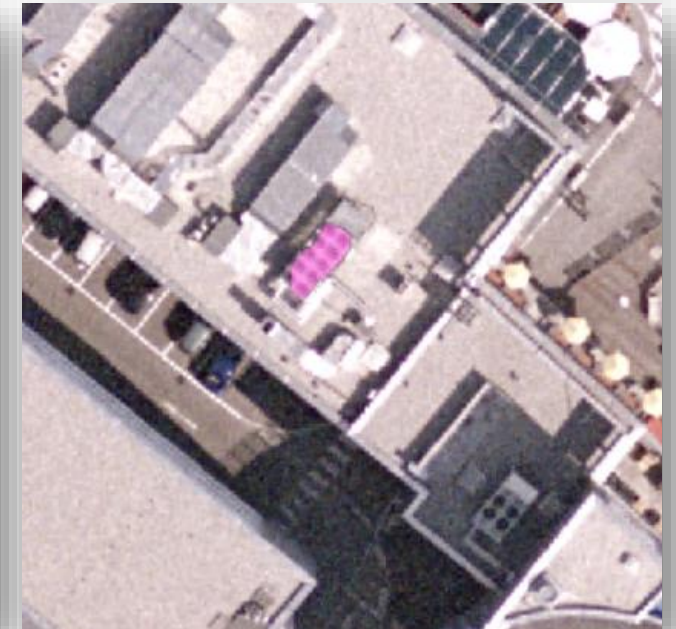
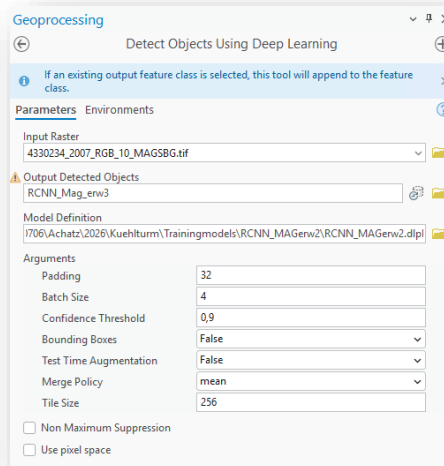
Ground Truth / Predictions



## Objekte detektieren



bis auf 3 Anlagen wurden im Untersuchungsgebiet  
alle potentiellen Anlagen detektiert



## Fehldetektionen

- Autos
- LKW
- Container
- Strukturen auf Dächer

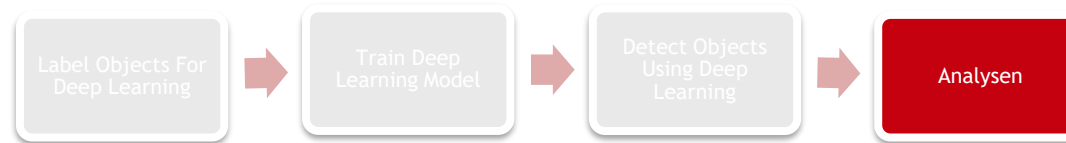


## Problemlösung

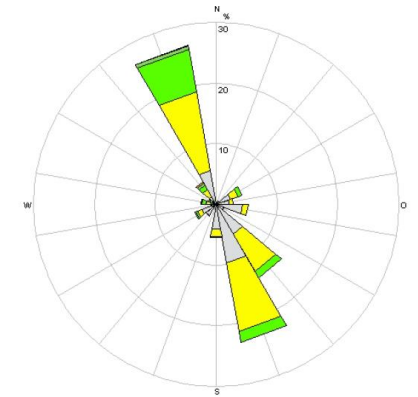
- Definition einer 2.Klasse in den Trainingsdaten



## Weitere Analyseschritte



- Einschränkung des Suchgebiets aufgrund der vorherrschenden Windrichtung zum Erkrankungszeitpunkt (aktuelle meteorologische Daten)
- Räumliche Verschneidung der Ergebnisse mit Gebäudedaten, um Adressen zuzuordnen
- Weitere Erhebungen und Beprobungen durch Gesundheitsbehörde



## Fazit

- Deep Learning Modul gut geeignet für rasche Detektion von Objekten
- Gezielte Wahl der Trainingsdaten
- Bessere Precision beim Trainieren des Models durch mehrere Epochen
- Batch Size reduzieren
- Validierung der Ergebnisse notwendig  
Überwiegender Teil der detektierten Objekte erwiesen sich als andere technische Anlage mit Radialkühlern

The background of the slide is split into two main sections. The upper section is a solid dark blue color, overlaid with a pattern of thin, white, irregular contour lines that resemble a topographic map. A curved, diagonal line separates this blue section from the lower section. The lower section features a vibrant sunset or sunrise sky with a gradient of colors from deep purple and blue at the edges to bright orange and yellow in the center, with some darker, silhouetted cloud shapes visible.

Fragen?

