Cereal morphology through proximal stereo vision

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What was our goal?

Develop a **phenotyping tool** to measure **cereal canopy architecture** in a **non-destructive** way.
What is stereo vision?
What is stereo vision?
For who?
Why choosing stereo vision?

**COMPACT**
- 40 mm
- 100 mm

**LOW COST**
- 80 mm
- 150 – 2000 €

**IMAGE**
What about the experiment?

2 RGB cameras

Baseline 50 mm
What about the experiment?

- **Winter wheat** *Edgar*
- **Spring barley** *Planet*
- 4 fertilization practices
- 4 plot replication

Shoot image 1!
Shoot image 2!
Shoot image 3!
Shoot image 4!
Is the wind a problem?
Is the wind a problem?

Without trigger

With trigger
What does it measure?

Plant ratio

Neural networks
SVM

Segmentation accuracy: 98.5%
Some barley

What about the 3D information?

Height map
What about the 3D information?

Some wheat

Height map (2019 result)
What about the 3D information?

1. Detect leaf edges
2. Sample zone of good matching
3. Fit a plane on the point cloud
4. Compute zenith angle
5. Compute azimuth angle
What are the results? The perspectives?

- Plant ratio
- Canopy height
- Leaf angles
- Spike counting
- Leaf Area Index
- Height of spikes
- Biomass estimation
Any take home message?

Hello the (outside) world
Thank you for your attention!

How to contact me? : sebastien.dandrifosse@uliege.be
What are the perspectives?

Stereo

Multispectral
Sampling of leaf zones

Leaf edge OK

Sample OK

Sample NOT OK
How to reconstruct a 3D surface?

Part of a leaf → 3D point cloud → Triangle mesh
How to calibrate the device?
Leaf angle distribution

- Wheat: Apr 11 (180 DAS)
- Wheat: Apr 23 (192 DAS)
- Wheat: May 02 (201 DAS)
- Wheat: May 16 (215 DAS)
- Wheat: May 24 (224 DAS)
Plant ratio

**Wheat**

- Fertiliser at stages: Tillering (2 Apr) and Stem elongation (21 Apr) (kgN/ha)
  - 0–0
  - 30–90
  - 60–0
  - 90–30

**Barley**

- Fertiliser at stages: Seedling (14 Apr) and Stem elongation (13 May) (kgN/ha)
  - 90–30
  - 135–45
  - 0–30
  - 45–15
What is stereovision?

Stereo vision: from 2D images to 3D information

What camera L sees

What camera R sees