

# Nutzen Sie das Potential Ihrer Imagery-Daten mit Raster Analysen und Deep Learning

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| SEE WHAT  
| OTHERS CAN'T

Esri Konferenz 2020



# Agenda

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- 1 Einleitung
- 2 Change Detection mit Raster Analytics
- 3 Deep Learning auf Imagery Daten

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# Einleitung

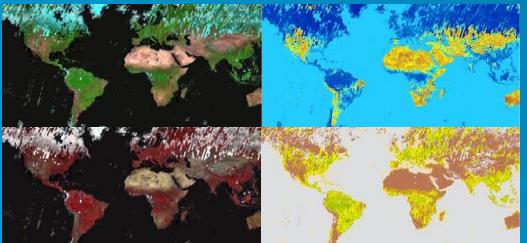


# Imagery-Daten

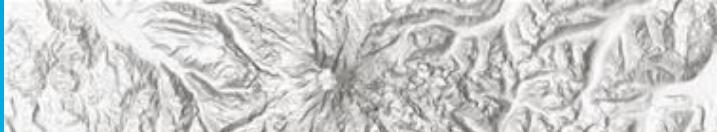
ArcGIS Online und The Living Atlas of the World



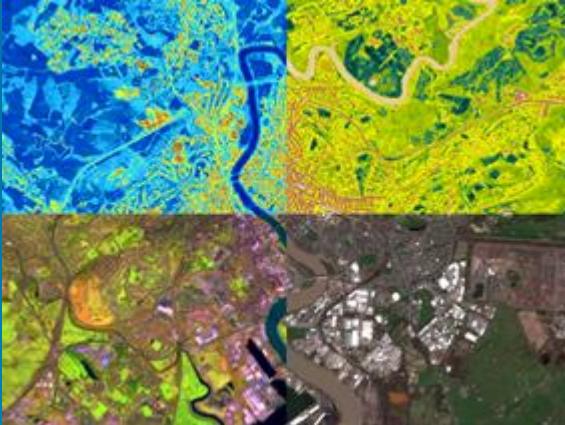
World Imagery & Wayback



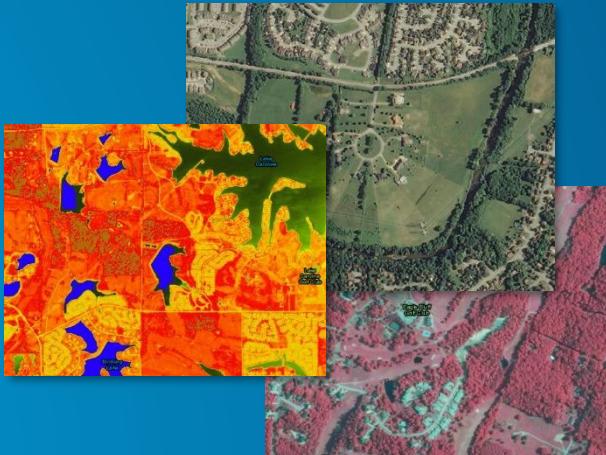
Landsat



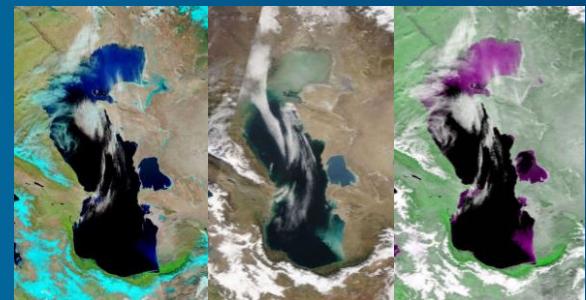
World Terrain



Sentinel 2



NAIP



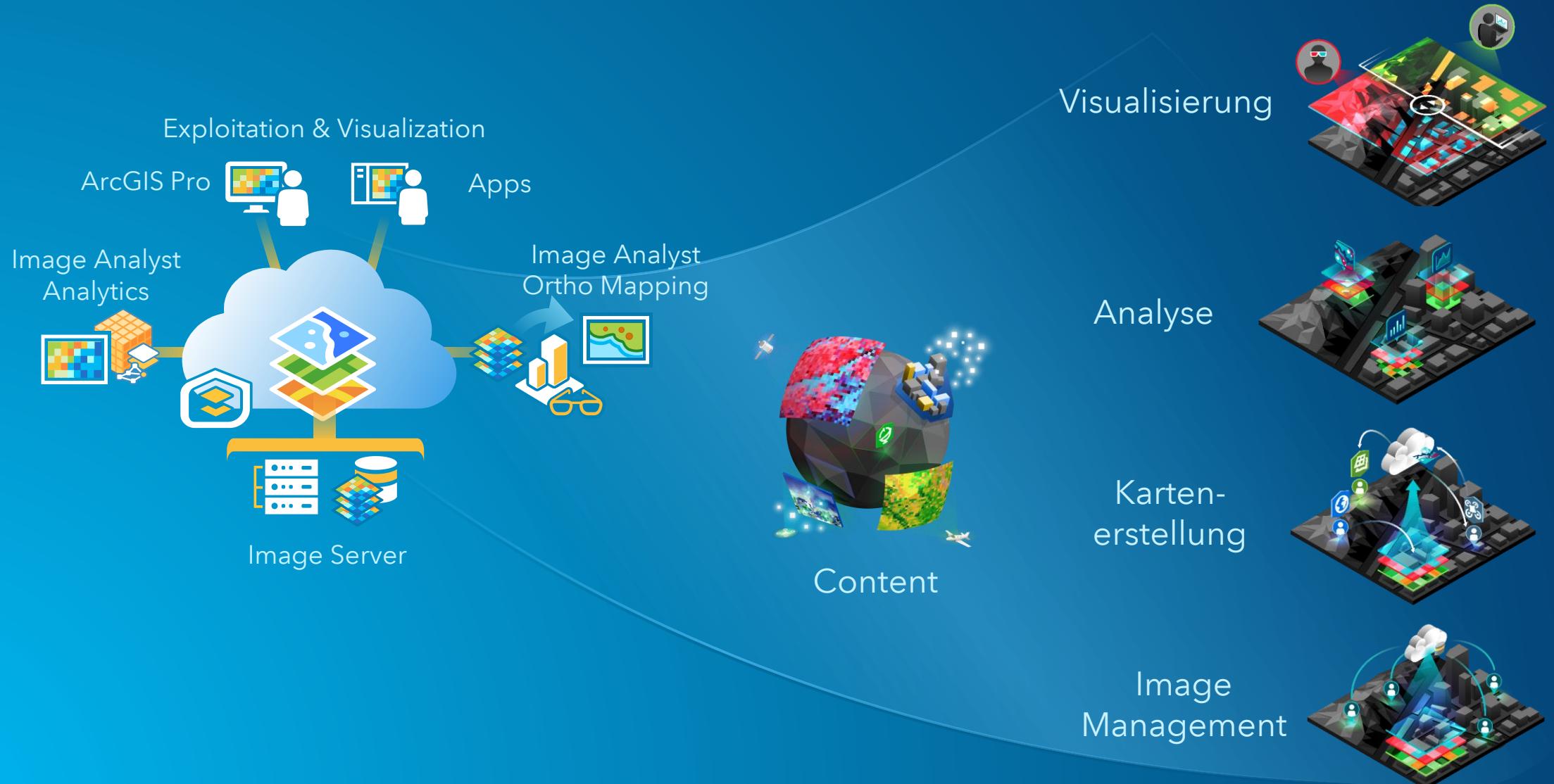
MODIS



Partner



# ArcGIS ist die Plattform für Imagery & Remote Sensing



# Die 5 Key-Capabilities für Imagery & Remote Sensing in ArcGIS

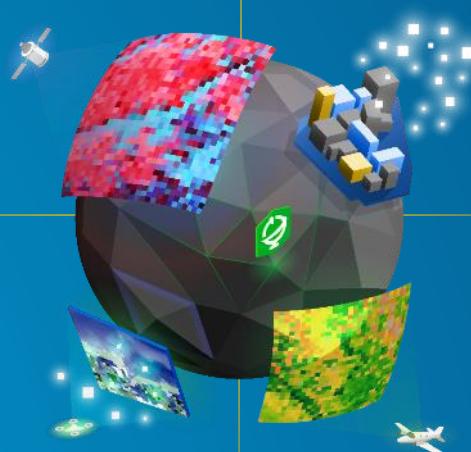
Visualisierung  
& Auswertung



Analyse



Content



Management



Karten-  
erstellung



# Capability → Produkt

Capabilities  
(WAS?)



## Management

Produkt  
(WOMIT?)  
- Features  
(Ergebnis)

- ArcGIS Pro
  - Authoring Mosaic Datasets
  - Raster Types/Products
- ArcGIS Image Server
