Exploitation d'images acquises par drone pour la caractérisation de la structure des rangs de vigne.

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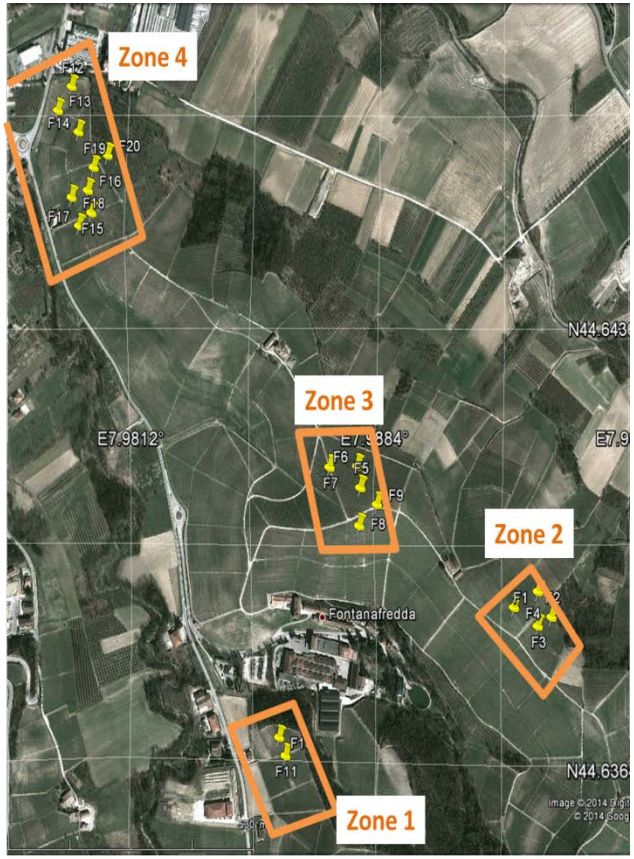
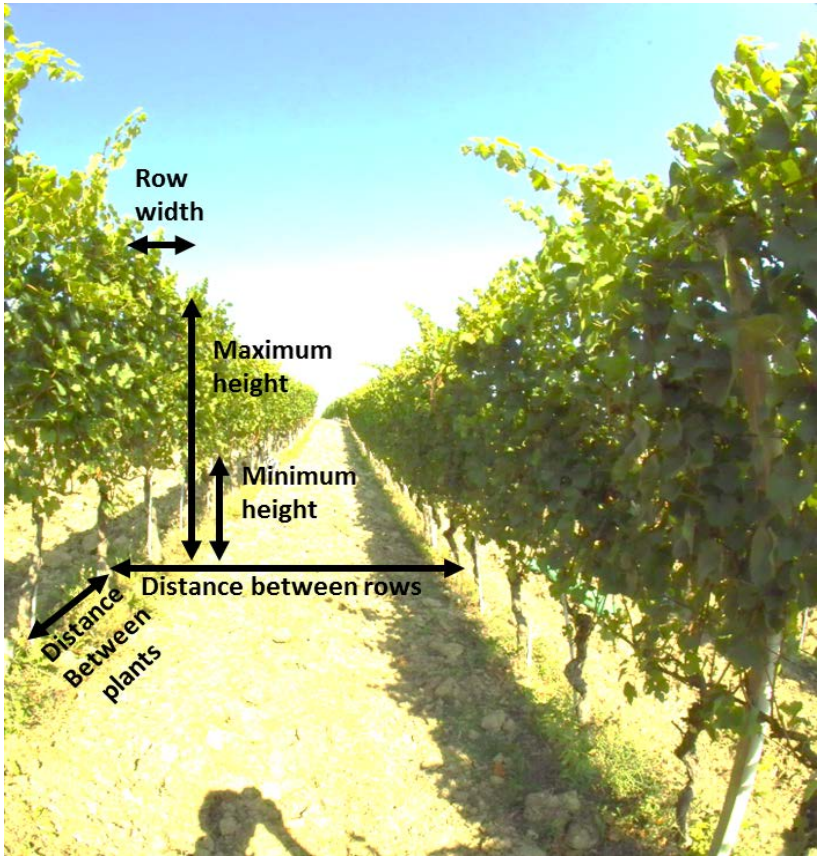
Objectives

