PRESENTATION OF FIELD ACRE BENCHMARKS

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- **Functionality Benchmark (FBM)**
  - Focused on a basic functionality part of integrated solutions
  - Functionalities benchmarks are single and independent from each other

- **Task Benchmark (TBM)**
  - Complex task involving association of multiple basic functionalities
  - TBM = association of several Functionalities Benchmarks

FBMs and TBMs concern both:

. Robotics solutions

. Smart implements solutions

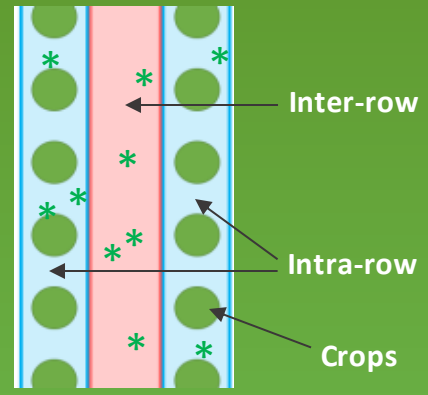
Functionality Benchmark (FBM)

- **5 FBMs :**

  - Plant discrimination
  - Leaf Area estimation
  - Biomass estimation
  - Weed destruction
  - Field navigation

Plant discrimination FBM

Goal: *being able to differentiate crops from weeds (intra-row detection)*



Evaluation Method :

Data acquisition by the Challenger Team

Automatic detection process by Challenger Team

Manual labellisation by Challenge Organizers

Source: DIANNE LNE software

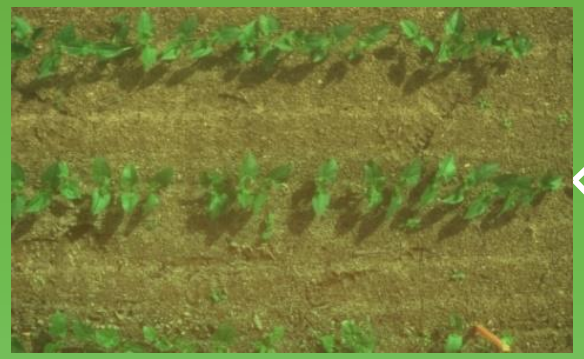
Comparison:
1. Plant discrimination mapping
2. Error rate calculation

Leaf Area estimation FBM

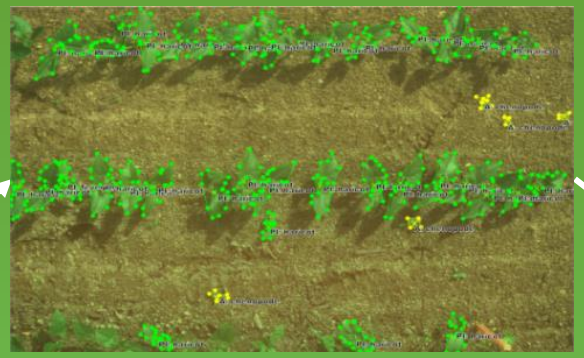
METRICS

Goal: *Estimate the Leaf Area **<u>of plants</u>** along a cultivated row*

Evaluation Method:



Data acquisition by the Challenger Team



Automatic detection process by Challenger Team

Estimated Leaf Area by Challenge Organizers

Comparison:
1. Leaf Area mapping
2. Error rate calculation

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Biomass estimation FBM

METRICS

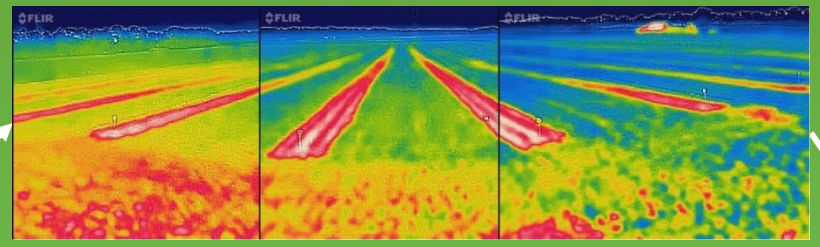
Goal: *Estimation of the above-ground crop biomass*

- global

- weeds and plant dissociated

Evaluation Method:

Data acquisition by the Challenger Team



Automatic detection process by the Challenger Team

Biomass manual measurements by Challenge Organizers

Comparison:

1. Biomass mapping
2. Error rate calculation

Weed destruction FBM

Goal: *Destroy weeds in the row without damaging the crops*

- *Evaluation in the intra-row area before and after the weeding*
- *Artificial visual markers used to be independent from other functionalities benchmarks (Plant Discrimination FBM)*
- *No requirement about autonomously driving of robot in the row*

Evaluation Method :

