INTRODUCTION TO IMAGE PROCESSING AND COMPUTER VISION

LABORATORY PROJECT 1 (LABORATORIES 1 & 2)

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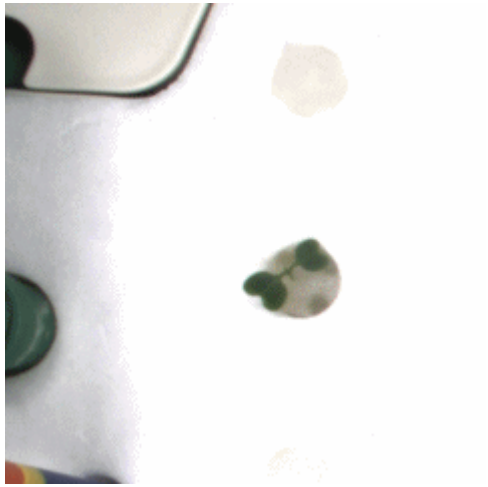
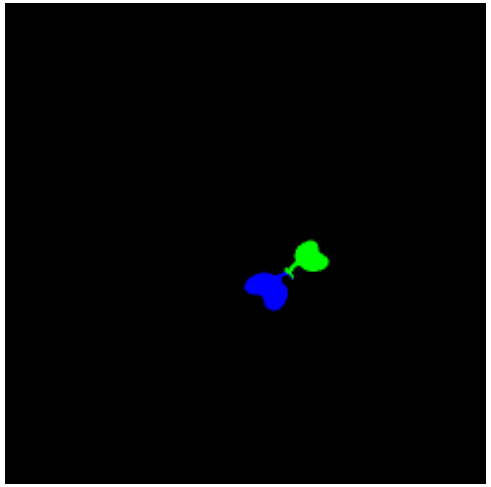
REALIZATION

- algorithms elaborated with OpenCV library
  - OpenCV (C++)
  - SimleCV/OpenCV (Python)
  - EmugCV (C#)
- solution for the laboratory task should contain:
  - source code with description (GUI is not obligatory)
  - folder containing segmentation results (prediction masks)
  - documentation (description of solution, testing procedure, results and comments)
- solution should be send up to 17.12.2019

PLANT SEGMENTATION AND LABELING

- input: images of plants (during growing process)
- KOMATSUNA dataset for instance segmentation, tracking and reconstruction - **Multi-view dataset**
- 900 images of plants (3 cameras each observing 5 plants and making photos every 4 hours by 10 days)
- 15 separate plants together with masks/labels of individual leaves



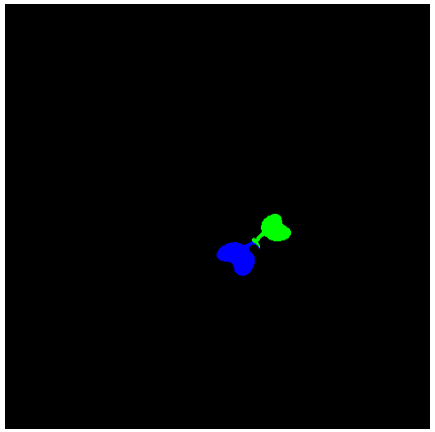


http://limu.ait.kyushu-u.ac.jp/~agri/komatsuna/

PLANT SEGMENTATION AND LABELING

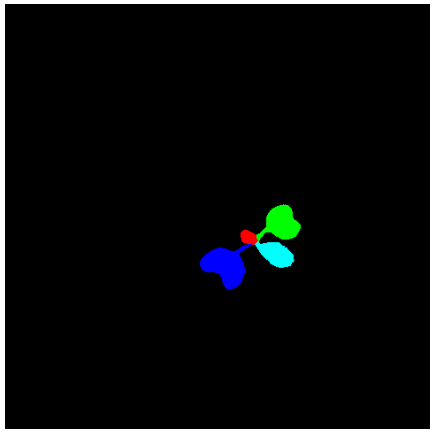
- input: images of plants (during growing process)
- KOMATSUNA dataset for instance segmentation, tracking and reconstruction **- Multi-view dataset**

rgb_00_00_000_00



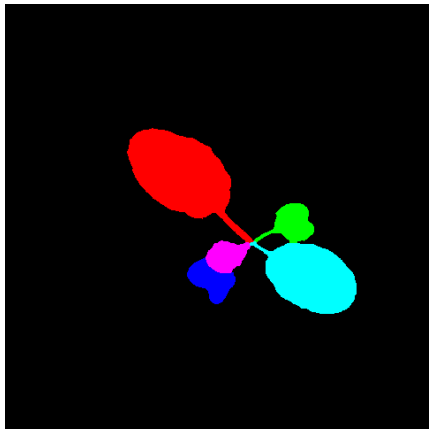
label_00_00_000_00

rgb_00_00_002_00



label_00_00_002_00

rgb_00_00_006_00



label_00_00_006_00

PLANT SEGMENTATION AND LABELING

- input: images of plants (during growing process)
- KOMATSUNA dataset for instance segmentation, tracking and reconstruction - **Multi-view dataset**

