



INnovations in plant Varlety Testing in Europe

Deliverable D2.6

RGB low-cost phenotyping tools selected to
be demonstrated for their applicability in
WP5 and 6 (M36)

Technical References

Project Acronym	INVITE
Project Title	INnovations in plant VarIety Testing in Europe
Project Coordinator	François Laurens
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¹ PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

Document history

V	Date	Beneficiary	Author
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2	26/10/2022	INRAE	François Laurens



Summary

In this deliverable we point toward tools among those presented in D2.5 that we believe of highest value for a possible translation for their applicability in WP5 and 6



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1.Introduction

Each of the tools presented in D2.5 are ready to be used in WP5 or WP6. Some are exe files easy to be installed and deployed. Other require a specific configuration. We go through them one by one.

2.Results

1. Apple fruits counting in orchard (UA-INRAe-REFPOP)

In this model apples are automatically detected in images as visible in Figure 1. The application has been made available under a NAPARI plugin. This is a recent initiative from the bio imaging community which allows to non coding expert to use the work of coding expert. It is easy to be developed thanks to its user friendly interface. The plugin is therefore ready to be used in WP5 and WP6.



Figure 1 : Left input image right output image where all apples are detected.

2. Apple flowering estimation in orchard (UA-INRAe-REFPOP).

In this model apple flowers are automatically segmented in images as visible in Figure 2. Here again a NAPARI plugin has been delivered and is therefore accessible to non coding expert of WP5 and WP6.



Figure 2 : Left input image right output image where all flowers are detected.

3. Cercosporiose segmentation in field (UA)

In this model cercosporiose spots are segmented on leaves. Here again a NAPARI plugin has been delivered and is therefore accessible to non coding expert of WP5 and WP6.

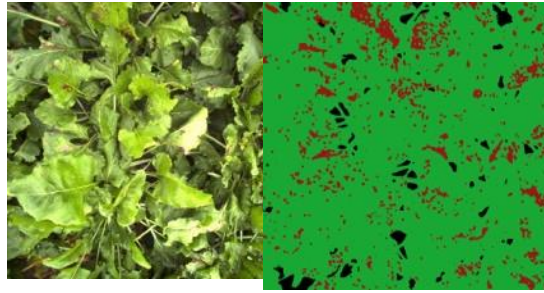


Figure 3 : Left input image right output image where all cercosporiosis lesion in red are detected.

4. Seedling emergence detection (UA-GEVES)

This model performs the classification of seedling emergence stages as described in detail in Garbougé, H., Rasti, P., & Rousseau, D. (2021). Enhancing the Tracking of Seedling Growth Using RGB-Depth Fusion and Deep Learning. *Sensors*, 21(24), 8425. The interface has been delivered under the form of an exe file and is therefore ready to be used in wP5 and WP6.

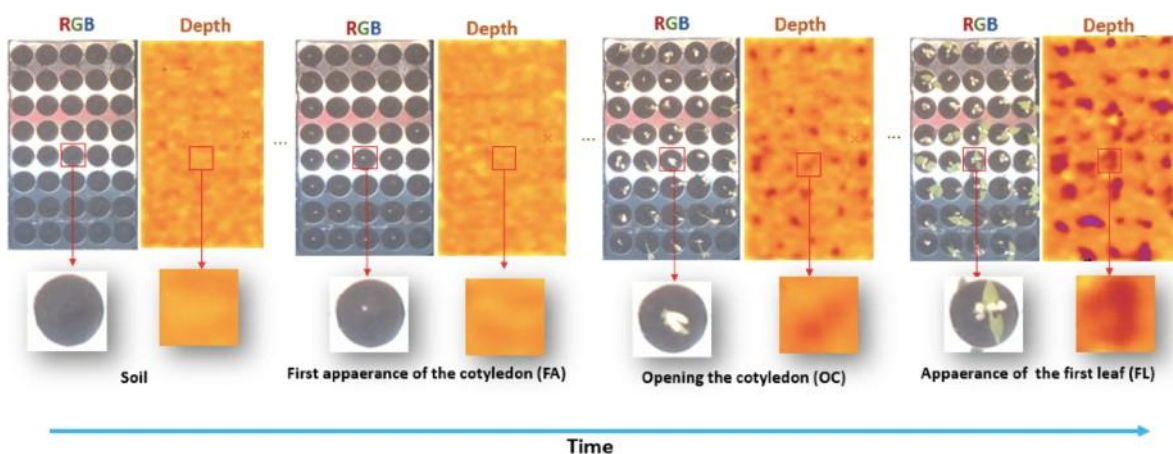


Figure 4 :Time series of each RGB and Depth images for each stage of development.