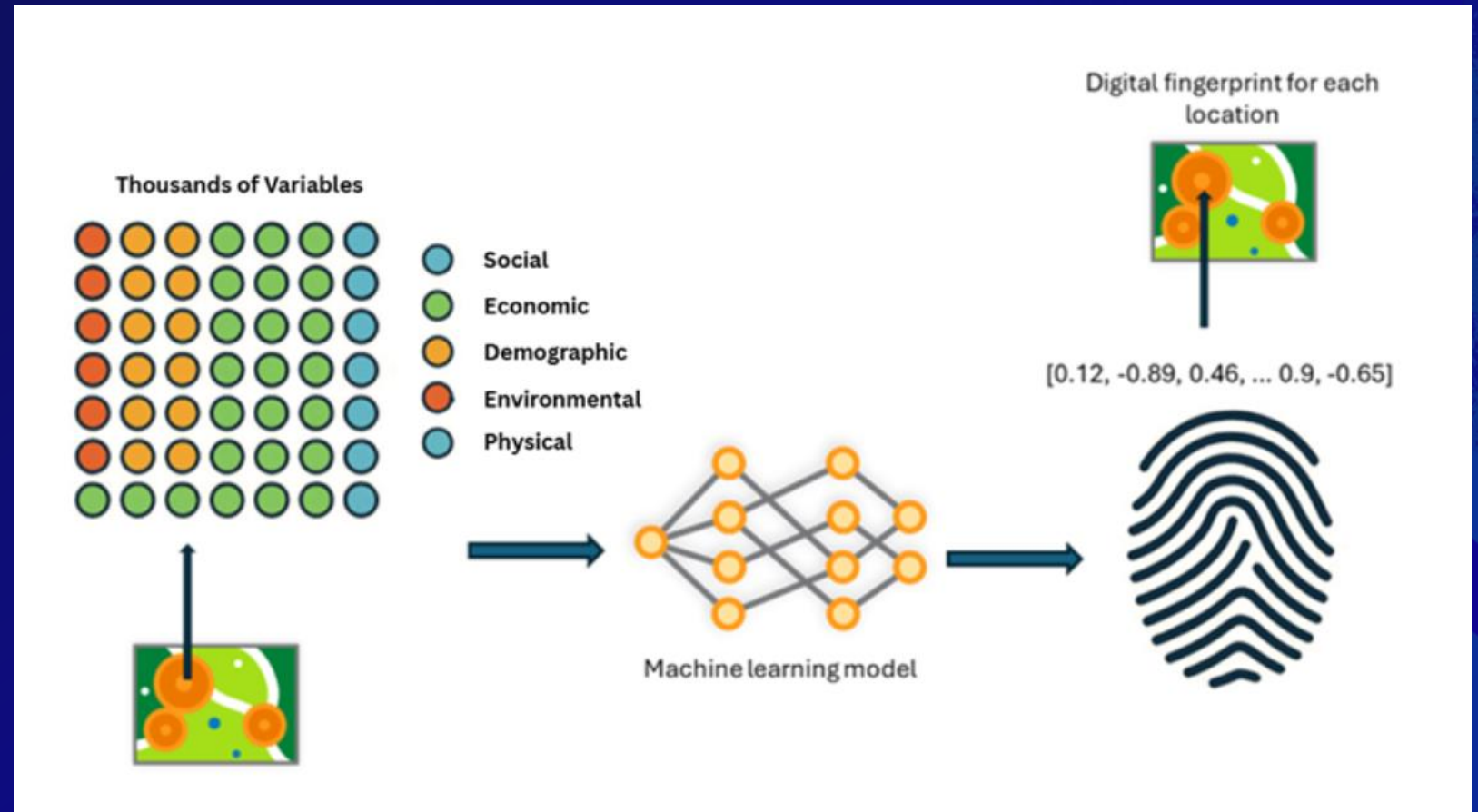
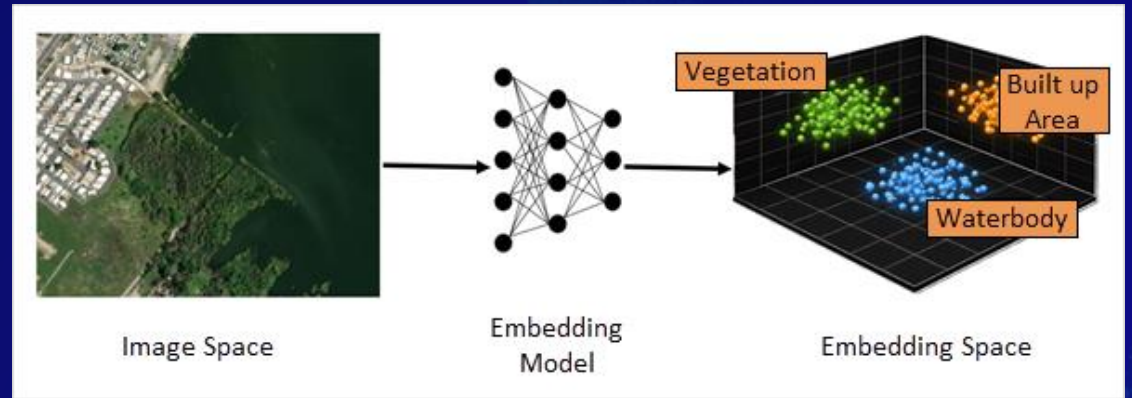


# Hands-On: Pre-Trained Models & Embeddings

Leslie Jessen

# What is an Embedding?

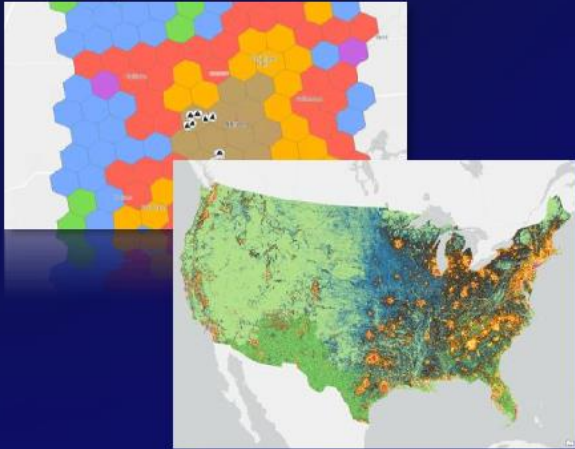
- Numerical vectors that capture meaning & relationships in data
- In a form (blob) computers can process
- Represent the essence of a place, beyond it's coordinates



# What can you do with Embeddings?

## Clustering

Lead exposure risk clusters



Geodemographic clusters  
(K means) for all 1.8 million bins

## Similarity Search

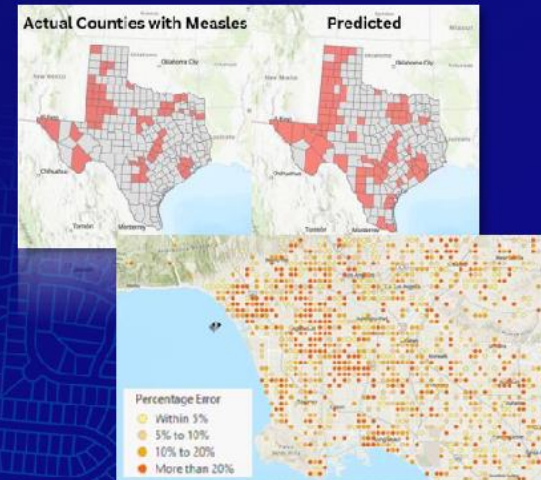
New restaurant locations



Agricultural pits

## Enhance Predictions

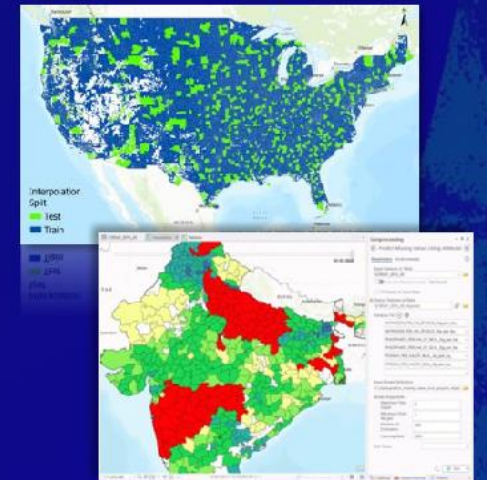
Measles outbreaks



House price prediction

## Fill Missing Values

Interpolation



Extrapolation

# How do I generate Image-based Embeddings?

1. Select a model



Embeddings generated using  
1.4 meter grid size



Similarity search results

2. Select a grid-size



Embeddings generated using  
2.8 meter grid size



Similarity search results

# Generate Embeddings GP Tool

Geoprocessing

←

Generate Embeddings Using AI Models

+

3

?

Parameters

Environments

Input Feature Class Or Raster

Stadt Wien - Orthofoto 2025 - Grid 35\_4

▼

📁

⚠️ Output Embeddings Feature Class

at\_zollamt\_dinov3\_embeddings\_16\_4

🕒

📁

Input Model Definition File

C:\Users\l.jessen\models\embeddings\DINOv3.dlpk

📁

Arguments

Batch Size

16

Grid Size

4

# Sample Output, Find Similar (Ribbon)

The screenshot displays the 'Find Similar' tool interface. The main window shows an aerial photograph of a city street with several buildings highlighted in pink and blue. The left sidebar contains a 'Contents' panel with a search bar and a 'Drawing Order' list. The 'Drawing Order' list includes the following items:

- ☒ Cooling Towers - Embeddings
  - ☐ Hellgraue Referenzkarte
  - ☐ Find Similar - Geoprocessing Tool
    - ☐ Embeddings 16.4 selection
    - ☐ Find Similar - Full Image: 70%
    - ☐ Find Similar - Full Image: 75%
- ☒ Image Embeddings
  - ☐ at\_zollamt\_dinov3\_embeddings\_16\_4
  - ☒ at\_zollamt\_dinov3\_embeddings\_4\_2
- ☒ Stadt Wien - Orthofoto 2025 - Grid 35\_4

Below the 'Drawing Order' list, there is an 'RGB' section with three color-coded boxes: Red: Band\_1, Green: Band\_2, and Blue: Band\_3. At the bottom of the sidebar, there is a checkbox for 'Hellgraue Grundkarte' which is checked.