  - Scalability
  - Dynamic Image Services

- ArcGIS Online
  - Publish Tile Layers

- Imagery Workflow Tools
  - MDCS
  - MDTools
  - OptimizeRasters
  - Oriented Imagery



## Kartenerstellung

- ArcGIS Pro (Advanced)
  - Ortho Mapping
  - Generate Ortho
  - Generate DSM/DTM
- Drone2Map
  - Generate 2D & 3D Products

- ArcGIS Image Server
  - Ortho Mapping
  - Ortho Maker

- ArcGIS Online
  - Publish Results



## Analyse

- ArcGIS Pro
  - Image Visualization
  - Raster Functions
  - GIS Integration
- ArcGIS Image Analyst
  - Classification
  - Deep Learning
- Spatial Analyst Extension
  - Raster Analysis
  - HydroTools
- ArcGIS Image Server
  - Raster Analytics
  - ArcGIS for Python
  - REST APIs



## Visualisierung & Auswertung

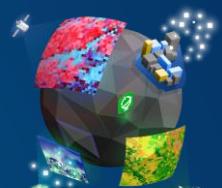
- ArcGIS Pro
  - Image Visualization
  - Raster Functions
  - GIS Integration

- ArcGIS Image Analyst
  - Stereo
  - Image Space
  - Motion Imagery

- ArcGIS Online
  - WebMapViewr
  - Imagery Templates
  - WABIS
  - Image Discovery
  - Oriented Imagery

- ArcGIS Excalibur
  - WebBased Image Exploitation

- ArcGIS Image Server
  - Dynamic Image Services
  - Base for Excalibur



## Content

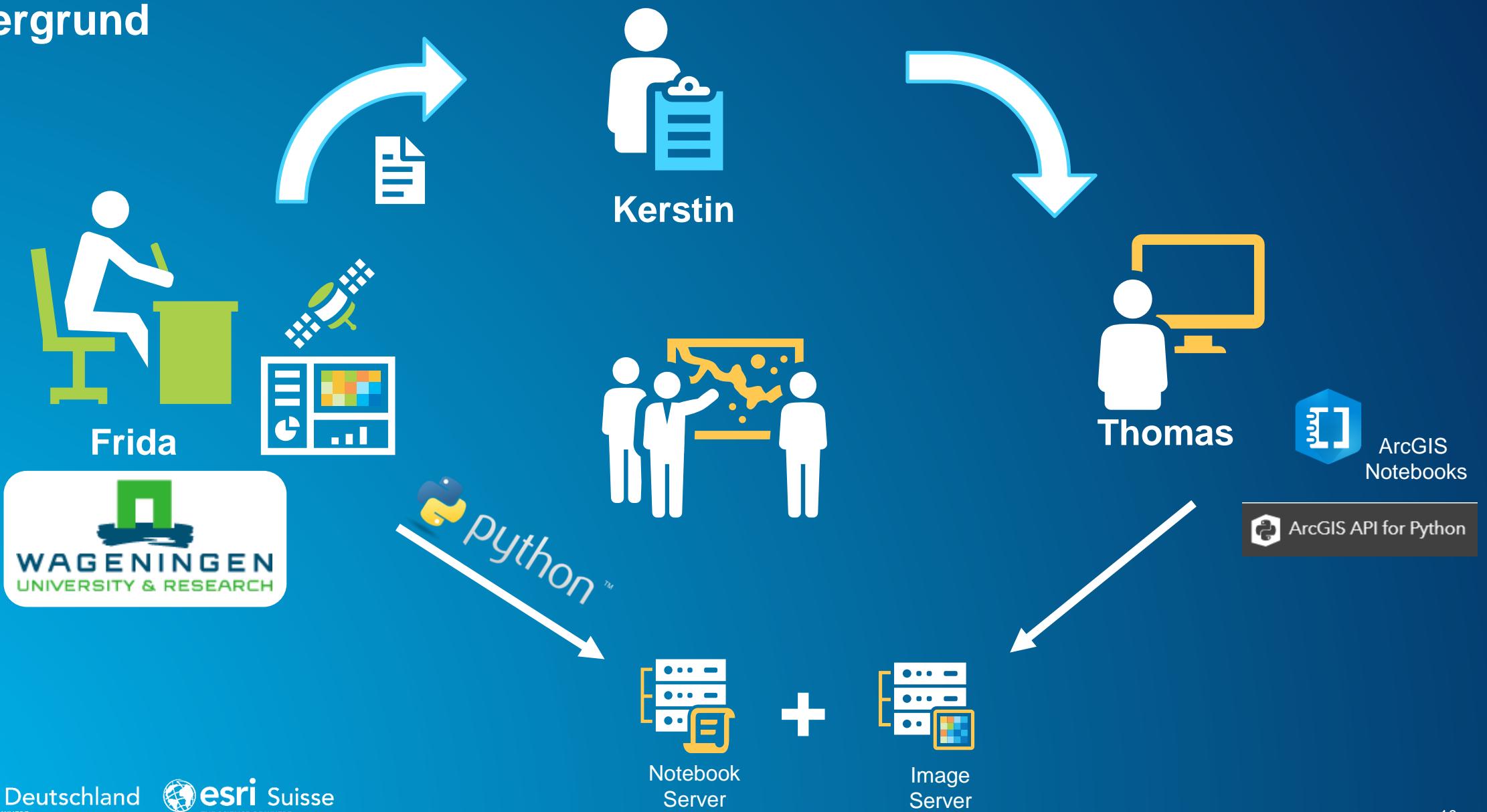
- ArcGIS Online
  - Imagery content
  - The Living Atlas of the World

