**Data AND EVALUATION description**

LEAF SEGMENTATION CHALLENGE (LSC)

# COMPUTER VISION PROBLEMS IN PLANT PHENOTYPING (CVPPP) at eccv 2014

**Zurich, September, 2014, in conjunction with ECCV 2014 (**[**http://eccv2014.org/**](http://eccv2014.org/)**)**

http://www.plant-phenotyping.org/CVPPP2014-challenge

**1. Introduction**

Data provided here was used as training data for the Leaf Segmentation Challenge component of the CVPPP workshop.

This document provides also important information on how the testing and evaluation occurred. The Matlab code provided with the data was used for this evaluation, and can also be used to conveniently evaluate results on the training data.

Details on the data, plants shown, setup etc. can be found in the following report:

*Hanno Scharr, Massimo Minervini, Sotirios A. Tsaftaris. Annotated Image Datasets of Rosette Plants. Technical Report. No. FZJ-2014-03837, Forschungszentrum Jülich, 2014*

Using the data for scientific publications is allowed, given that citations to the following are provided:

*Hanno Scharr, Massimo Minervini, Sotirios A. Tsaftaris. Annotated Image Datasets of Rosette Plants. Technical Report. No. FZJ-2014-03837, Forschungszentrum Jülich, 2014*

*Massimo Minervini, Mohammed M. Abdelsamea, Sotirios A. Tsaftaris, Image-based plant phenotyping with incremental learning and active contours, Ecological Informatics, Available online 6 August 2013, ISSN 1574-9541, http://dx.doi.org/10.1016/j.ecoinf.2013.07.004.*

The technical report describes the data acquisition, plant material, and environmental conditions in detail. The paper by Minervini et al. documents the first experiment of the dataset.

**2. The data set**

The provided zipped archive contains three folders (A1, A2, A3). Each of these folders contains raw color images of plants, in the following convention:

*plantXXX\_rgb.png* 🡺 the raw color image in RGB  
*plantXXX\_label.png* 🡺 the corresponding label image (8bit with color map)  
  
where XXX is an integer number. Note that plants are not numbered continuously.

Overall, A1, A2 and A3 contain 128, 31, and 27 RGB images and the same number of label images respectively. These images were used as training data set for LSC. The testing data set has the same folder structure, where A1, A2 and A3 contain 33, 9, and 56 RGB images respectively, but no ground truth.

**3. Evaluation Function**

Evaluation functions (in MATLAB) allow comparing segmentation outcomes between ground truth and algorithm results. The function uses the DICE function to evaluate segmentation results. It returns the following:

**Table 1.** Reported values of the evaluation functions

|  |  |
| --- | --- |
| **Function name** | **Purpose** |
| *BestDice*: Average DICE among all objects (leaves) | to estimate average leaf segmentation accuracy |
| *FGBGDice*: DICE on the foreground mask (ie., the whole plant assuming the union of all labels different than background) | to estimate how good the algorithm identifies plant from background |
| *DiffFGLabels*: Returns the difference in object count, as number of leaves in ground truth minus the algorithms results | to estimate how good the algorithm is in identifying the correct number of leaves present |
| *AbsDiffFGLabels*: absolute value of *DiffFGLabels* | to estimate how good the algorithm is in identifying the correct number of leaves present |

The main function ‘LSC\_Evaluation(inpath, gtpath)’ takes two folder names as arguments:

* inpath: folder name, where subfolders for each experiment run (or participant in the case of LSC) can be found. Subfolder names are used as unique identifier for each set of results.
* gtpath: folder name, where ground truth files can be found. Subfolders are assumed to be named 'A1', 'A2', and 'A3'

Results should be stored in a folder in ‘inpath’ containing the **same folder structure** as the testing dataset but **includes only** the results of your algorithms, with filenames as:

*plantXXX\_label.png* 🡺 the labeled image as compressed indexed PNG file.

‘gtpath’ also needs to contain the same folder structure and only the ground truth label images as png-files.

**Attention**: Folder structure and image numbering must **NOT** change, as this will result in a naming mismatch error and results will not reported for such mismatches filenames.

The evaluation code creates comma separated value (csv) tables containing the above mentioned performance values on a per image basis for each subfolder ‘A1’, ‘A2’, and ‘A3’ separately as well as for all folders together. In addition a LaTeX file containing a summary table is created for convenient integration in publications, similar to the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **BestDice (%)** | **FGBGDice  (%)** | **AbsDiffFGLabels** | **DiffFGLabels** |
| **A1** | 81.6 (±7.5) | 98 (±2.5) | 1.5 (±1) | -1.5 (±0.5) |
| **A2** | 81.2 (±7.5) | 98 (±2.5) | 1.5 (±1) | -1.5 (±0.5) |
| **A3** | 71.6 (±7.5) | 98 (±2.5) | 1.5 (±1) | -1.5 (±0.5) |
| **all** | 81.6 (±7.5) | 98 (±2.5) | 1.5 (±1) | -1.5 (±0.5) |

**3. Acknowledgements**

Data labeling was performed by:  
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