The right sidebar contains the 'Find Similar' tool settings. It has a 'Change the selection' button, an 'Input Embeddings Layer' dropdown set to 'at\_zollamt\_dinov3\_embeddings\_4\_2', and a 'Threshold' slider set to 0.85. Below these settings is a 'Display Options' section. At the bottom of the right sidebar, there is a status bar showing 'Find Similar', 'Similar Features: 51', and 'Zoom To Results'. There are also buttons for 'Export Result', 'Clear Result', and 'Find Similar'.

# Find Similar GP Tool

Geoprocessing

Find Similar Features Using Embeddings

Parameters

Environments

Embedding Features

at\_zollamt\_dinov3\_embeddings\_16\_4

Query Features

Embeddings 16\_4 selection

Output Embeddings Feature Class

at\_zollamt\_dinov3\_embeddings\_16\_4\_FindSimilar\_DemoSelection

Threshold

0,5

# "Traditional" AI

Train your  
own model

To power end-  
to-end user  
workflows

Labelling

Data  
Prep

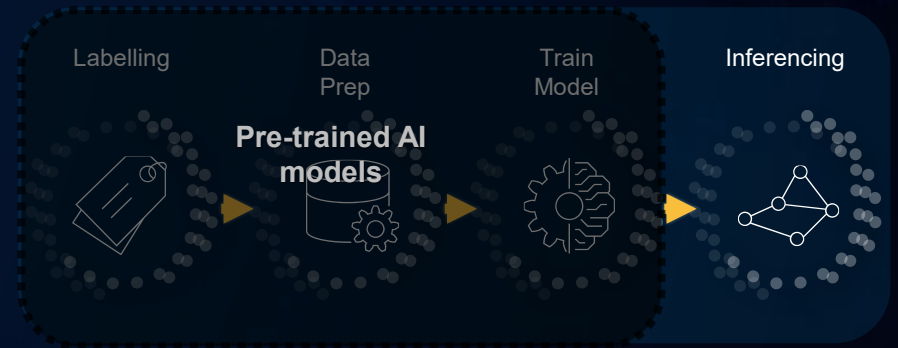
Train  
Model

Inferencing

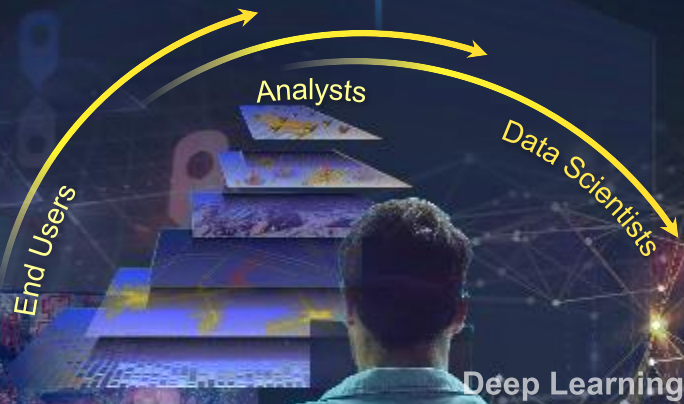
- End-to-end workflow designed to support your:
  - Geography
  - Resolutions
  - Imagery properties
  - Asset types

## Pre-trained Models

Making AI more accessible



- Eliminates:
  - Imagery requirements for model training
  - Labelling requirements
  - Training AI models
  - Massive compute requirements



## Fine-Tune an existing model

Shorten end-to-  
end user  
workflows

Labelling

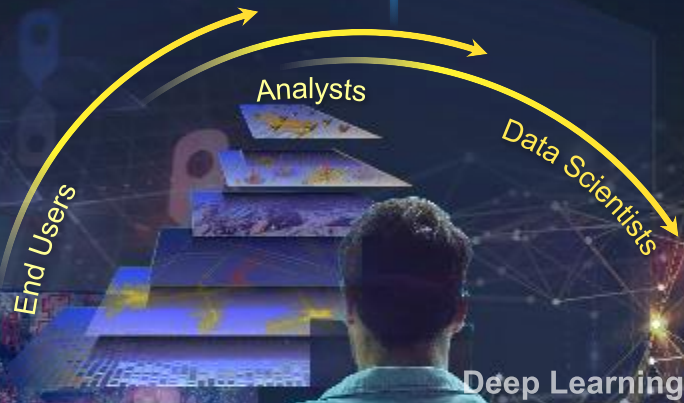
Data  
Prep

Train  
Model

Inferencing



- Shortened end-to-end workflow designed to support your:
  - Geography
  - Resolutions
  - Imagery properties
  - Asset types



# Pre-Trained Model

1. Detect Objects Using Deep Learning

Geoprocessing

Detect Objects Using Deep Learning

Parameters Environments

Input Raster  
Stadt Wien - Orthofoto 2025 - Grid 35\_4

Output Detected Objects  
coolingtowers\_ptm\_100\_4\_40\_400

Model Definition  
C:\Users\l.jessen\models\pretrained\coolingtowers\CoolingTowerDetection\_USA.dlpk

Arguments

|                        |       |
|------------------------|-------|
| Padding                | 100   |
| Batch Size             | 4     |
| Confidence Threshold   | 0.4   |
| Bounding Boxes         | False |
| Test Time Augmentation | False |
| Merge Policy           | mean  |
| Tile Size              | 400   |