- ArcGIS Marketplace
  - Premium data

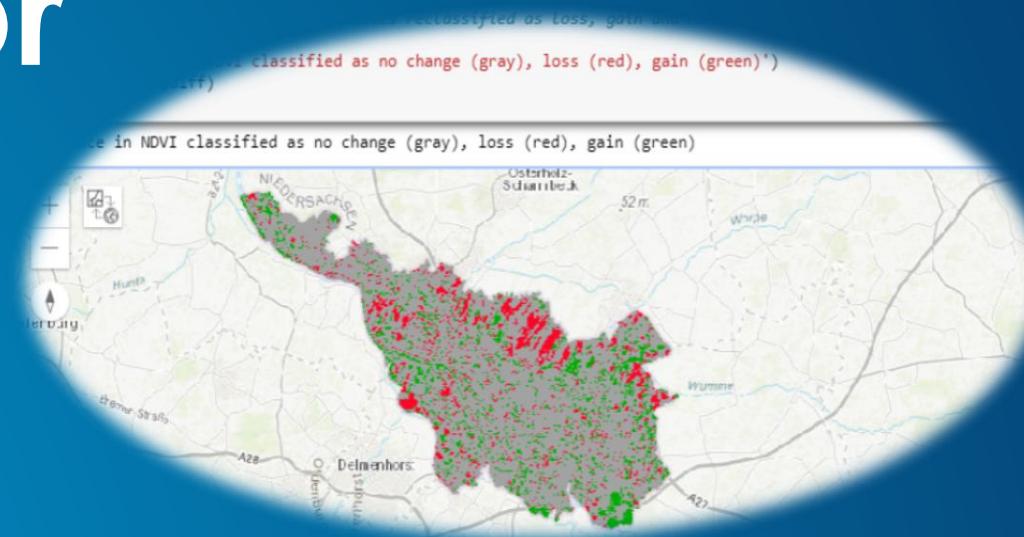
2

# Change Detection mit Raster Analytics

# Hintergrund



# Simple change detection for vegetation monitoring



# Internship Project

The **main objective** of this project was to:

“Create a showcase for **ArcGIS Notebooks** and explore the advantages it offers to create **end-to-end workflows for raster analysis**”

# Methode

Change detection algorithm	Approach	Comments
Manual change interpretation	Two images (or photographs) are visually compared to manually identify changes.	<ul style="list-style-type: none"><li>This method is simple and sometimes the most feasible method for change detection, especially when other techniques fail to accurately identify changes</li><li>Requires human experience</li><li>Results are subjective and strongly depend on interpretation skills</li><li>Time consuming interpretation process</li></ul>
Post-classification comparison	Independent spectral classification results from each image date and pixel-by-pixel or segment-by-segment comparison to detect changes in land cover types.	<ul style="list-style-type: none"><li>Minimizes radiometric differences between multi-date images</li><li>Provides complete change matrix</li><li>The accuracy of the post-classification comparison is dependent on the accuracy of the initial classification.</li><li>Requires time and classification expertise</li></ul>
Composite analysis	Multi-date images are analyzed through joint classification including change categories.	<ul style="list-style-type: none"><li>Simple and time-saving in classification</li><li>Requires many classes (5 land cover classes=25 possible change classes).</li><li>Demands prior knowledge of the logical interrelationships of classes</li></ul>
Univariate image algebra (difference/ratio)	Subtraction/ratio of one date original or transformed imagery (e.g. vegetation index, radiance, etc.) from a second date.	<ul style="list-style-type: none"><li>Can only differentiate change or no-change, i.e. cannot generate detailed change matrix information</li><li>Requires criterion/threshold of changes or no-changes (e.g. Standard deviation method)</li></ul>

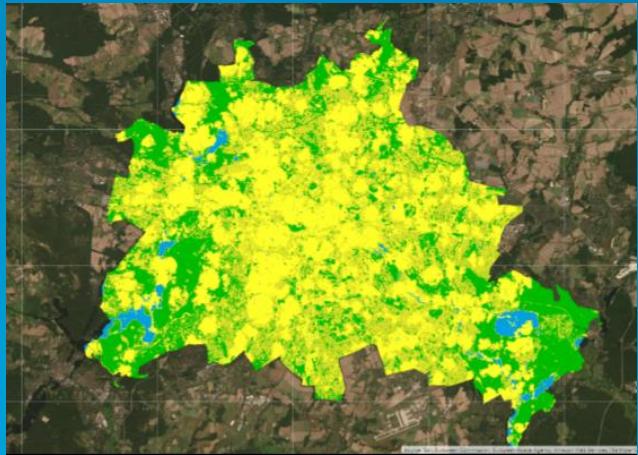
Different Methods for change detection

Quelle: Herlod M, Remote Sensing techniques WUR, 2019

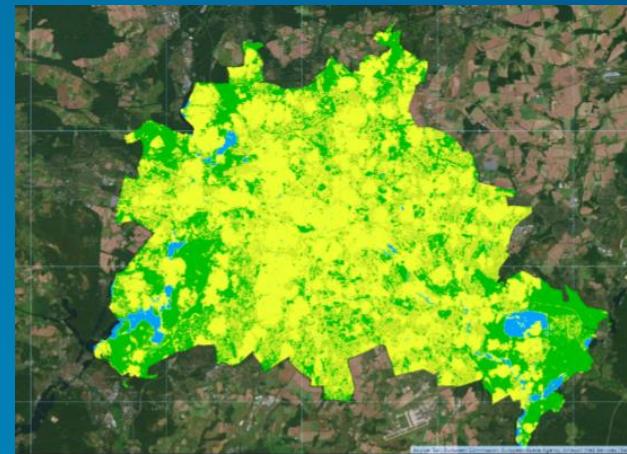
- **Image Algebra (Image subtraction method) & Post-classification comparisons**
- Üblicherweise für zwei Zeitpunkte durchgeführt
- Relativ unkompliziert und werden weit verbreitet genutzt

