Adaption to new growing conditions

BGU , computer vision group

Abstract

This presentation summarizes the parameters adjustment required for developing the fruit detection modules. Proper values for these parameters will result in a more accurate and faster detection.

Fruit detection and localization modules using ROS code includes sweet peppers, apples and grapes from both platform sensors and gripper sensors.

Fruit detection : platform

- There are several parameters that affect the process of fruit detection and supplying the proper values for these parameters will result in a more accurate and faster detection.
- The parameters control these aspects are:

1. Detect red-only or red and green fruit
2. Use pruning methods (or not)
3. Define working distance from robot

- The next slide lists the different parameters and the slide after that explains how to choose the appropriate values.

Fruit detection – Parameters

- has_registration: Set to 1 to work with registered images and to 0 for depth only.
- svm_model: Set to pepperModel.txt or appleModel.txt according to the crop type
- min_z and max_z: These parameters have a great effect in terms of speed and detections results. When the distance from the foliage and its width are known (even roughly), set min_z to the distance from the camera to beginning for the foliage and max_z to the distance from the camera to the end of the foliage.

Fruit detection – Parameters

- params_file: Path to internal parameter file. File options:

1. paramsAllPeppers_noPruning.txt : Detect peppers of all colors, do not use pruning.
2. paramsAllPeppers_withPruning.txt : Detect peppers of all colors, use pruning based on highlights.
3. paramsRedPeppers_withPruning.txt : Detect red peppers, use pruning based on the fruit redness.
4. paramsAllApples_noPruning.txt : Detect apples of all colors, do not use pruning.
5. paramsAllApples_withPruning.txt : Detect apples of all colors, use pruning based on highlights.
6. paramsRedApples_withPruning.txt : Detect red apples, use pruning based on the fruit redness.

Fruit detection – Clarifications

- pruning algorithms are designed according to the supplied dataset WUR200. Therefore, new images should be taken in the same setting for best results.
- min_z and max_z: Measuring foliage distances accurately is not needed. Just make a coarse measurement and define min_z to be slightly less than the measurement and max_z to be slightly more.

Fruit detection – Clarifications

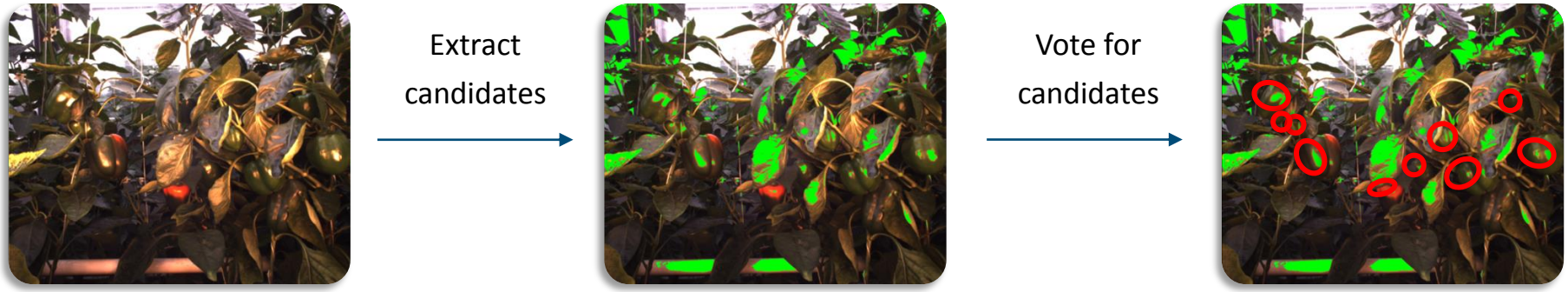
Params_file Selection strategy:

1. Choose one from either 1-3 or 4-6 according to crop type.
2. When working with red fruit, choose 3 or 6. If red fruit is not detected switch to work with 1 or 4 (3 and 6 are better and faster as long as the fruit is red)
3. When working with non-red fruit, choose 2 or 5. If the fruit is not detected switch to work with 1 or 4 (2 and 5 are better and faster when fruit have highlights. This depends on the chosen lighting conditions).