☒ Non Maximum Suppression

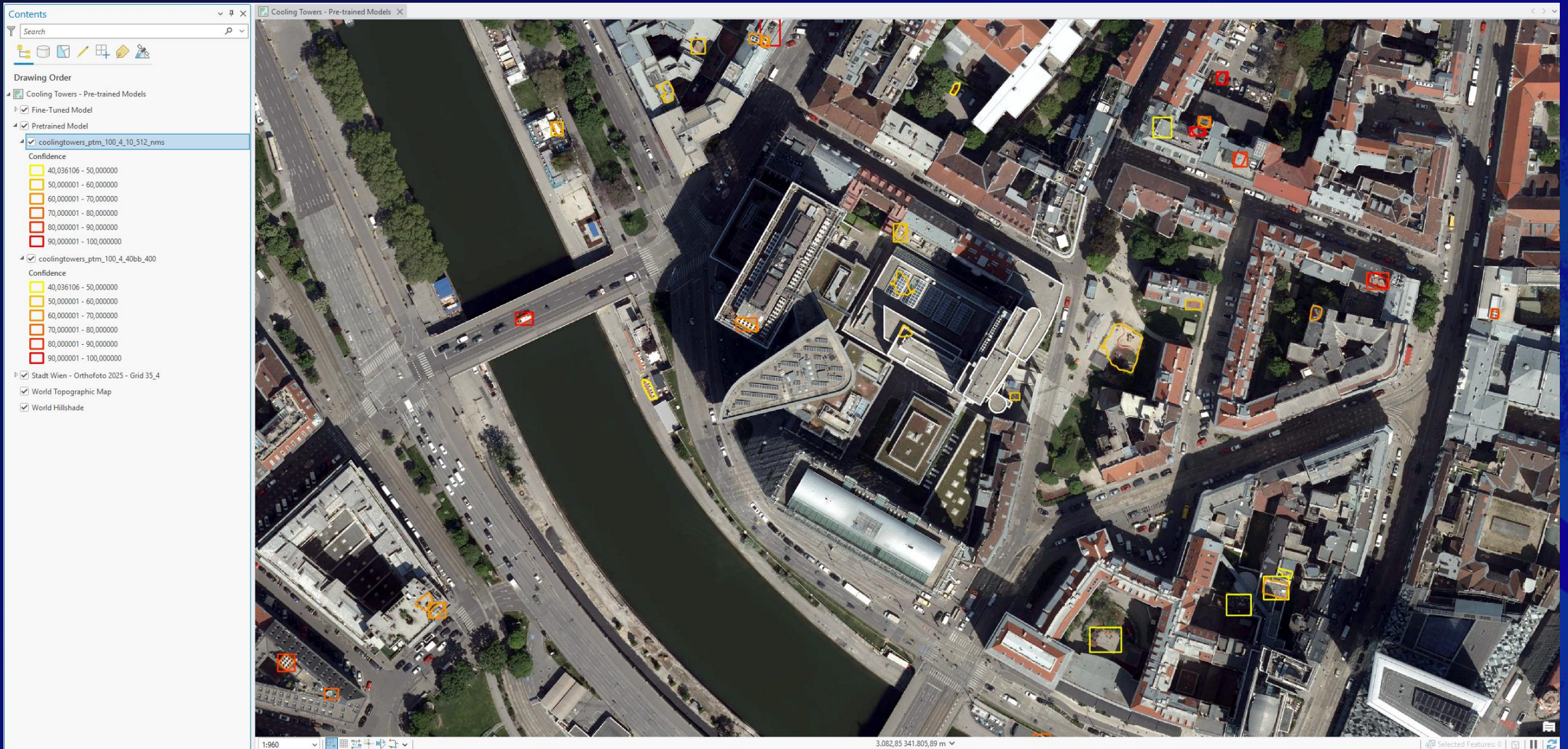
Confidence Score Field  
Confidence

Class Value Field  
Class

Max Overlap Ratio  
0

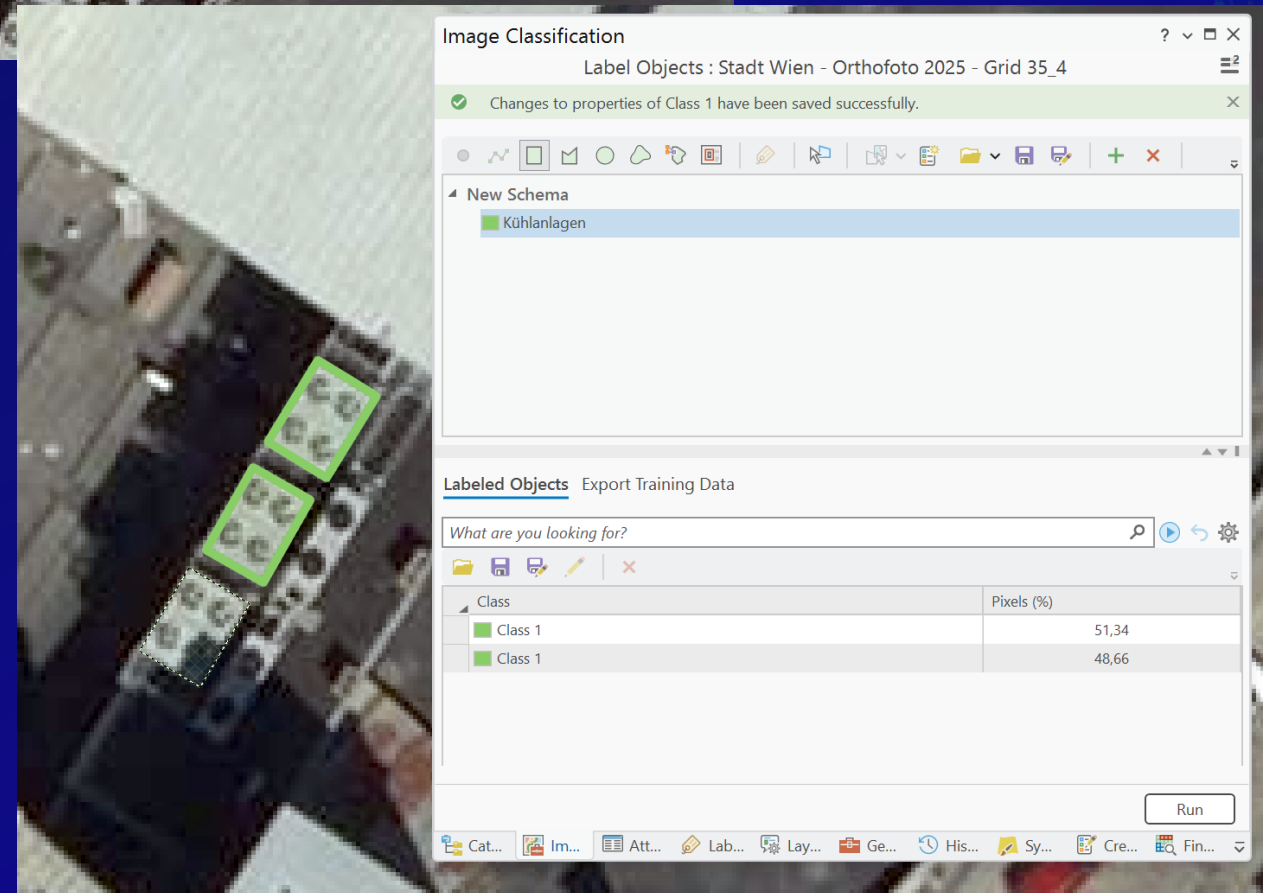
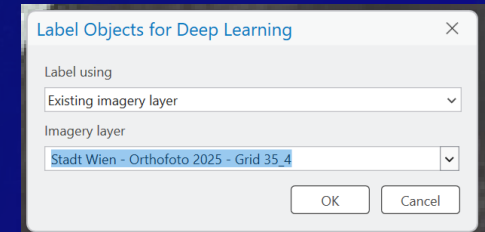
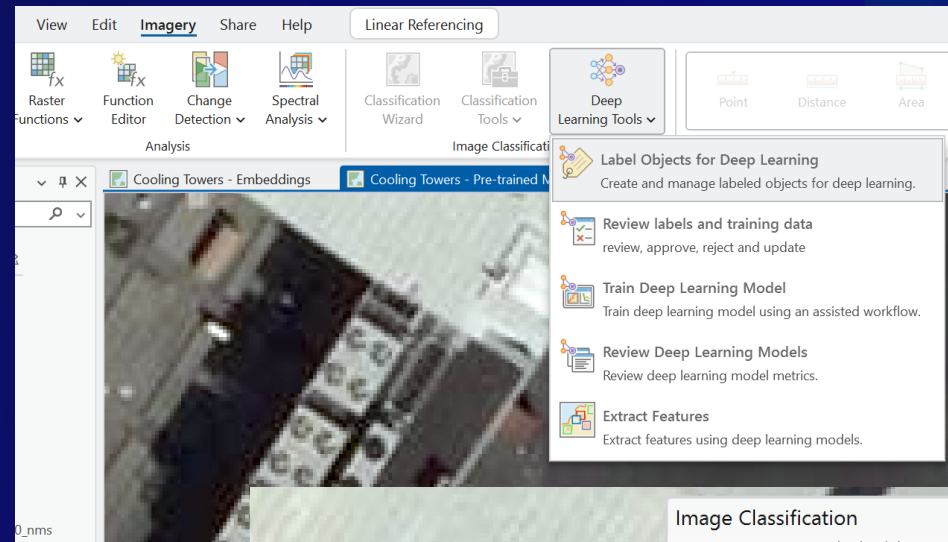
☐ Use pixel space