- Develop decision making tools within VINTAGE

- Row structure mandatory for:
  - Some technical practices (pruning)
  - Compute the radiation absorption efficiency
  - Use to interprete remote sensing images @decametric resolution

The experiment





THE UAV and the sensor

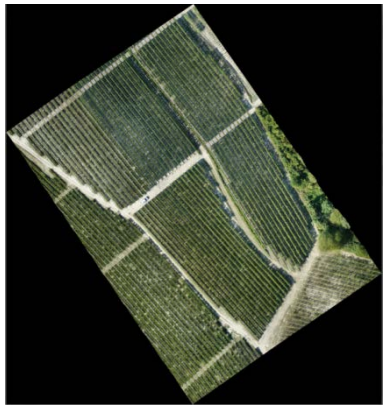
Fixed wing
2 kg mass total
2.0 m wing span
10 minutes autonomy

12 million pixels with a focal length of 14 mm and a pixel size of 4.32 µm

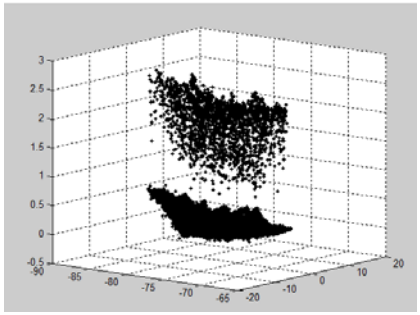
Data processing

Series of images with overlap