Highlight detection with application to sweet pepper localization

The algorithm is based on two components:

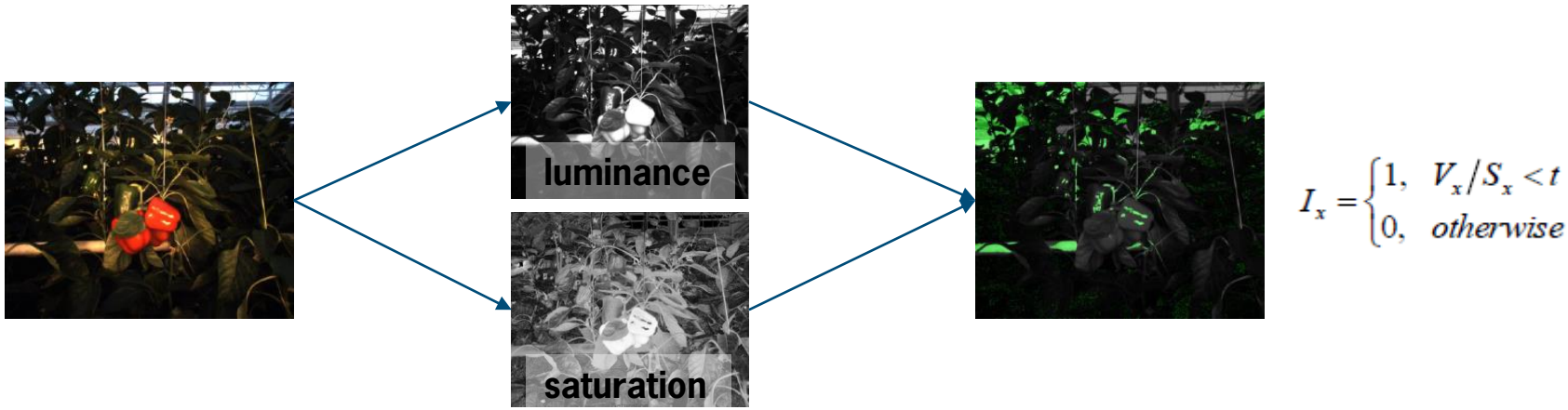
1. Detection of candidate highlights (based on luminance & saturation).
2. Voting for candidates according to a model of specular highlight.



Highlight detection with application to sweet pepper localization

1. Extraction of candidate highlights:

Based on luminance saturation values that characterize highlights.

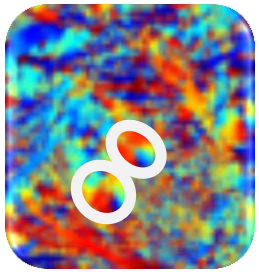


Luminance and saturation thresholds require adjustment to achieve best output.

Highlight detection with application to sweet pepper localization

2. Voting for extracted candidates:

based on detecting unique pinwheel signatures of highlights.



- **The model**: concentric circles (C_1, C_2, … C_n) of increasing radii, encoding the expected orientation values.
- Voting is done based on:
  - Td = The agreement for a single orientation value.
  - Tc = The agreement percentage per circle in the model.
  - Th = Required number of “agreement” circles.
- All three parameters require adjustment:
  - To adapt to new illumination conditions.
  - In order to detect highlights at different expected sizes.

SEVENTH FRAMEWORK PROGRAMME

CROPBS

Fruit detection : gripper

- There are several parameters that affect the process of fruit detection and supplying the proper values for these parameters will result in a more accurate and faster detection.
- The parameters control these aspects are:

1. Luminance thresholds
2. Model size

Fruit detection : gripper

- **Luminance thresholds**

Current defult Luminance threshold is based on FestoGH100 and CSIC9 datasets, for

thresholds adjustment change the **Luminance** parameter.

- **Model size**

Current defult Model size is based on FestoGH100 and CSIC9 datasets, for adjustment change the **Model size** parameter according to the new data set avarege fruit size according to the working distance from robot

Grape detection paramaters

- The Grape detection algorithm isolates grape bunches by detecting and grouping individual grapes.
- Grape detection parameters include:
  - Expected Grape Radius
    - To be determined based on grape size and platform distance
  - Grape Color Range
    - Should match the target crop, this parameter has a very high tolerance and can include a wide range of colors. Adjustment is necessary to distinguish blue grapes from red grapes, for example.
  - Valid luminance values
    - Should match expected lighting conditions at the deployment site. High/Low luminance areas are ignored. This parameter has a very high tolerance and will not need adjustment in most cases.