# Pre-Trained Model: Sample Output



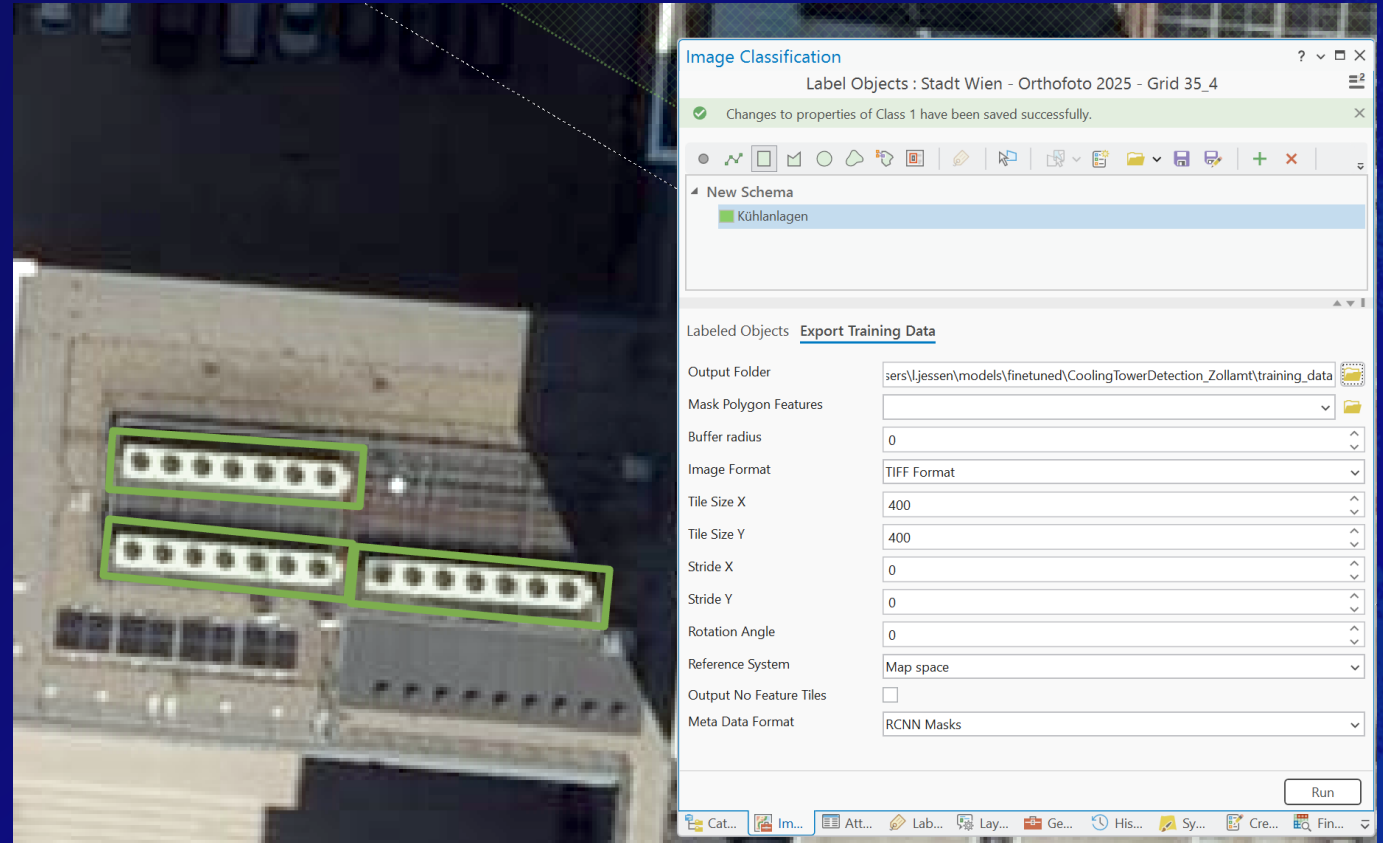
# Fine-Tune a Pre-Trained Model

1. Create label data
2. Export Training Data for Deep Learning
3. Train Deep Learning Model
4. Detect Objects Using Deep Learning



# Fine-Tune a Pre-Trained Model

1. Create label data
2. **Export Training Data for Deep Learning**
3. Train Deep Learning Model
4. Detect Objects Using Deep Learning



*\*Make sure to use the correct export parameters for the model: Fine-tune the model–ArcGIS AI models | Documentation*

# Fine-Tune a Pre-Trained Model

1. Create label data
2. Export Training Data for Deep Learning
3. **Train Deep Learning Model**
4. Detect Objects Using Deep Learning

Geoprocessing

Train Deep Learning Model

**Parameters** Environments

Input Training Data

training\_data\_v1c

Output Folder

model\_v1c

Max Epochs

100

Pre-trained Model

C:\Users\l.jessen\models\pretrained\coolingtowers\CoolingTowerDetection\_USA.dlpk

**Data Preparation**

Data Augmentation

Default

Batch Size

64

Validation %

10

Chip Size

400

Resize To

**Advanced**

Learning Rate

Monitor Metric

Validation loss

☒ Stop when model stops improving

☒ Freeze Model

☐ Enable Tensorboard

# Fine-Tune a Pre-Trained Model

1. Create label data
2. Export Training Data for Deep Learning
3. Train Deep Learning Model
4. **Detect Objects Using Deep Learning**

Geoprocessing

Detect Objects Using Deep Learning

Parameters Environments

Input Raster  
Stadt Wien - Orthofoto 2025 - Grid 35\_4

Output Detected Objects  
coolingtowers\_ftv1c\_100\_4\_40\_400\_nms

Model Definition  
C:\Users\l.jessen\models\finetuned\CoolingTowerDetection\_Zollamt\model\_v1c\model\_

Arguments

|                        |       |
|------------------------|-------|
| Padding                | 100   |
| Batch Size             | 4     |
| Confidence Threshold   | 0.4   |
| Bounding Boxes         | False |
| Test Time Augmentation | False |
| Merge Policy           | mean  |
| Tile Size              | 400   |