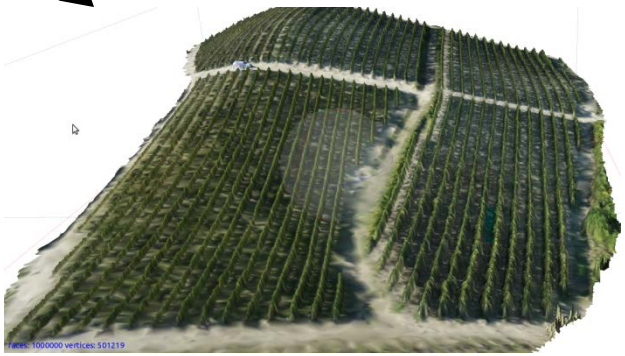
Agisoft Photoscan



mosaic

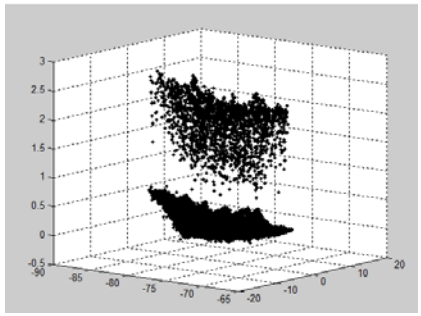


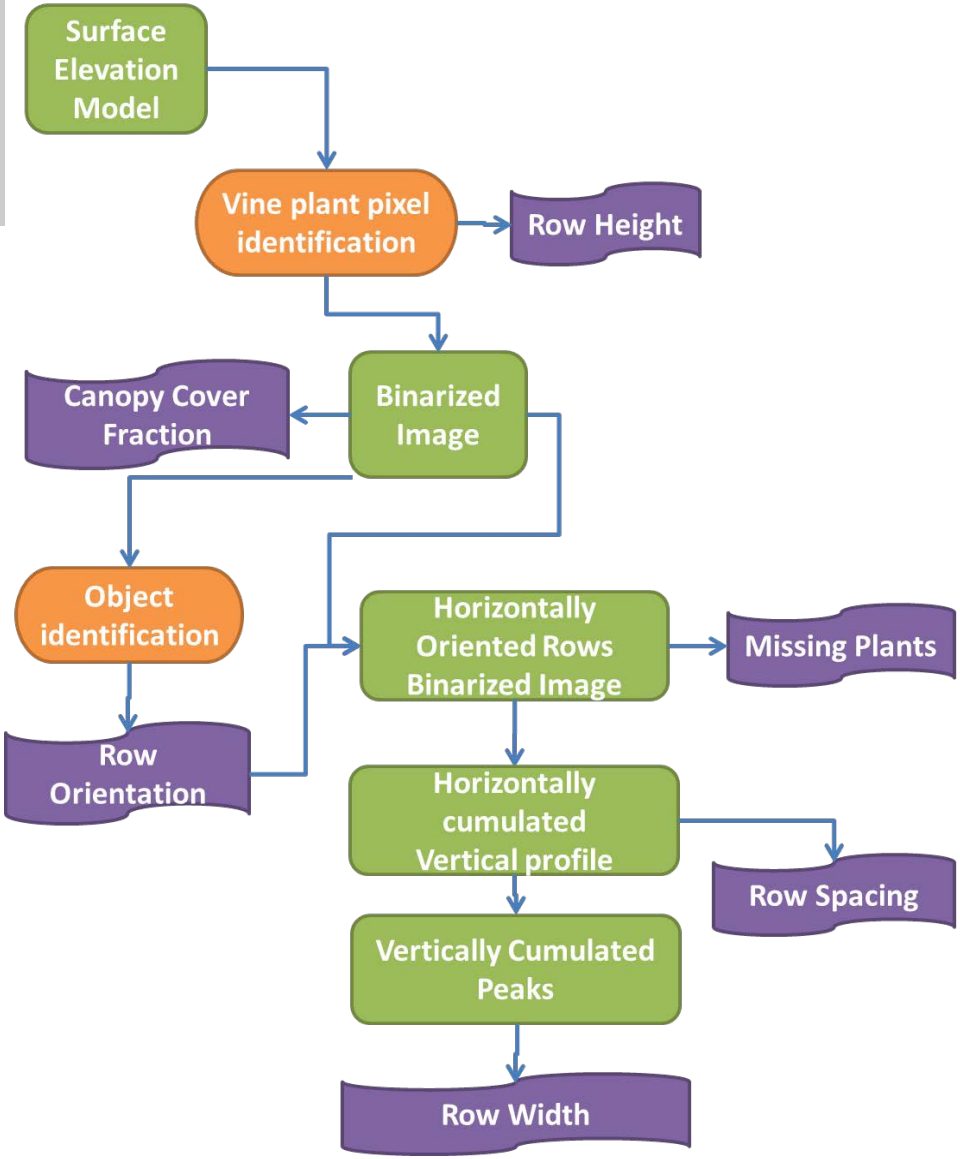
3D point cloud



3D mesh

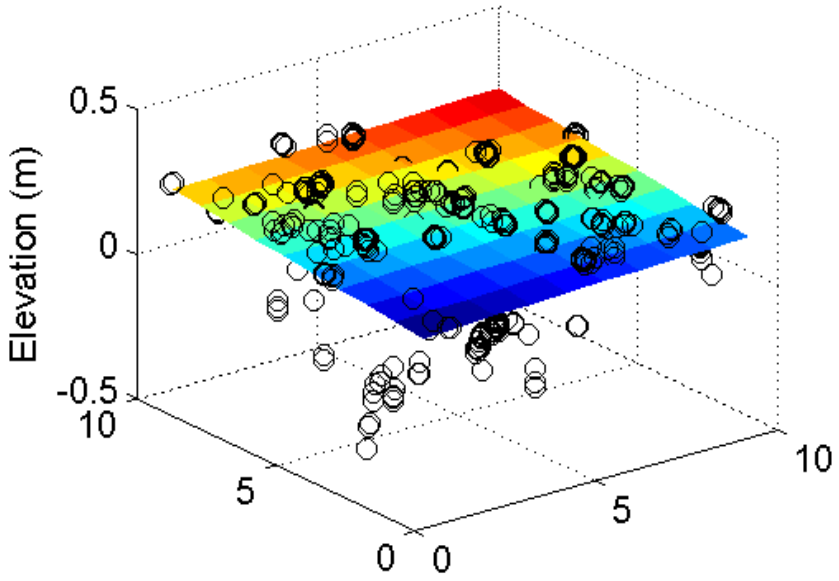
Method




Surface Elevation Model
Vine plant pixel identification
Row Height
Canopy Cover Fraction
Binarized Image
Object identification
Horizontally Oriented Rows Binarized Image
Missing Plants
Row Orientation
Horizontally cumulated Vertical profile
Row Spacing
Vertically Cumulated Peaks
Row Width

Defining the reference level (soil)

