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Deep Learning in Forestry: Single Tree Detection

The Jurassic Bark: Single Tree Version

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The raw data:

Overview:

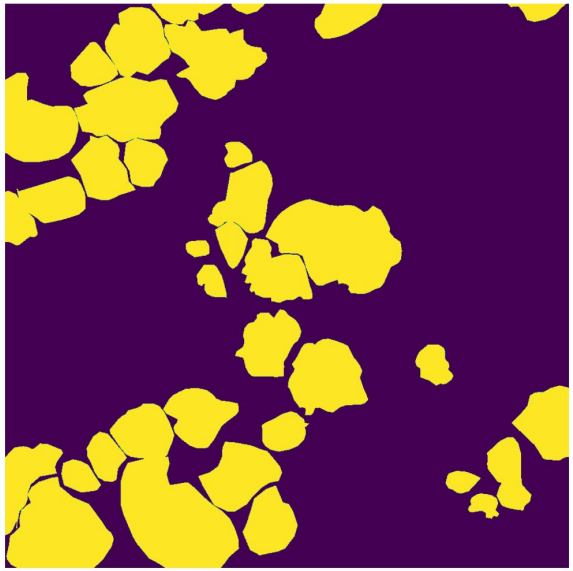
- Göttingen urban city landscape
- 38 plots + masks
- 4 bands (R, B, G and IR)
- Aerial image
- Spring 2018

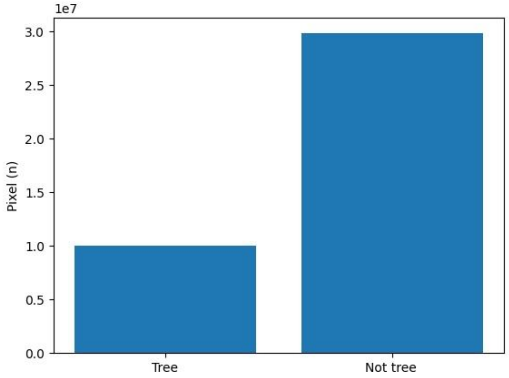
The raw data:

Closeup on the data:

Tile

Mask





- 1024*1024 pixels
- 1 pixel = 10 cm
- Pixel imbalance
- Small amount of data
- Augmentation necessary

Taking an overview:

<u>The infrared band:</u>

- band combination:
- exchange the red band into IR
- Tile 25
  - Band 4 (IR)
  - Band 2 (Green)
  - Band 3 (Blue)

Taking an overview:

Side by side comparison :

Original RGB Image

IrGB Image

Mask

Transforming the data:

Segmenting the mask:

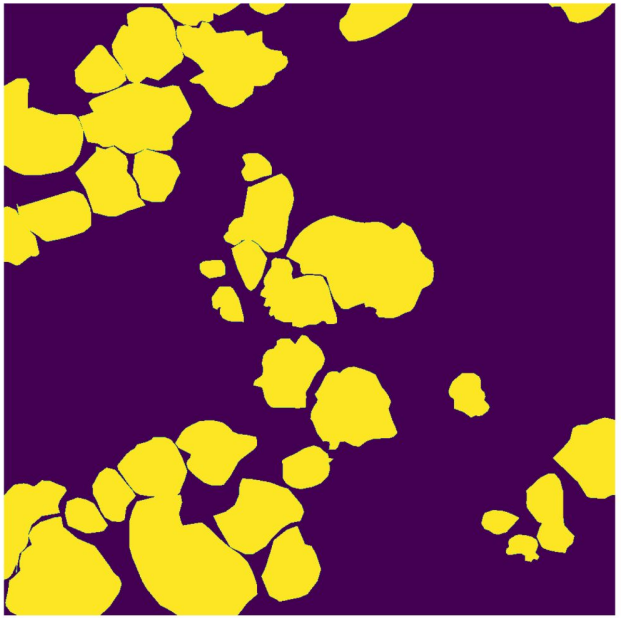
How to Separate the mask's trees ?