☒ Non Maximum Suppression

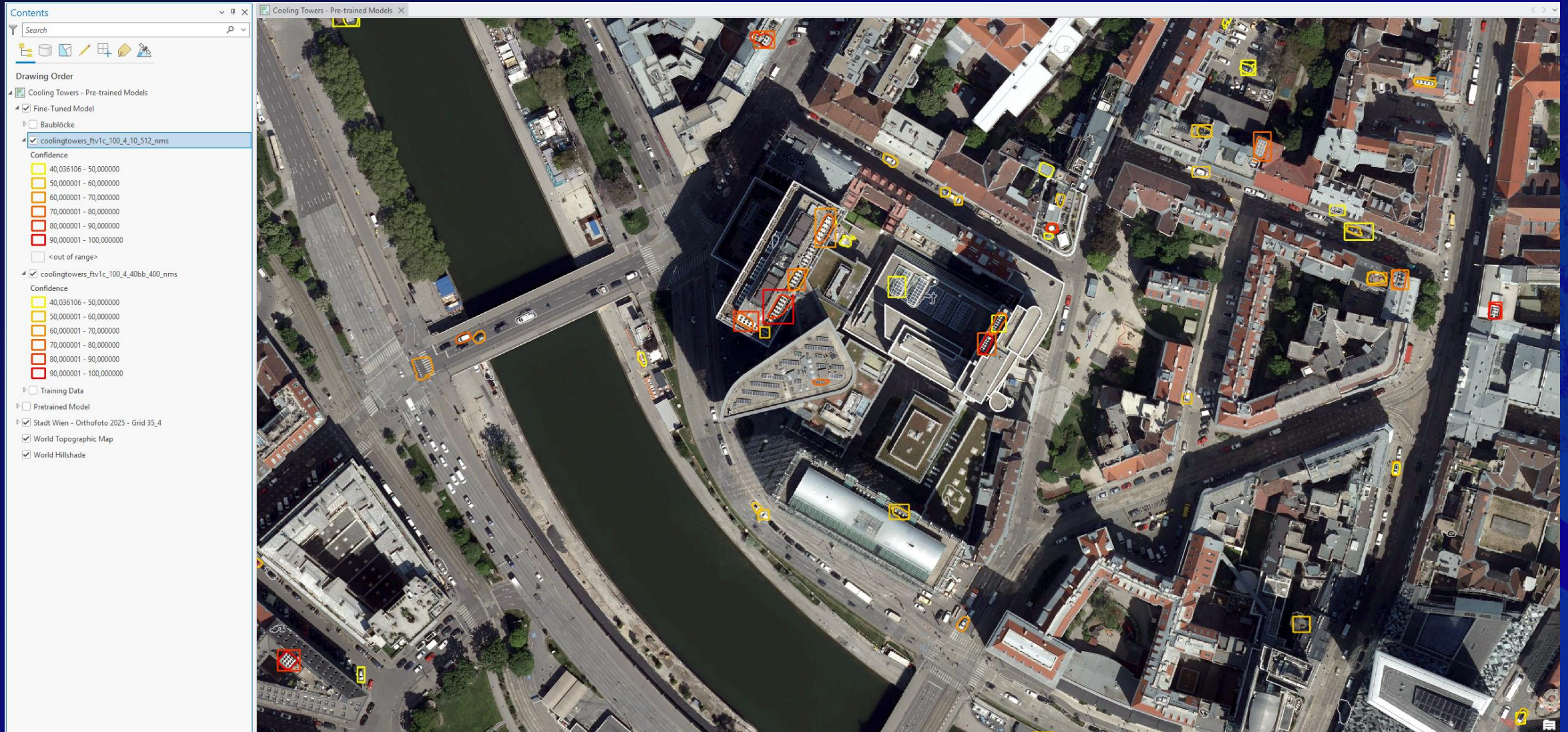
Confidence Score Field  
Confidence

Class Value Field  
Class

Max Overlap Ratio 0

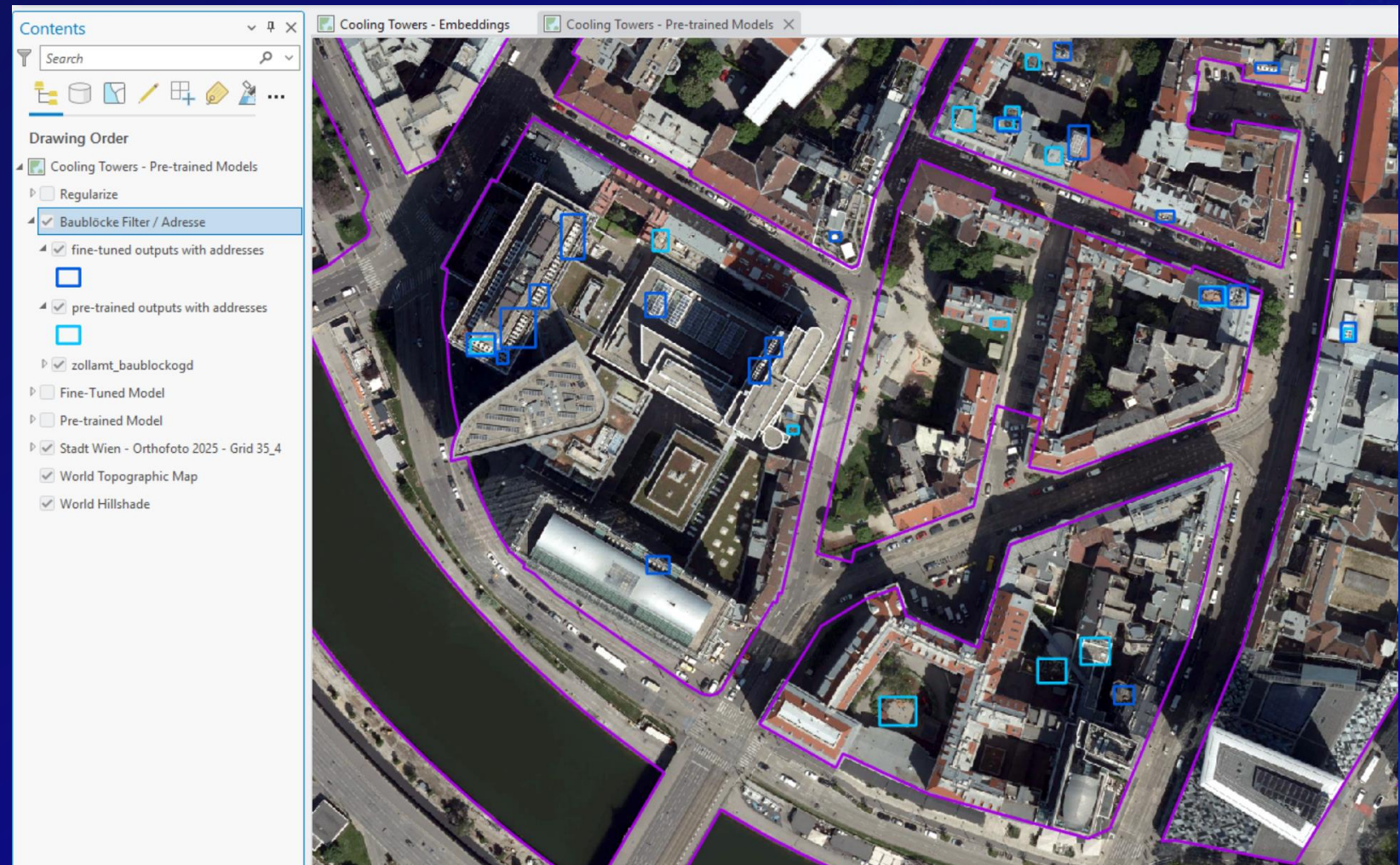
☐ Use pixel space

# Fine-Tuned Model: Sample Output



# Additional Steps

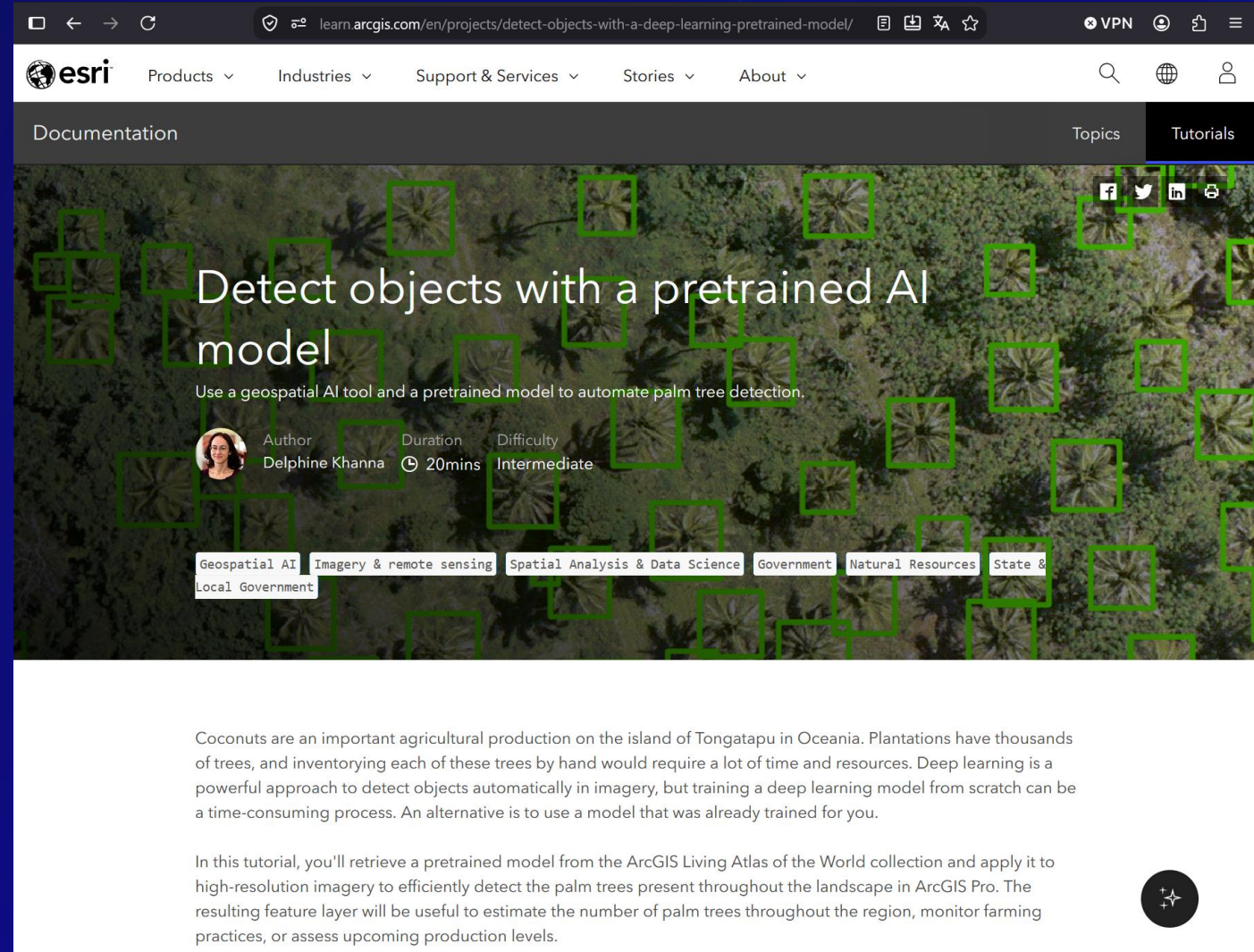
- Improve the training data
- Train a new model
- Use buildings, blocks, waterbodies, streets, etc. as a filter
- Join with addresses
- Area estimates
- ...



# Try it yourself?

Step by Step with ArcGIS Learn

- [Detect objects with a pretrained AI model | Documentation](#)
- Publically Available
- Requirements
  - ArcGIS Pro
  - ArcGIS Image Analyst
  - [Deep Learning Libraries](#) for ArcGIS Pro
  - Recommended:
    - NVIDIA GPU with a minimum of 4 GB of dedicated memory



The screenshot shows the ArcGIS Learn website interface. The browser address bar displays the URL: [learn.arcgis.com/en/projects/detect-objects-with-a-deep-learning-pretrained-model/](https://learn.arcgis.com/en/projects/detect-objects-with-a-deep-learning-pretrained-model/). The page header includes the Esri logo and navigation links: Products, Industries, Support & Services, Stories, and About. A search icon and a user profile icon are also present. Below the header, there is a navigation bar with 'Documentation' selected, and 'Topics' and 'Tutorials' tabs. The main content area features a large image of a palm tree plantation with green bounding boxes around the trees. The title 'Detect objects with a pretrained AI model' is prominently displayed. Below the title, a subtitle reads: 'Use a geospatial AI tool and a pretrained model to automate palm tree detection.' The author's name, 'Delphine Khanna', is shown next to a small profile picture. The duration is listed as '20mins' and the difficulty as 'Intermediate'. A horizontal bar contains several tags: 'Geospatial