5. Post-harvest apple shape analysis (UA-IRTA)

This model performs annotation of apple shape analysis based on the UPOV catalog scheme. The approach is generic to any DUS trait and ready to be used on apples.

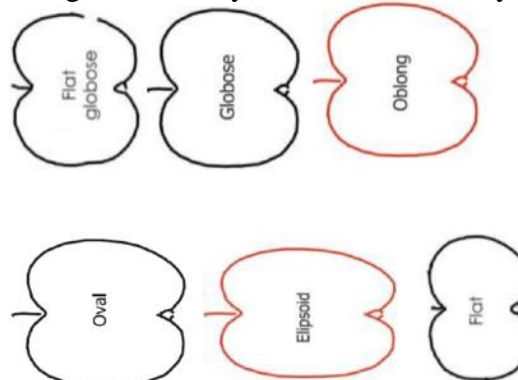
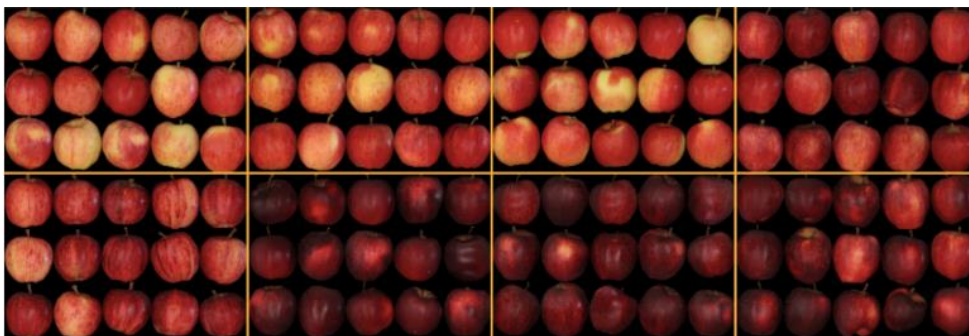


Figure 5 : Apple shape from UPOV catalog.

6. Post-harvest apple color analysis (UA-INRAe

Angers)

This model performs measurement of apple color for distinctness analysis of apples as described in detail in Couasnet, G., El Abidine, M. Z., Laurens, F., Dutagaci, H., & Rousseau, D. (2021). Machine learning meets distinctness in variety testing. In *Proceedings of the IEEE/CVF International Conference on Computer Vision* (pp. 1303-1311). Its is ready to be used for expert in WP5 and wP6 as an Exe file.



7. Ordinalisys (UA)

This application performs dimension reduction for ordinal data as described in detail in Zine-El-Abidine, M., Dutagaci, H., & Rousseau, D. (2021, August). Dimensionality Reduction for Ordinal Classification. In *2021 29th European Signal Processing Conference (EU-SIPCO)* (pp. 1531-1535). IEEE.. The associated software is ready to be used by partners of WP5 and 6 as an exe file.