Data acquisition by the Challenger Team

Automatic destruction process by Challenger Team

Manual counting carried out by Challenge Organizers

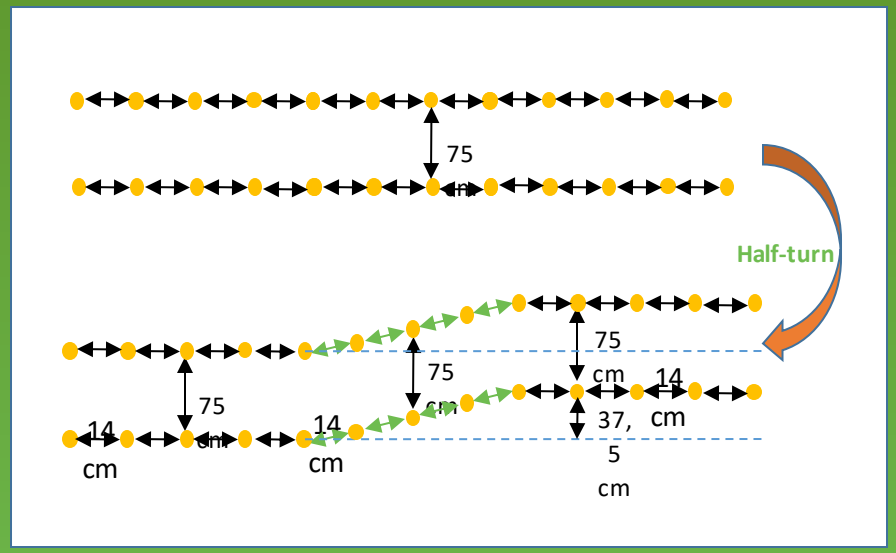
Comparison:
1. Weeding performance
2. Preservation of crop
3. Error rates calculation

Field Navigation FBM *for robotics solutions only*

METRICS

Goal: *Navigation through a field row without causing damage to the crop. No implement in action (No weeding):*

- ***First step :*** *Evaluation in straight line with a half-turn at the end of the crop row*
- ***Second step :*** *First part in straight line - Change of direction - second part in straight line too but shifted*



Evaluation Method:

Evaluation:

1. Guidance accuracy with reference localization system (Laser tracker)
2. Preservation of plants (No damage)
3. Working speed measurement (site performance)

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METRICS

Task Benchmark (TBM)

- **2 TBMs**
  - Intra-row weeding
  - Crop mapping

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Intra-row weeding TBM

Goal: *To perform fully autonomous intra-row weeding of a row crop (robotic solutions or smart implement solutions)*

Evaluation Method:

- Weeds destruction performance in the row
- Plants preservation performance in the row

- Speed execution performance
- Energetic criteria (power consumption, …)

Crop mapping TBM

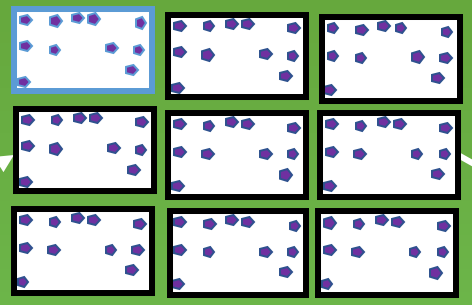
METRICS

Goal: *Produce a field map of the crop (for all significative field area) by autonomously exploring*

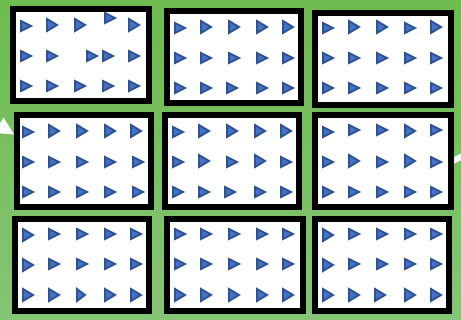
[sensors embedded on terrestrial mobile plateforms (autonomous or not)]

Evaluation Method:

Data acquisition by the Challenger Team



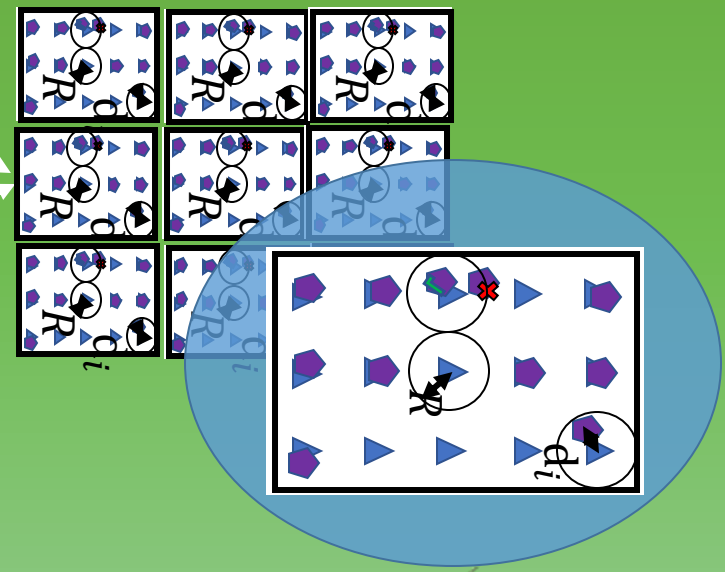
Estimated map by the Challenger Team



Ground truth map by the Challenge Organizers

Comparison:

1. Maps alignment
2. Evaluation with an ad-hoc error metric



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Rules for Field ACRE challenger teams

Field campaigns of the ACRE competition will:

- involve **at least two FBMs** (Plant discrimination, Leaf Area estimation, Biomass estimation, Weed destruction, Field navigation)

and one TBM (Intra-row weeding, Crop mapping)

First rulebook part for the ACRE field campaigns are in the ACRE D5.1 Evaluation Plan (see https://metricsproject.eu/agri-food/)

If needed additional TBMs (and/or FBMs) can be added in a constructive manner between Challenger Teams and Challenge Organizers

Benchmarks construction and execution of METRICS/ACRE Challenge done in a **Coopetition Mode** (win/win for all involved actors)

THANK YOU

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