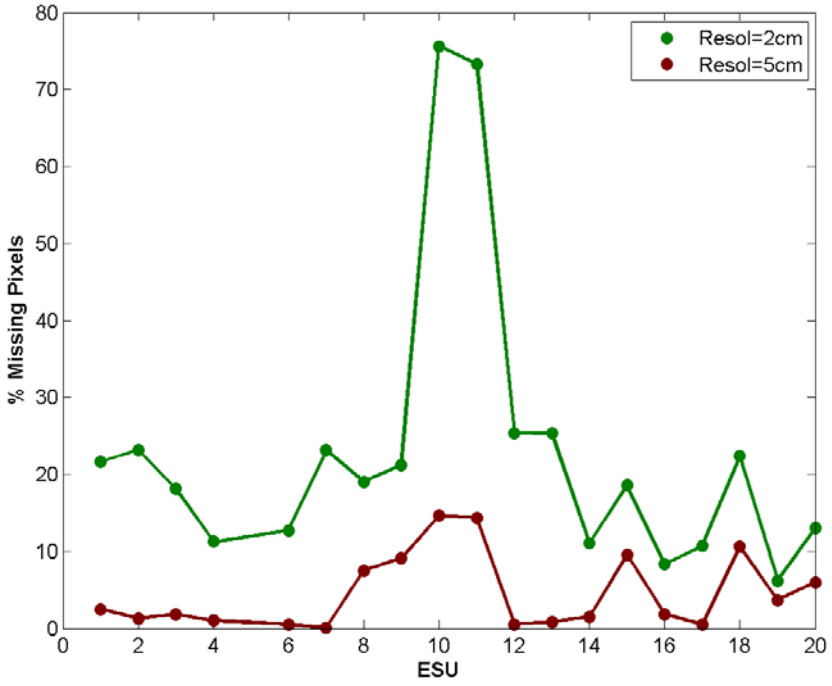
Fit a local plan on the 10% lowest points: relative soil level

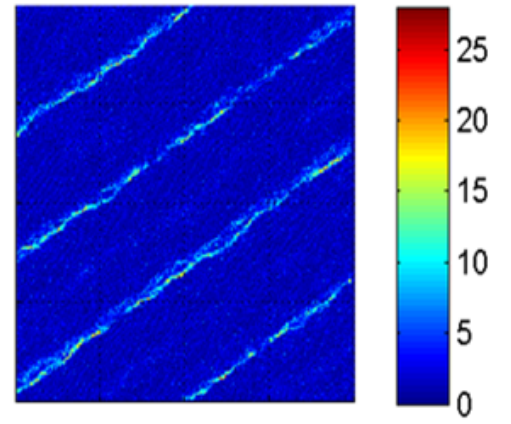


Allows to compute the height relative to the reference soil level

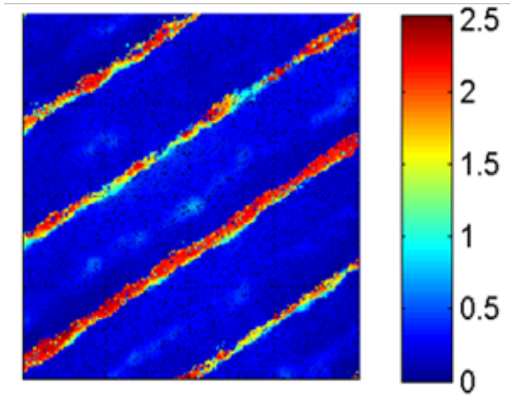
Creating binary image

Gridding the 3D point cloud image to get a vertical projection image
Select the resolution to get enough points per pixel: 5cm