# Methode

First Date

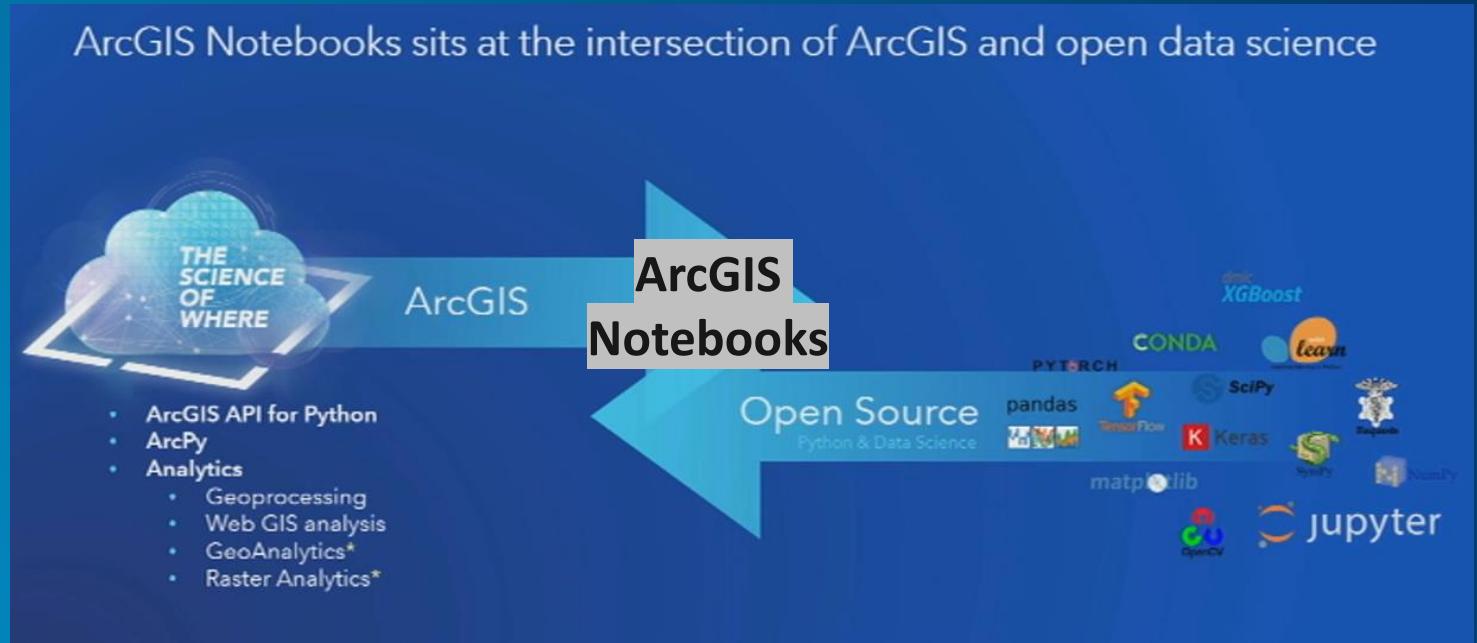
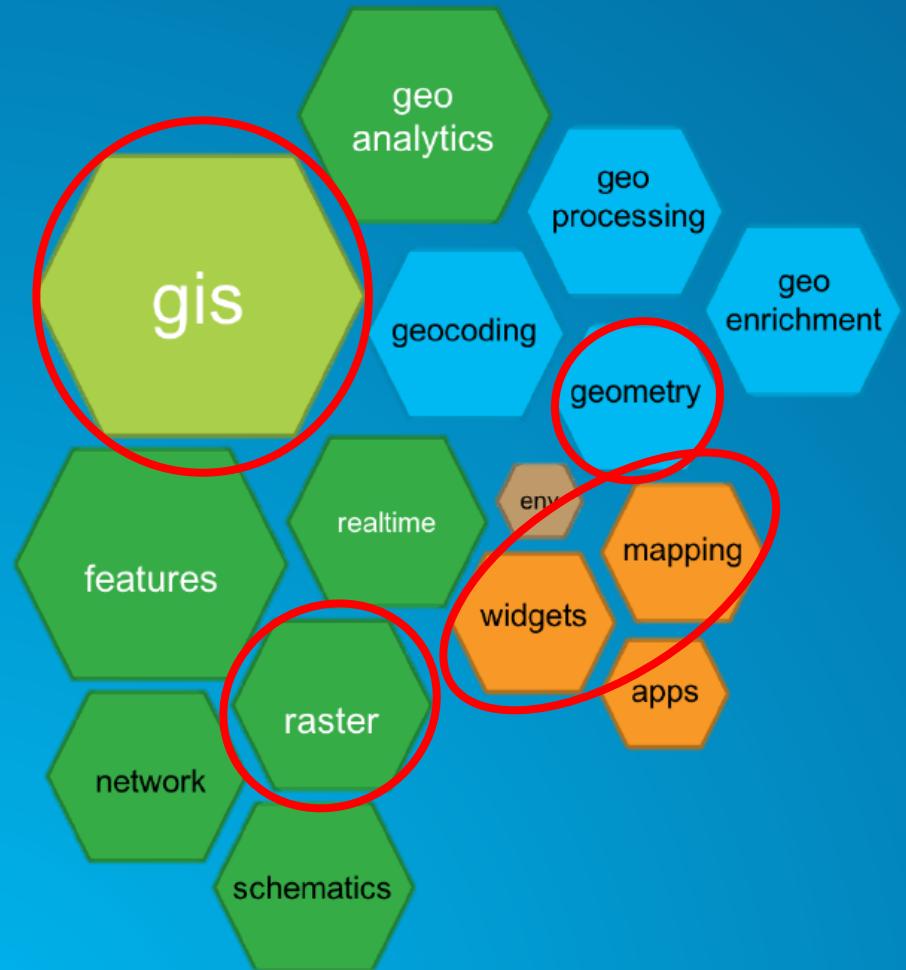


