Machine Learning for Agricultural Applications

Assignment 10

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Summer Term 2020

Release: 09.07.2020
Discussion: 16.07.2020

Weed Detection

In this task you will use a U-Net[1] to perform segmentation on the CWFID-dataset.[2]
Start with the code on
`https://github.com/totti0223/deep_learning_for_biologists_with_keras`.

Download the data with:
`wget https://github.com/cwfid/dataset/archive/v1.0.tar.gz`

Unpack the data with: `tar -zxf v1.0.tar.gz`

In the code of `totti0223`[3] a small version of the U-Net is used for 128 x 128 images.

1. **Train basic model** [15 points]
   Train the model on the provided training data set and evaluate its predictive accuracy on the provided test data set. Measure the overall accuracy (at the level of individual pixels in the output) and the precision and recall for each of the two classes.

2. **Improve model architecure** [15 points]
   Try to improve the predictive accuracy of the model by increasing the size of the U-Net model. For example, you could try to add layers or increase the number of filters in a layer.

3. **Data augmentation** [20 points]
   Try to improve the predictive accuracy of the model using data augmentation, by flipping and rotating images (and their corresponding segmentation labels!) in the training set.

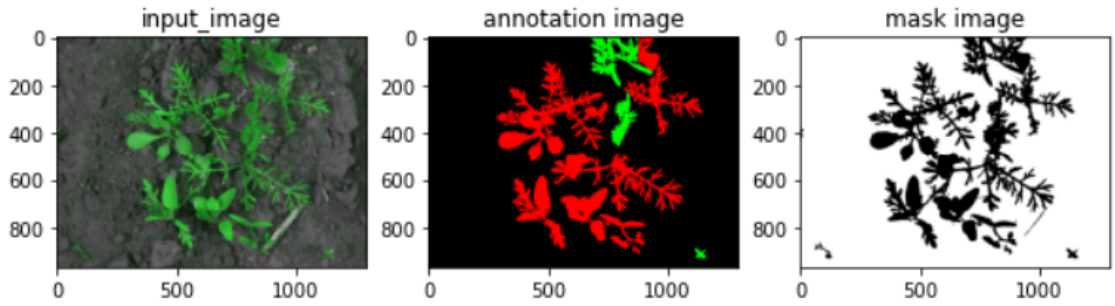

Figure 1: Sample of the CWFID dataset.

[1] U-Net: Convolutional Networks for Biomedical Image Segmentation. O. Ronneberger, P. Fischer and T. Brox. 2015, arXiv:1505.04597

[2] S. Haug and J. Ostermann. *A Crop/Weed Field Image Dataset for the Evaluation of Computer Vision Based Precision Agriculture Tasks*, 2015, Computer Vision - ECCV 2014 Workshops, `http://dx.doi.org/10.1007/978-3-319-16220-1_8` , p 105–116

[3] Yosuke Toda, researcher at Nagoya University / Agri-Heir Co., Ltd.

$$\text{Accuracy} = \frac{TP + TN}{ALL}, \quad ALL = TP + FP + TN + FN$$
$$\text{Precision} = \frac{TP}{TP + FP}$$
$$\text{Recall} = \frac{TP}{TP + FN}$$

Yaml-test-dataset contains number 28, which is already contained in the train-dataset! Delete... Also test-dataset is very large, check how 50-10-train-test-split works.

1. `ex10_1.py, (WS003)`. Validation accuracy 97.07%
2. `ex10_2.py, (WS003)`. Figuresize doubled and filter number doubled. Validation accuracy 97.48%
3. `ex10_3.py, (WS003)`. Changed direction and file structure, changed data read, implemented data augmentation with numpy, only rotation and implicit shrinking. With 9 augmented images per train image, validation accuracy 97.81%