5 cm resolution



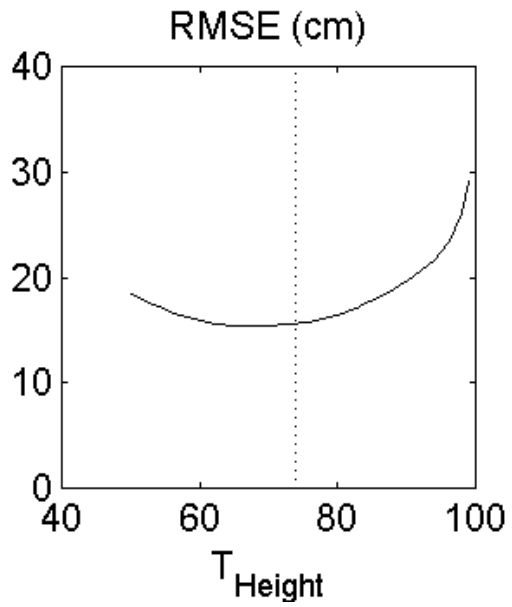
2 cm resolution

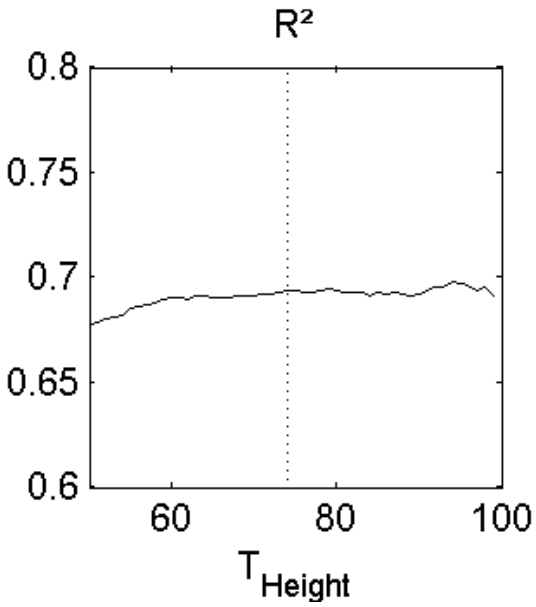
Creating a binary image

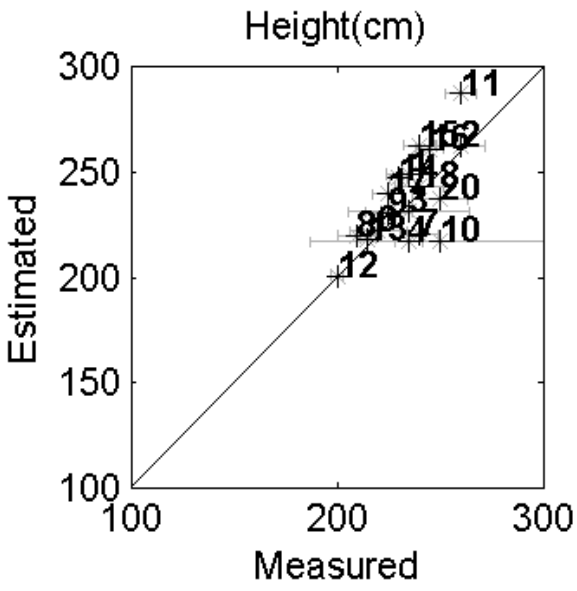
- Separating the soil/inter-row from the vine
  - Threshold height: 0.5*max_height

- Take the max height for each pixel (to get the upper enveloppe)