Using Scikit-Image :

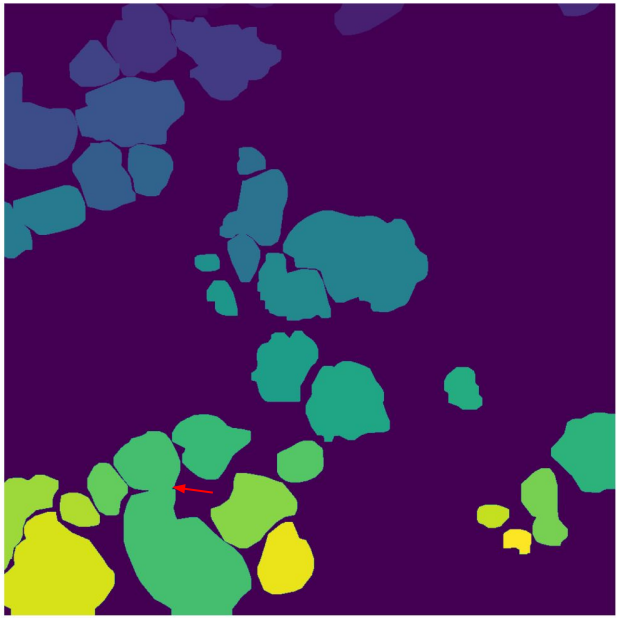
- Opening
- Erosion
- Labeling
- Revert the process

Improvements ?

Original



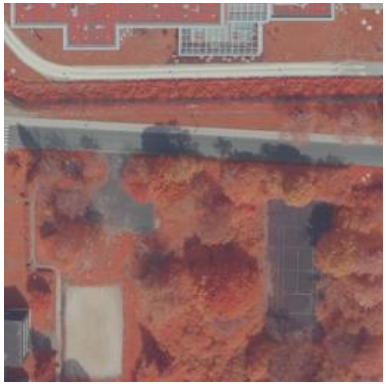
Modified



Transforming the data:

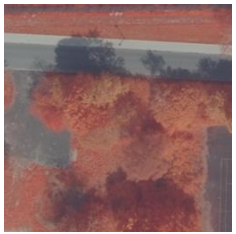
Data augmentation

38 images, 1024x1024

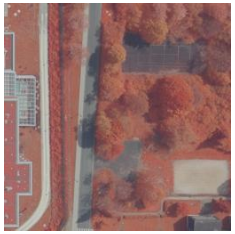


> 2500 images, 256x256

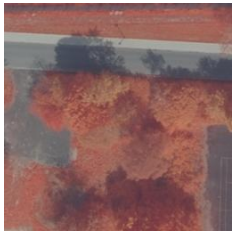
Flipping



Zoom In



Rotation (90°· k)



Combined

The Deep Learning Model:

MobileNetV2 pix2pix

Pre-trained model choice: U-net

- U-net common architecture for image segmentation
- Use pre-trained models as beginning weights
- Fine-tune the model to our task