Second Date



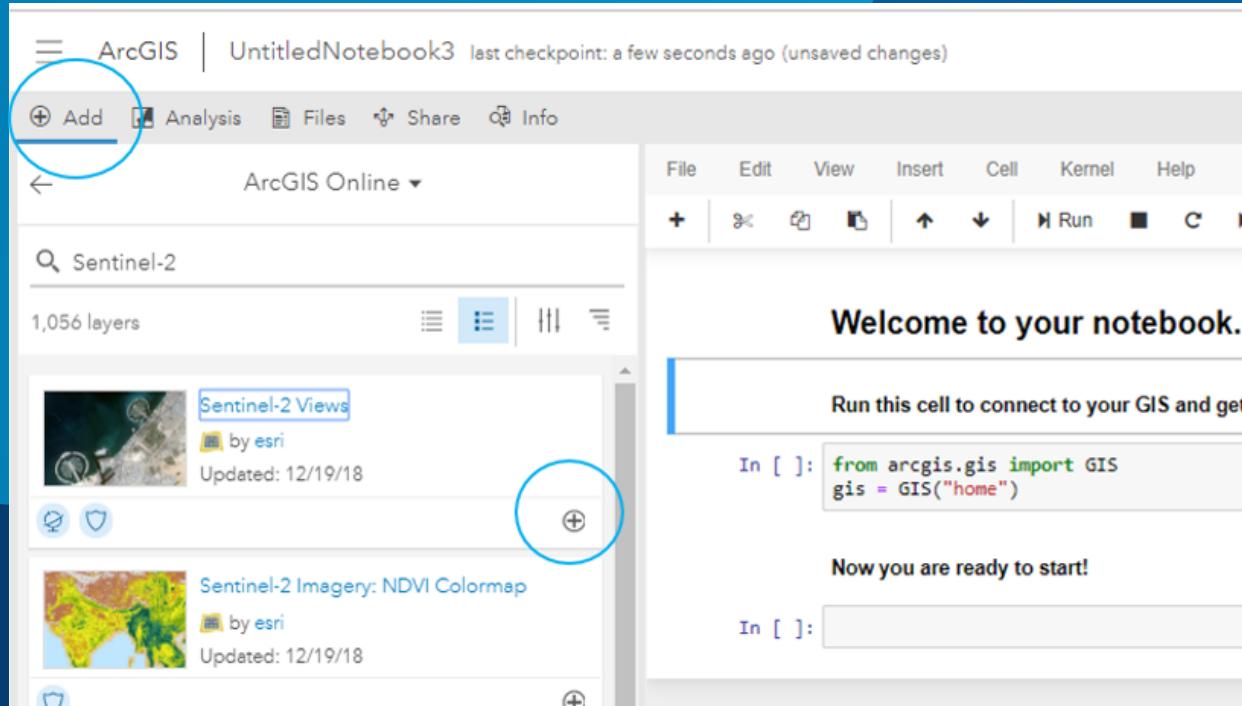
Difference  
map

# ArcGIS API für Python

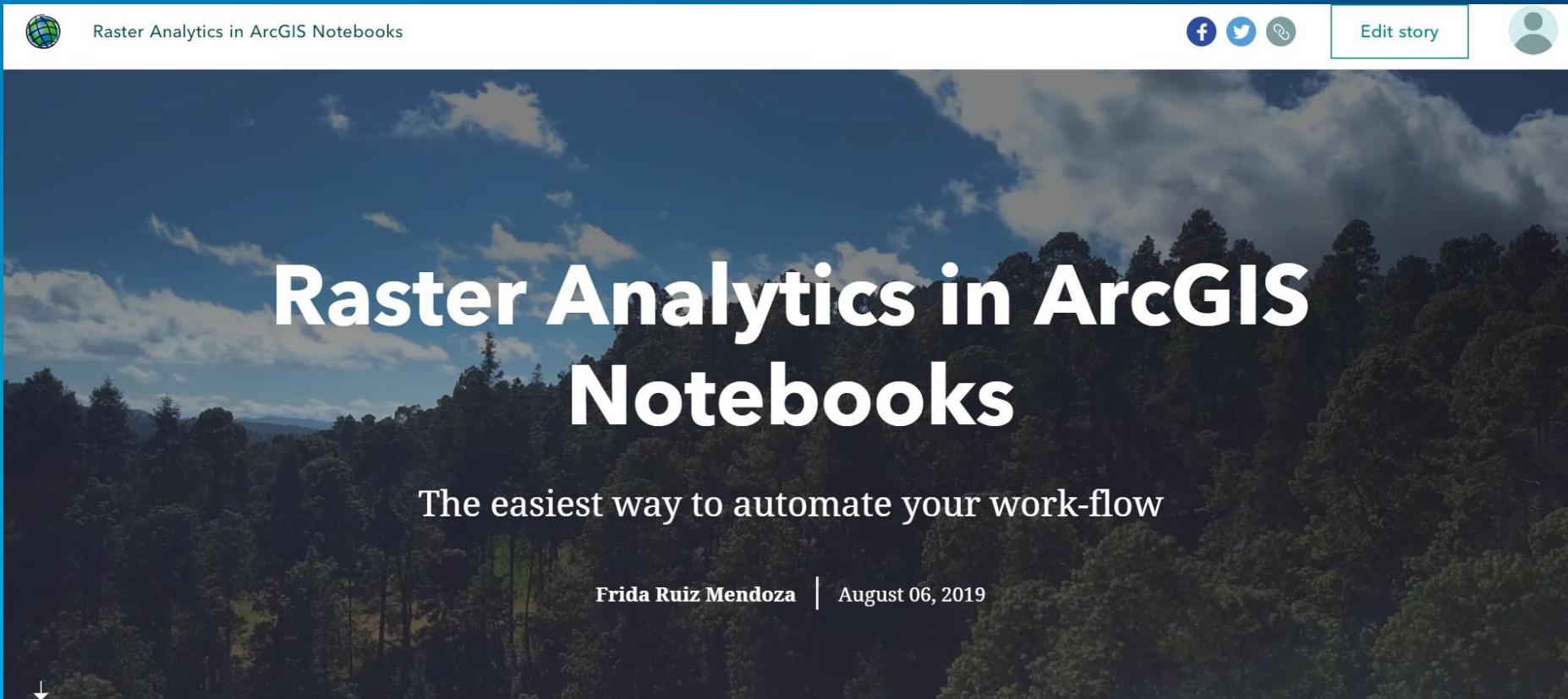


# Change Detection mit ArcGIS Notebooks

## Raster Analytics Demo



# Story Map



Raster Analytics in ArcGIS Notebooks

[Edit story](#)

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# Raster Analytics in ArcGIS Notebooks

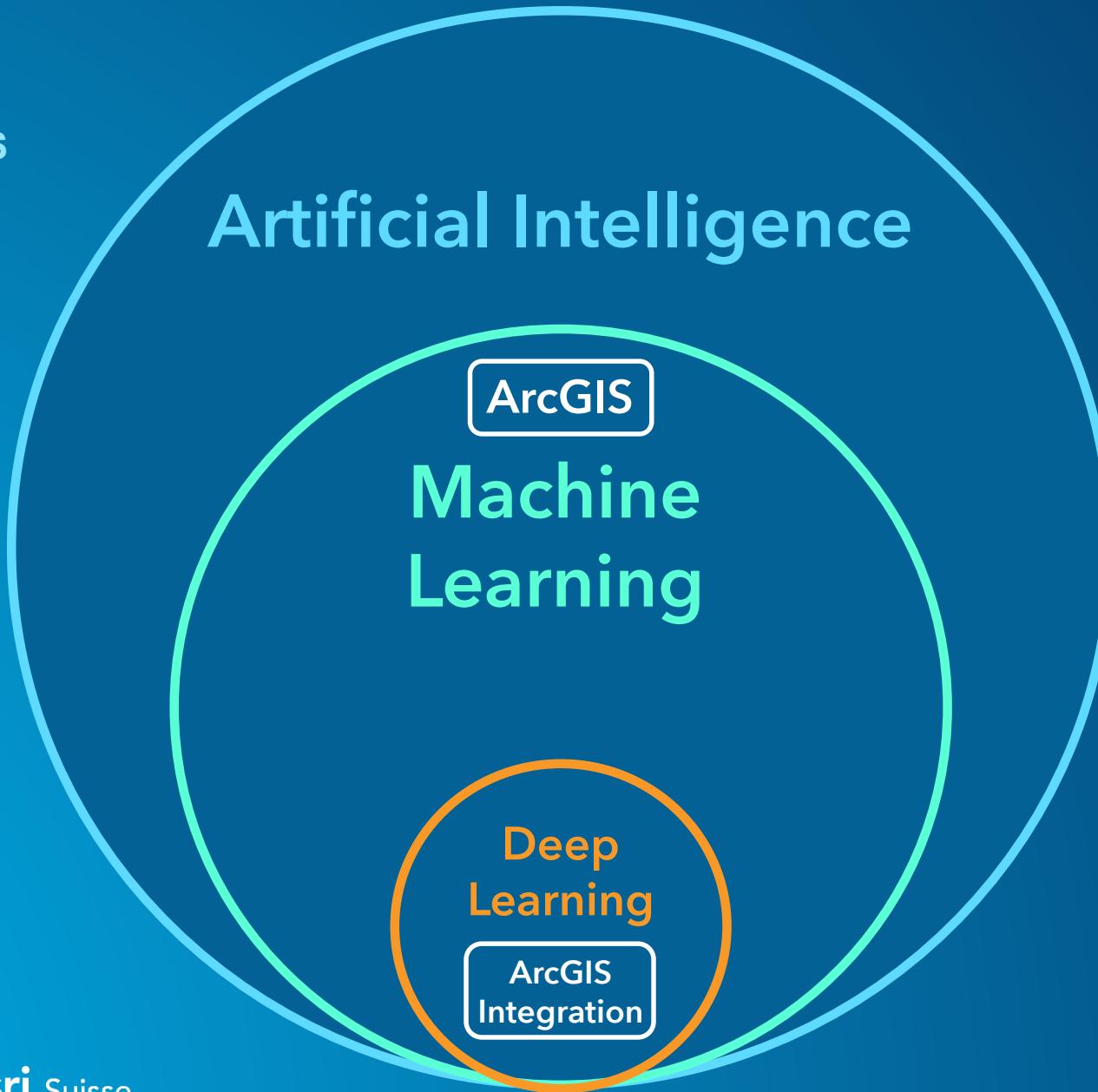
The easiest way to automate your work-flow