Results: row height

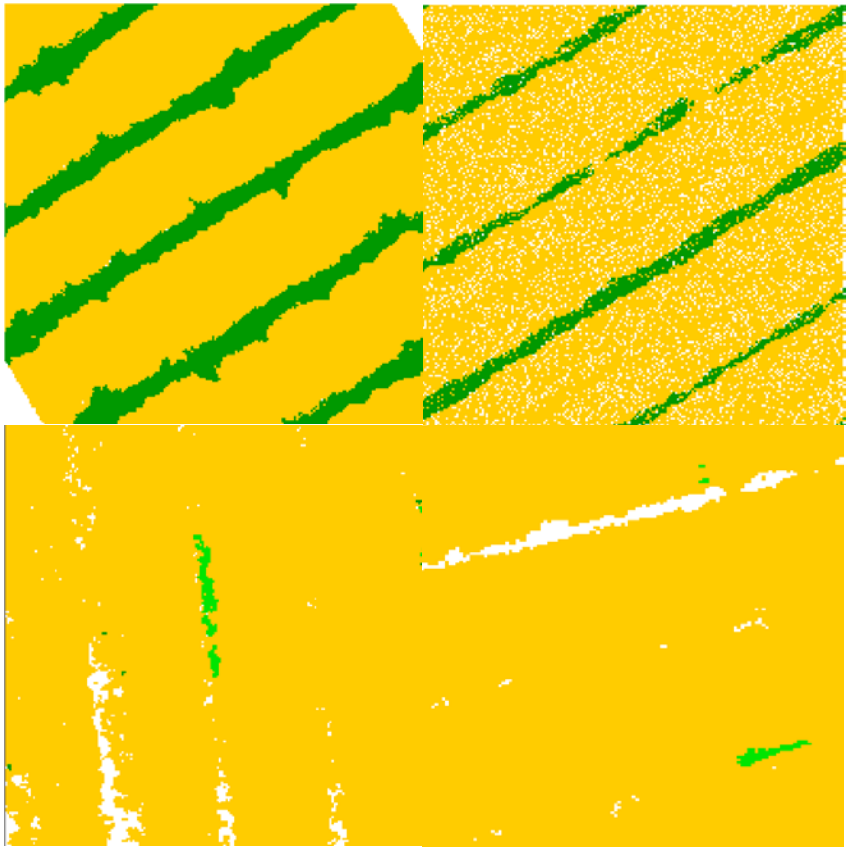






T_{Height}=74% RMSE=15cm

Cover fraction



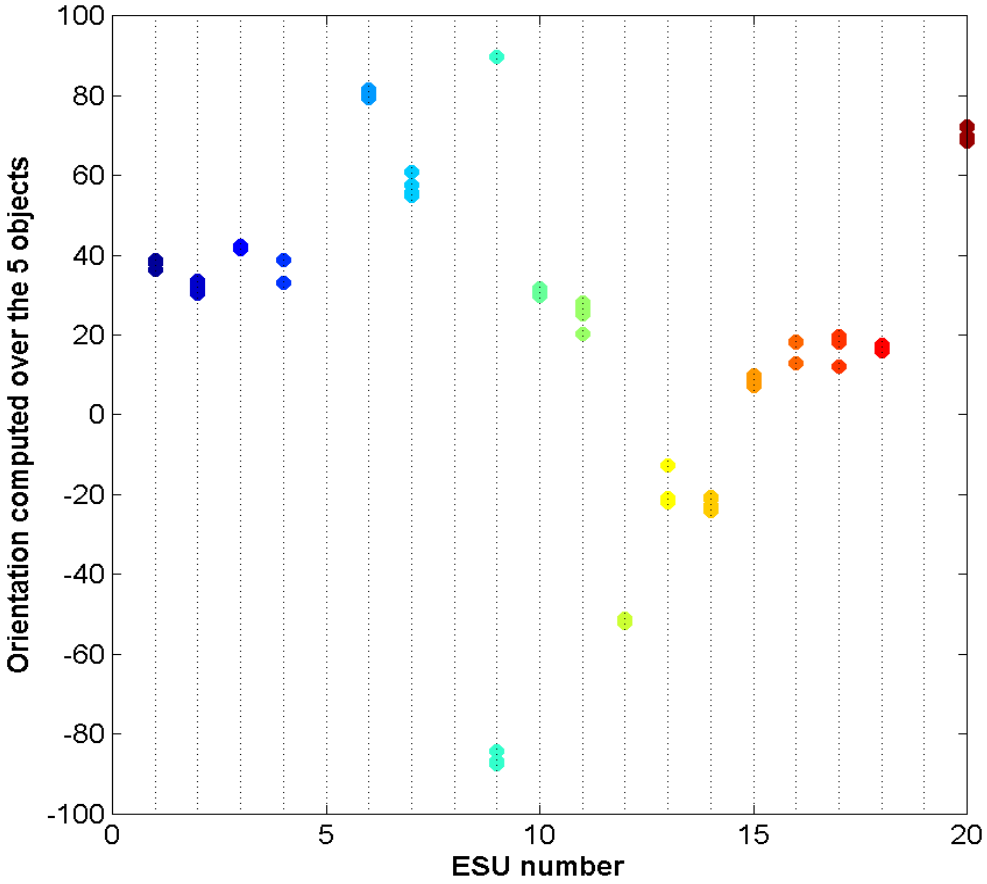
Limit: missing fraction: strongly depends on the original image resolution and number of images available (should be >9)