- Naming rules of images
  - Parameters
    - AA: camera ID from 00 to 02
    - BB: plant ID from 00 to 04
    - CCC: day ID from 000 to 009
    - DD: time ID from 00 to 05
    - EEE: capture number

      Note that one day starts at 3 p.m. and ends at 3 p.m. next day, and images are captured every 4 hours in one day.
  - File names
    - original images: rgb_AA_CCC_DD.png
    - plant images: rgb_AA_BB_CCC_DD.png
    - label images: label_AA_BB_CCC_DD.png
    - images for calibration : AA_EEE.png for geometric camera calibration and AA.png for color calibration if necessary

- Images
  - original images: RGB images from each camera
  - plant images: images containing one plant
  - label images: images containing manually assigned labels for leaves in plant images
  - images for calibration: images containing a chessboard and a color checker

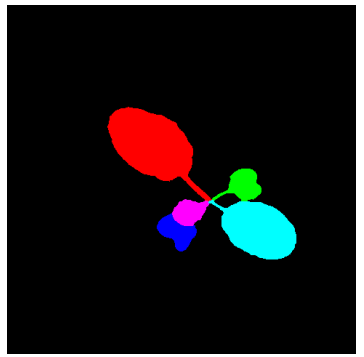
- Leaf colors in label images

  Leaf colors in plant images are common and determined from the oldest as follows.

From oldest	R	G	B
1	0	0	255
2	0	255	0
3	0	255	255
4	255	0	0
5	255	0	255
6	255	255	0
7	128	128	128
8	0	0	128

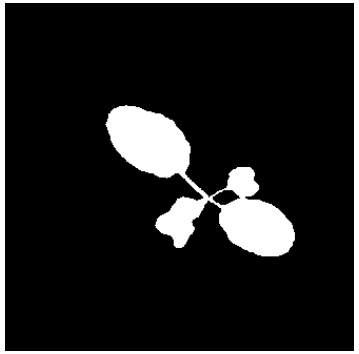
PLANT SEGMENTATION AND LABELING

- output: segmented plants (segmentation masks and bounding boxes optionally)
- binary segmentation (color multiclass masks need to be converted to binary masks)
- assessment according to Intersection over Union metric (IoU, also referred to as the Jaccard index) and Dice coefficient
- mean results for whole data set and per individual plant

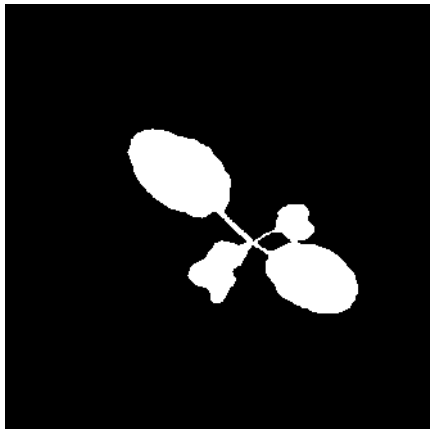


Ground truth
– labels for leaves

Ground truth (A, target)
– binary mask



Original image



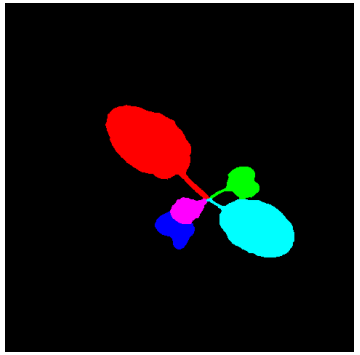
Segmentation result (B, prediction)
– binary mask

Segmentation result
– bounding box

$$IoU = \frac{target \cap prediction}{target \cup prediction}$$

$$Dice = \frac{2\,|A \cap B|}{|A| + |B|}$$

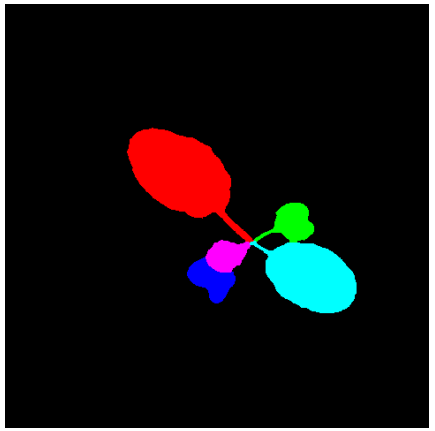
PLANT SEGMENTATION AND LABELING



Ground truth (targets) – labels for leaves

- output: segmented leavs (segmentation masks)
- multiclass segmentation (color multiclass masks)
- assessment according to Intersection over Union metric (IoU, also referred to as the Jaccard index) and Dice coefficient
- mean results for whole data set, per individual plant and per indicidual leaf in plant

Original image



Segmentation result (predictions) – each color is separate a mask

$$IoU = \frac{target \cap prediction}{target \cup prediction}$$

$$Dice = \frac{2\,|A \cap B|}{|A| + |B|}$$