Frida Ruiz Mendoza | August 06, 2019

<https://storymaps.arcgis.com/stories/41ede17ec6754aae81ea87d072902535>

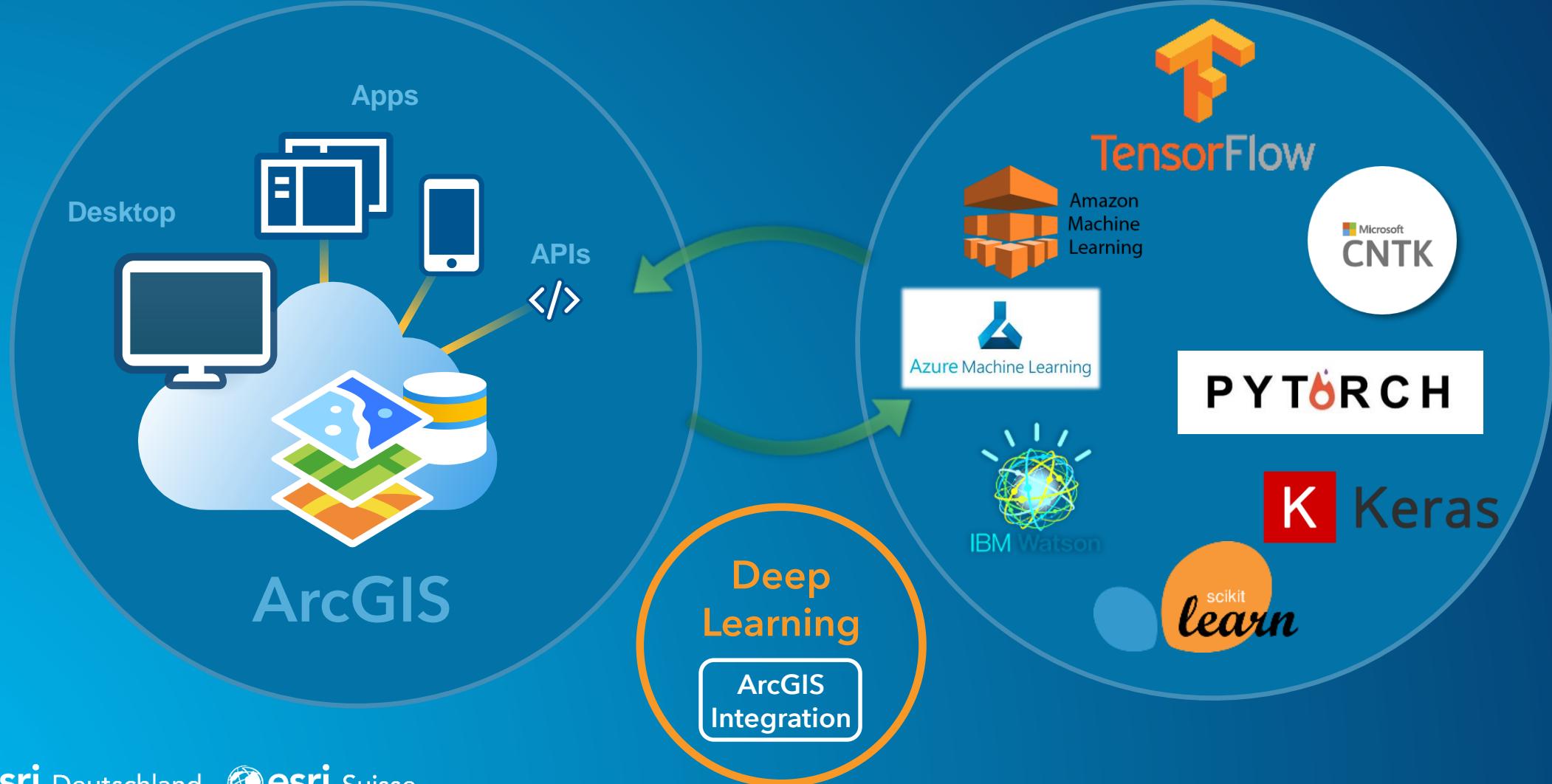
3

# Deep Learning für Imagery



# GeoAI

## Integration externer Frameworks



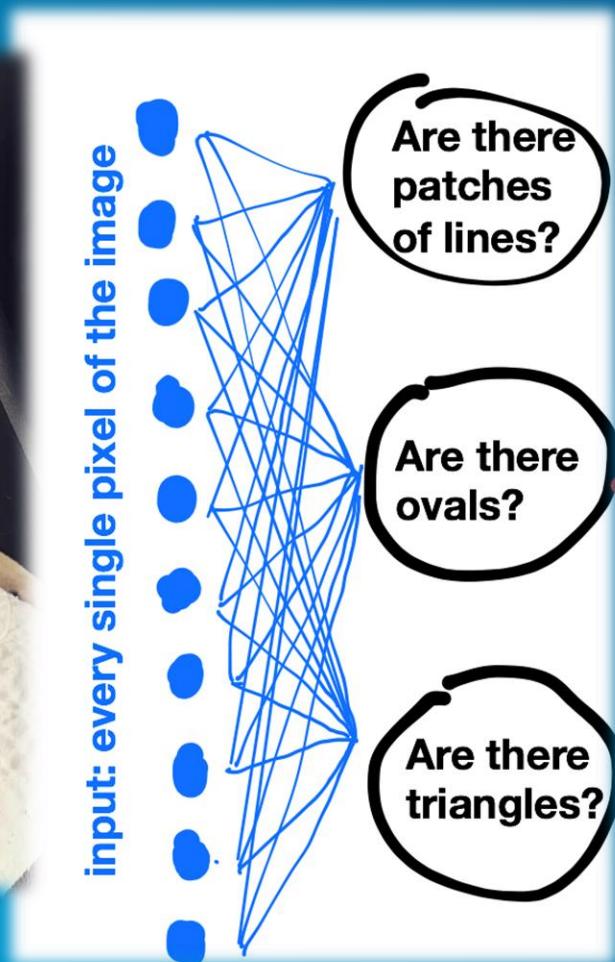
# Was ist Deep Learning?