Row orientation

2 methods

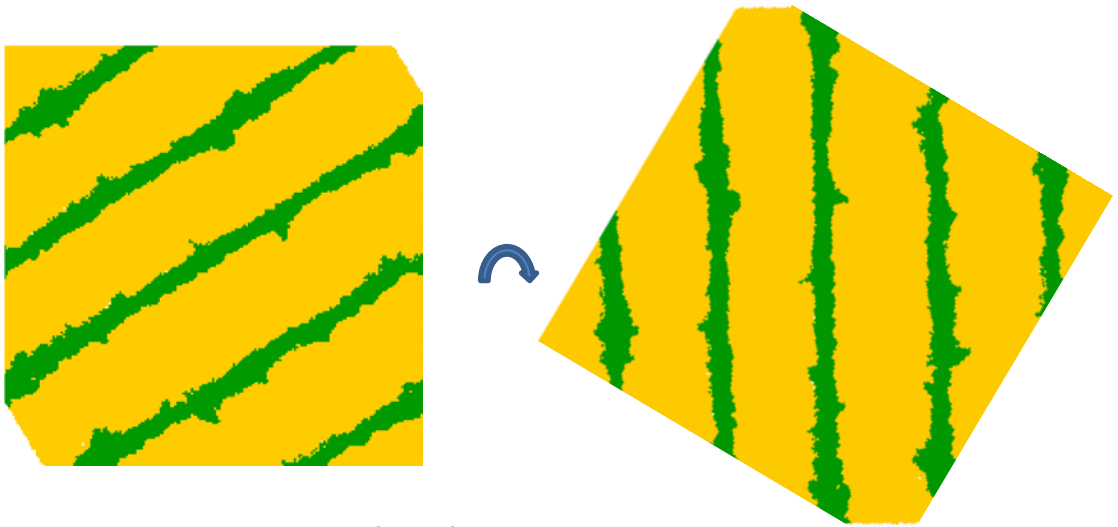
- Rotating the scene to maximize the differences between row/inter-row