AI', 'Imagery & remote sensing', 'Spatial Analysis & Data Science', 'Government', 'Natural Resources', and 'State & Local Government'. The bottom section of the page contains two paragraphs of text. The first paragraph discusses the importance of coconuts in Tongatapu, Oceania, and the challenges of manual inventorying, suggesting deep learning as a more efficient solution. The second paragraph describes the tutorial's objective: to retrieve a pretrained model from the ArcGIS Living Atlas of the World and apply it to high-resolution imagery to detect palm trees. A small circular icon with a star is visible in the bottom right corner.

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## Detect objects with a pretrained AI model

Use a geospatial AI tool and a pretrained model to automate palm tree detection.

Author: Delphine Khanna | Duration: 20mins | Difficulty: Intermediate

Geospatial AI | Imagery & remote sensing | Spatial Analysis & Data Science | Government | Natural Resources | State & Local Government

Coconuts are an important agricultural production on the island of Tongatapu in Oceania. Plantations have thousands of trees, and inventorying each of these trees by hand would require a lot of time and resources. Deep learning is a powerful approach to detect objects automatically in imagery, but training a deep learning model from scratch can be a time-consuming process. An alternative is to use a model that was already trained for you.

In this tutorial, you'll retrieve a pretrained model from the ArcGIS Living Atlas of the World collection and apply it to high-resolution imagery to efficiently detect the palm trees present throughout the landscape in ArcGIS Pro. The resulting feature layer will be useful to estimate the number of palm trees throughout the region, monitor farming practices, or assess upcoming production levels.