Computer Vision



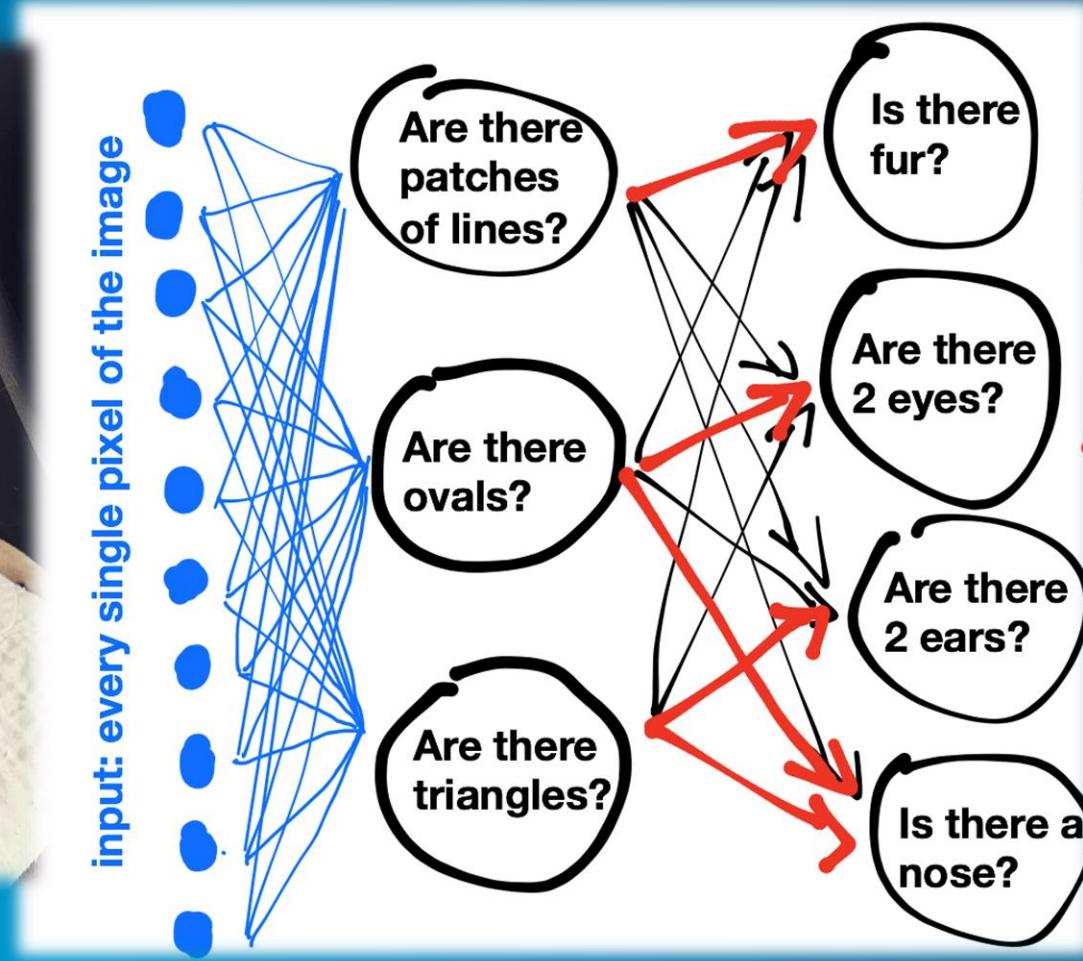
# Was ist Deep Learning?

Computer Vision



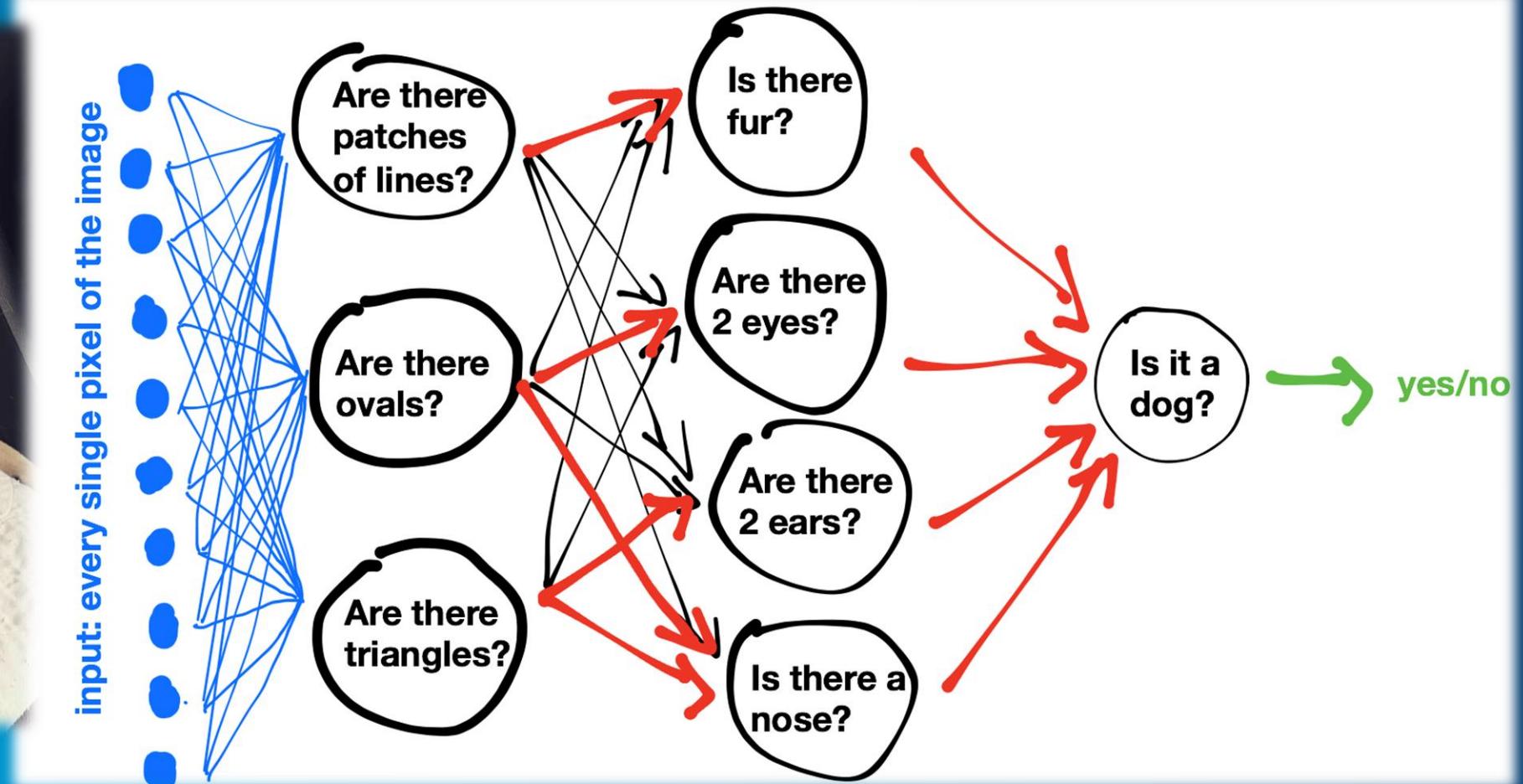
# Was ist Deep Learning?