- Identifying objects (after closure) and computing its main orientation

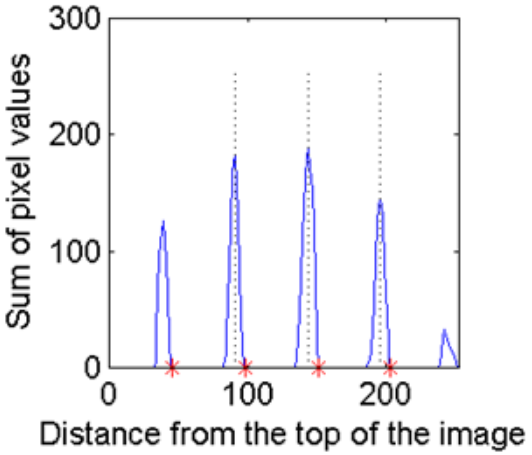


Very good consistency between the methods

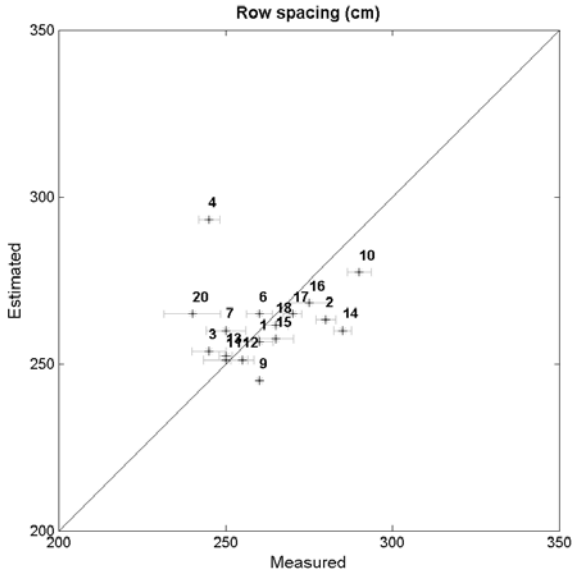
Row spacing



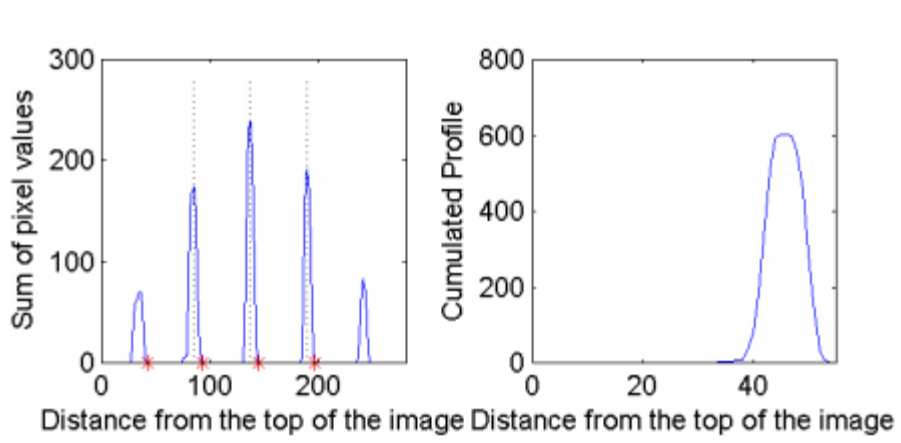
Rotation by the row orientation

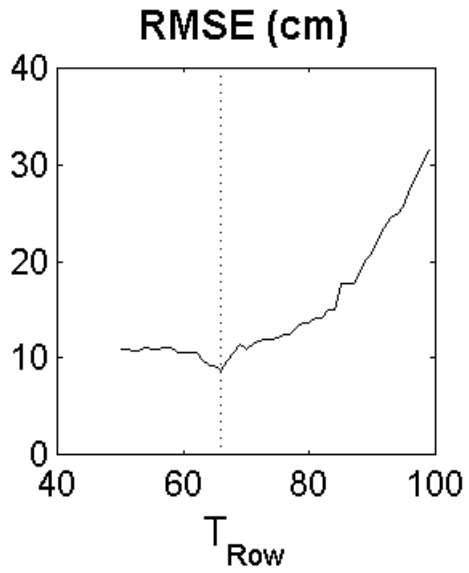


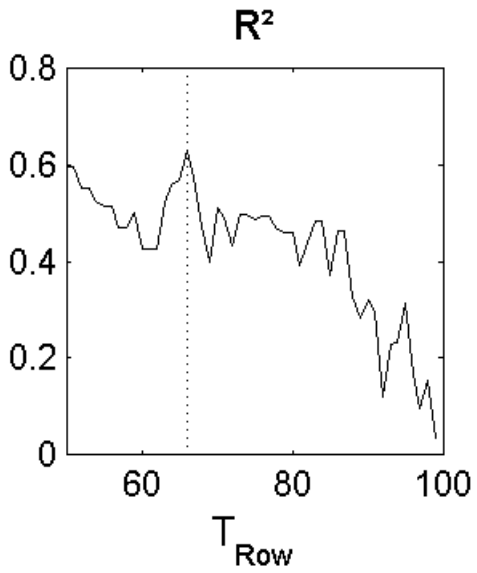
Sum of pixels along the colomns

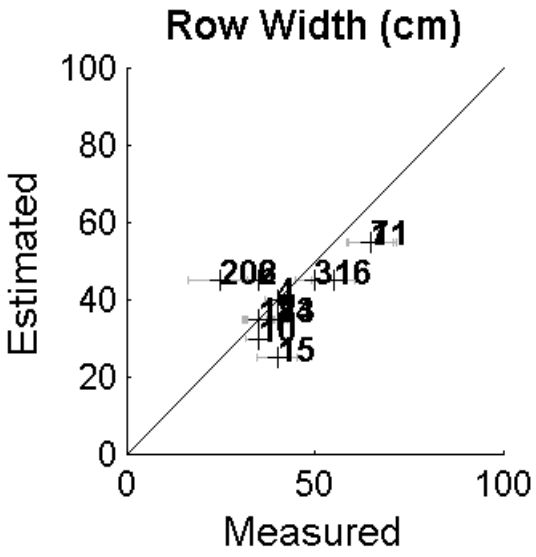


Row width









Trow=65% RMSE=9cm

Conclusion

- Good description of the row structure from UAV if the resolution of the resulting 3D point cloud is sufficient:
  - resolution of original images <3cm
  - Enough overlaping images (>9)
- Very heavy computation!!