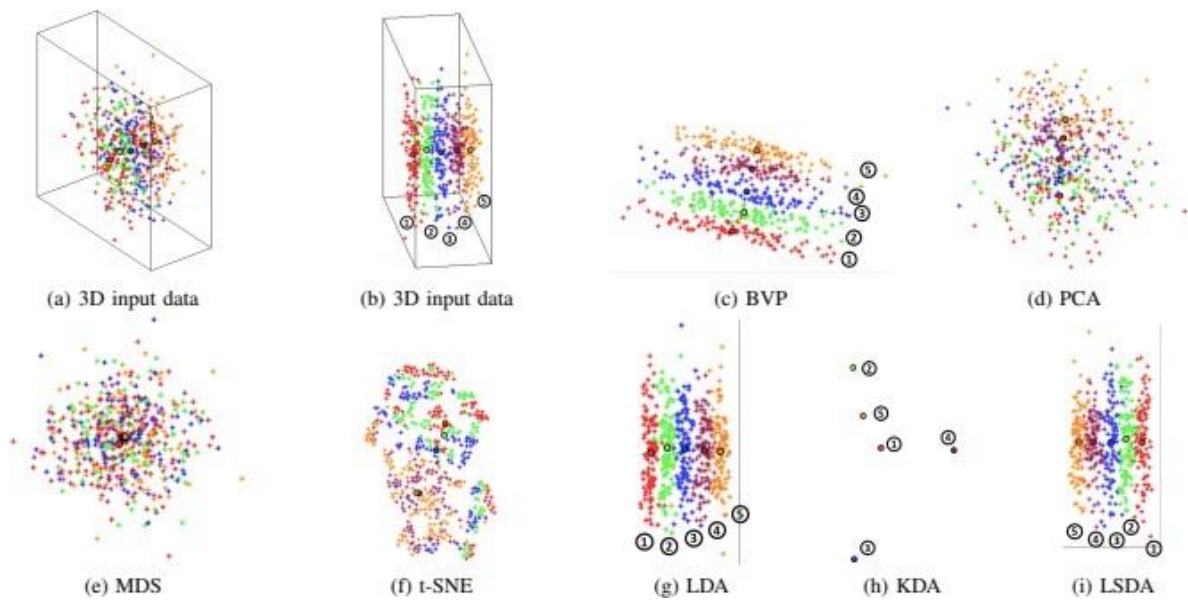


Figure 7 : view of various dimension reduction in comparison with the proposed Best view point optimized for ordinal data as often met in variety testing.

8. Post-harvest tomato analysis (WUR-NAKt)

This application segments tomatoes from a tray and performs automatic trait segmentation. Tomatoes must be placed in 3 orientations, Upright, on-side, and upside down. The application is fully operational and even deployed on android tablet ready to be used by WP5 or WP6 partners.

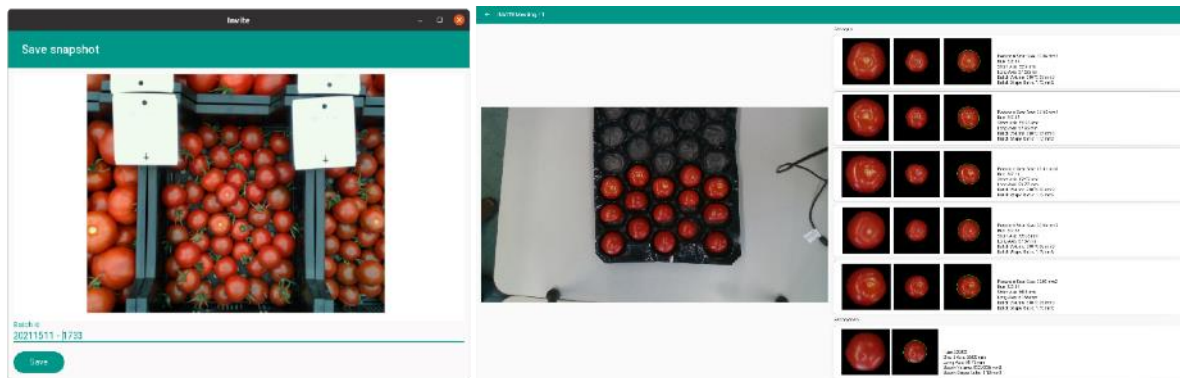


Figure 8: A Screenshot from the program showing an example of the image acquisition screen and the resulting trait extraction screen.

3. Conclusion

All the tools presented in D2.5 are ready to be used by expert of WP5 and WP6. There were all demonstrated during the INVITE annual meeting of 2022. <https://www.youtube.com/watch?v=zksmnYaHlcM&list=PLUukCwr0iCeehYIvs-qKkhjPeLAXwtpAL&index=19>. Some software need a bit of explanation to be installed on a computer. This is especially the case for those running on NAPARI. We have developed a tutorial playlist on a youtube channel to help the expert that would be eager to install our tools : <https://www.youtube.com/watch?v=bc53pvzVWDs&list=PLUukCwr0iCee4TNpAM-3tnI4pX6YxDvKO>. Currently this playlist is in French but will be translated into English during an online training planned in November 2022.