## Computer Vision



# Was ist Deep Learning?

## Computer Vision



# Was ist Deep Learning?

## Adversarial images



<https://imgur.com/a/K4RWn>

# Deep Learning Anwendungen auf Imagery

# Computer Vision

# Image Classification



# Object Detection



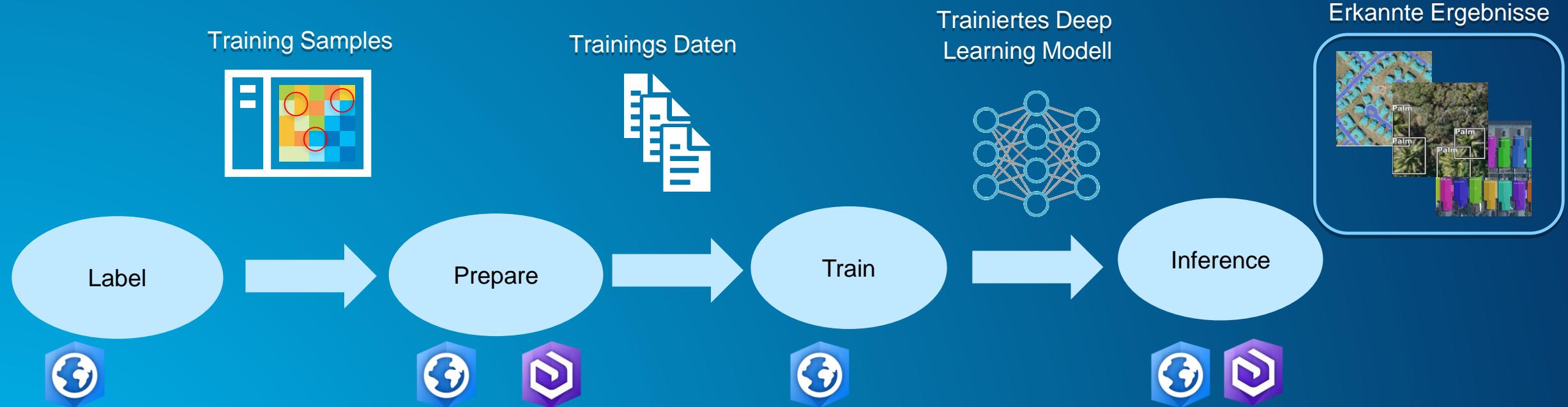
# Semantic Segmentation



# Instance Segmentation



# Deep Learning Workflow



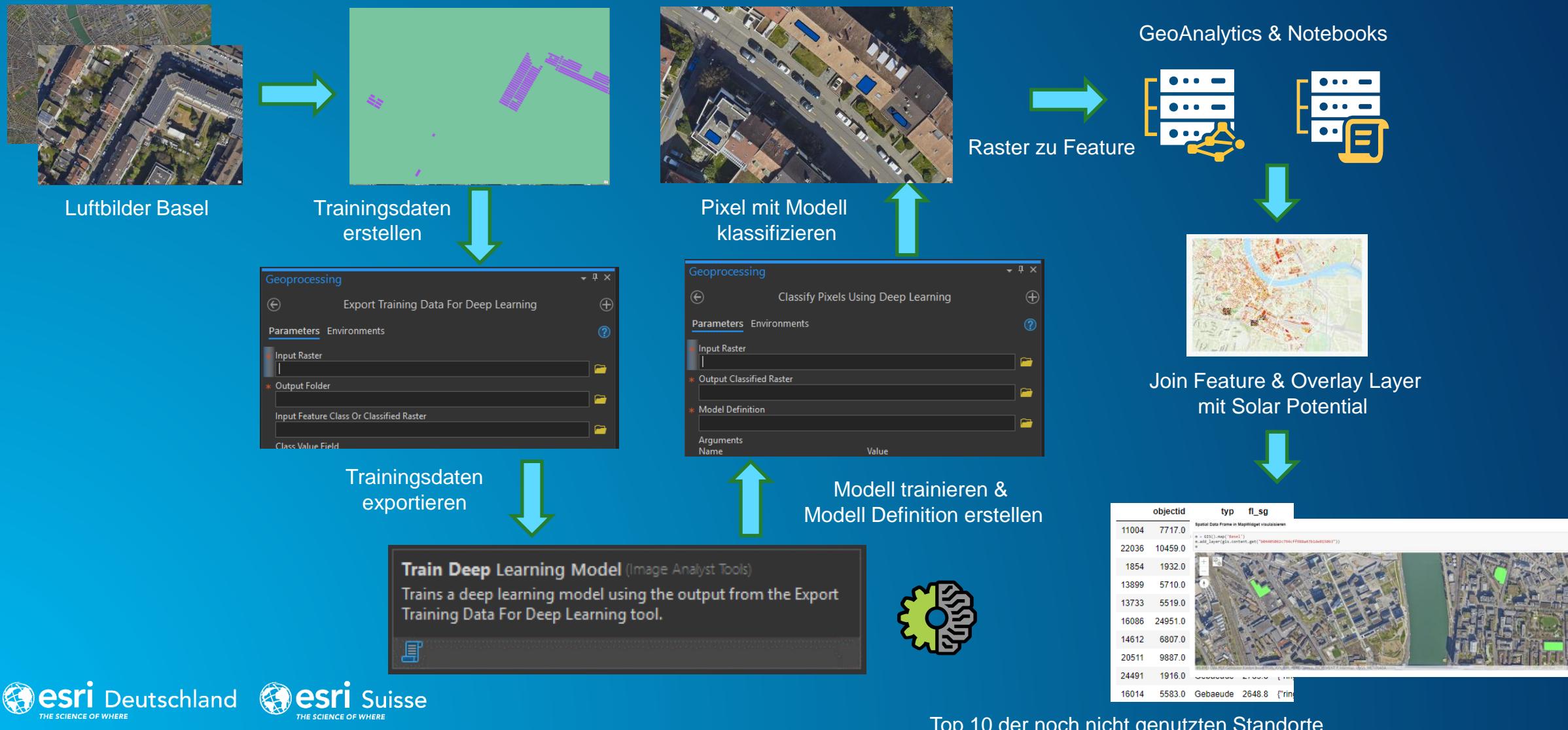


# Deep Learning in ArcGIS

Workflow in ArcGIS Pro + Analyse

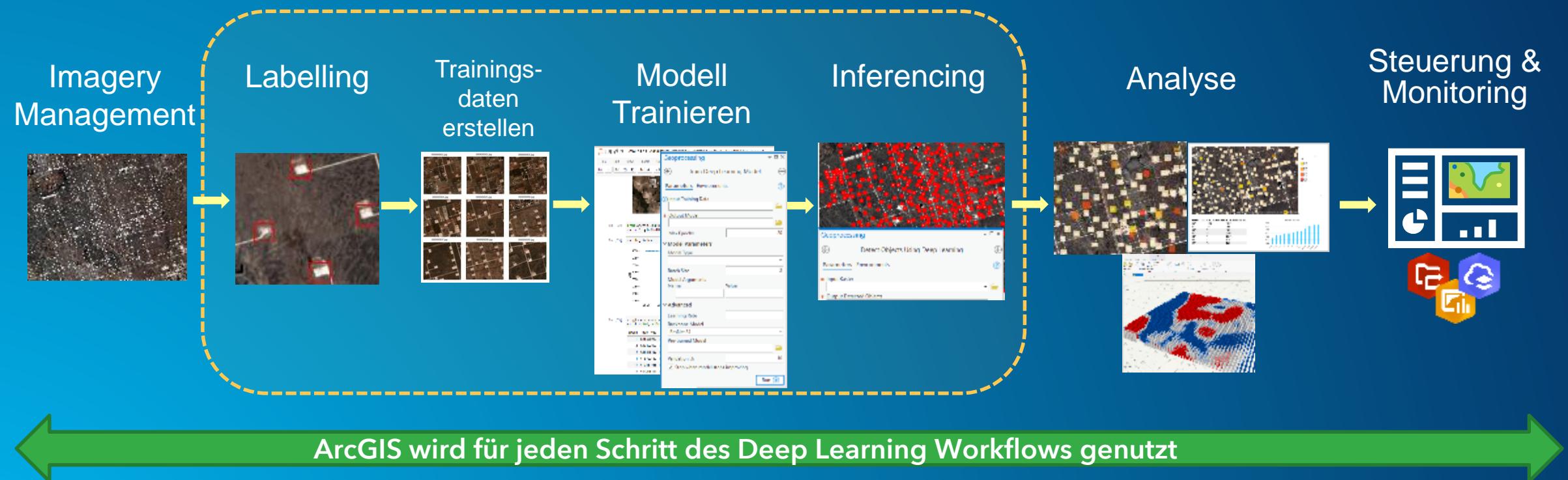
# Deep Learning in ArcGIS Demo

## Workflow



# Deep Learning Workflow in ArcGIS

End-to-end vom aufgenommenen Luftbild bis zum fertigen Informationsprodukt



SEE  
WHAT  
OTHERS  
CAN'T™



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