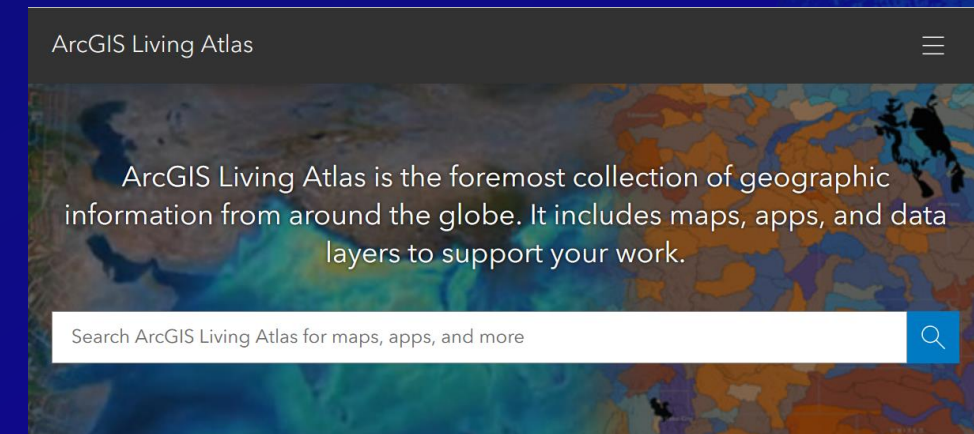
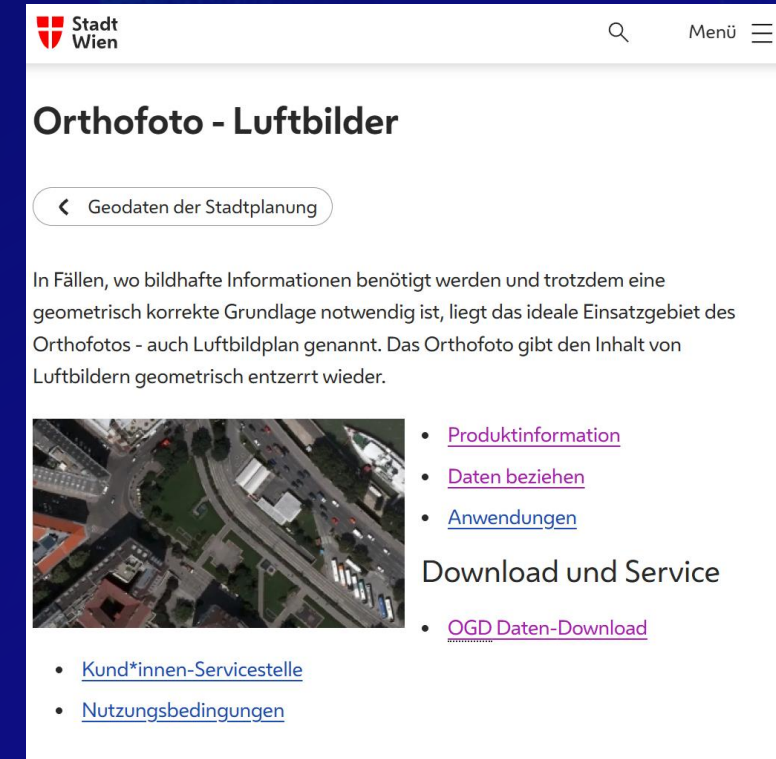
# Try it yourself?

Replicate this demo

- Embeddings Model: [DINOv3 - Überblick](#)
- Pre-Trained Model: [Cooling Tower Detection - USA – Überblick](#)
- Raster Data: [Orthofoto - Luftbilder der MA 41 - Stadt Wien](#)

## • Requirements

- ArcGIS Pro
- ArcGIS Image Analyst
- [Deep Learning Libraries](#) for ArcGIS Pro
- Recommended:
  - NVIDIA GPU with a minimum of 8 GB of dedicated memory
  - 10 GB Disc Space plus 6 GB for temporary files & downloads



# Try it yourself?

## Full Learning Plan with Esri Academy

- Essentials of AI Tools and Models in ArcGIS | Esri Learning Plan (18 Kurse)
- **About this Learning Plan**
  - AI-driven geospatial workflows.
  - Geospatial AI (sometimes called GeoAI) in ArcGIS is the integration of AI, machine learning (ML), and deep learning (DL) with GIS to produce knowledge and solve geographic problems. Explore AI tools and models for tasks related to clustering and pattern detection, prediction and forecasting, and information extraction from imagery, lidar, videos, and unstructured text data.
- Many courses require maintenance (Esri Maintenance Program)

## Esri Academy

Ihr Ort für lebenslanges Lernen in GIS.

Den Katalog durchsuchen

Zum Dashboard wechseln



# MOOC: Spatial Data Science

The New Frontier in Analytics

- [Spatial Data Science: The New Frontier in Analytics | Esri MOOC](#)
- Publically Available
- Online, September 23 - November 4, 2026
- Updated for ArcGIS Pro 3.7+

## Course Syllabus

### SECTION 1 Introduction to Spatial Data Science

Explore how spatial data, tools, and analysis techniques augment traditional data science. Understand that "spatial" means more than x,y coordinates and that place-based context reveals patterns in data that otherwise may be hidden. Start applying data engineering and visualization techniques in ArcGIS Pro and ArcGIS Notebooks.

### SECTION 2 The Spatial Approach to Predictive Analysis

Prediction is fundamental to data science. See how incorporating spatial properties into modeling workflows deepens understanding of data and adds predictive power. Learn how to apply random forest, a widely used machine learning approach, to solve problems. Train and evaluate a model, then use it to generate robust predictions.

### SECTION 3 Finding Optimal Locations Using Suitability Models

Apply widely used spatial analysis techniques to answer this universal question asked by all kinds of organizations: Where is the best location for <fill in the blank>? Perform a weighted overlay analysis that considers and ranks multiple suitability criteria. Learn how to transform data using functions to more completely represent suitability impact.

### SECTION 4 Pattern Detection and Clustering

Does a pattern have meaning or is it a product of random chance? ArcGIS includes a suite of tools to help analysts identify patterns and clusters in data and determine if they are meaningful. Learn how to apply statistical clustering methods to analyze patterns in space as well as time. Create a spacetime cube, then use space-time pattern mining tools to explore spatiotemporal trends and determine where and when high and low clusters occur.

### SECTION 5 Object Detection with Deep Learning

Take a deep dive into extracting information from massive data using deep learning. Learn how to automate the process of detecting objects and identifying features from imagery. Practice preparing training sample data, then use a neural network to train an object detection model.

### SECTION 6 Communicating Results with Impact

Successful analysts and data scientists must be effective storytellers. Learn how to present a complex analysis using information products that resonate with your audience. Design and build interactive, visual stories that share the key information you want decision-makers to understand and act on.



The background is split into two main sections. The upper section is a solid dark blue with a pattern of thin, white, irregular contour lines, resembling a topographic map. The lower section is a curved, semi-circular area showing a sunset or sunrise sky with soft, wispy clouds in shades of orange, pink, and purple. The transition between the two sections is a smooth, curved line.

# Fragen?

# Im Anschluss

## Plenary IV im Showroom

*2026 ESRI USER CONFERENCE AUSTRIA – powered by SynerGIS*

An aerial photograph of a river valley, showing a winding river and surrounding terrain. The image is partially covered by a large blue diagonal overlay that extends from the bottom left towards the top right.

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