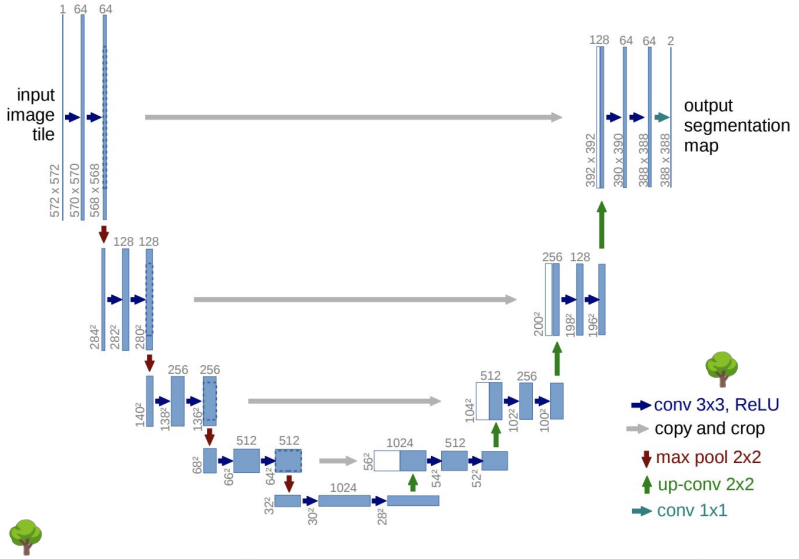
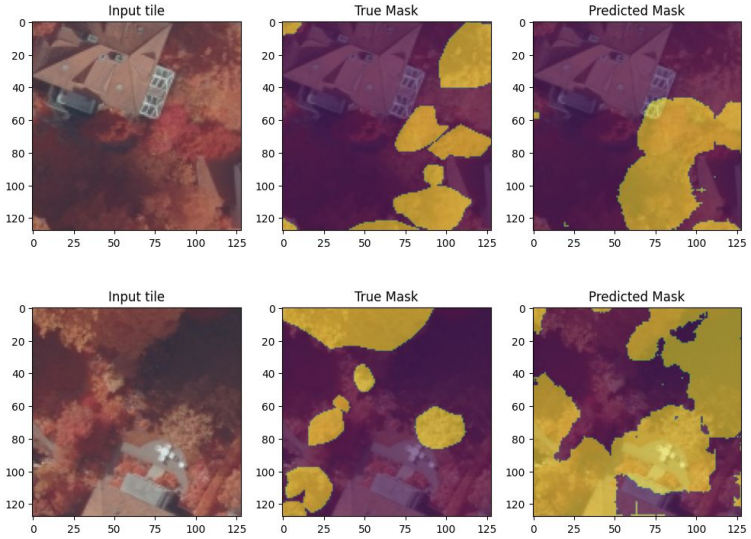
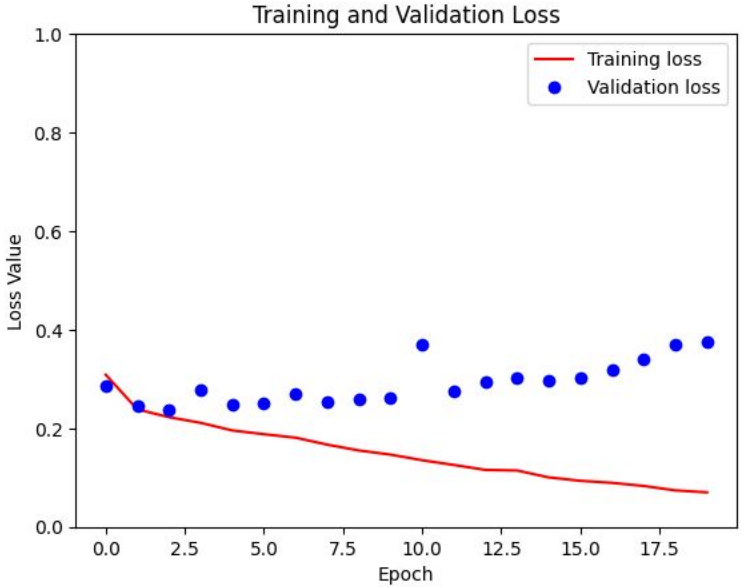


Fig. 1. U-net architecture (example for 32x32 pixels in the lowest resolution). Each blue box corresponds to a multi-channel feature map. The number of channels is denoted on top of the box. The x-y-size is provided at the lower left edge of the box. White boxes represent copied feature maps. The arrows denote the different operations.

The Deep Learning Model:

Pre-trained model choice: U-net



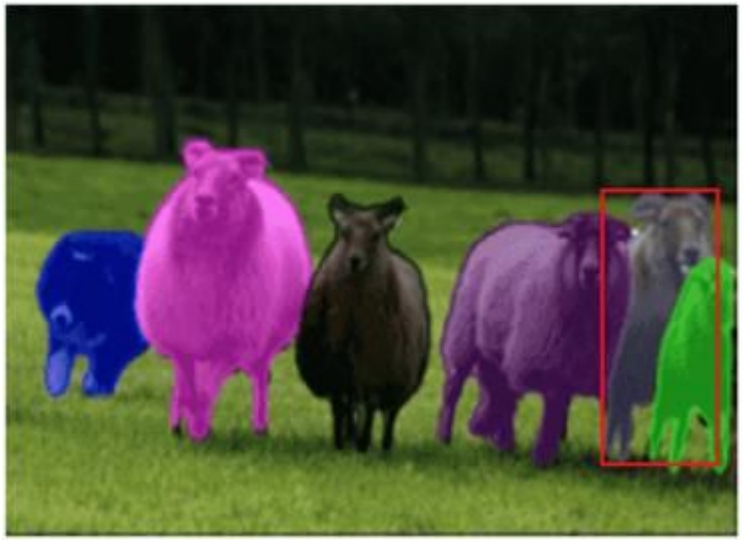


The Deep Learning Model:

Pre-trained model choice: YOLOv8

Pros:

- YOLO does instance based detection
- Processes the entire image in one pass
  - Fast (155 fps)
- YOLOv8 handles scale variations and other challenges more effectively
- Easy to train



Instance Segmentation

Future plans:

- Train and validate the model
- Apply the model on all of Göttingen
  - Check the labeling
  - Publish the dataset
- Potentially use it for other cities

Thanks for your Attention