

PROJECT TITLE

Development of a fully automated root image segmentation software

CONSORTIUM

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SUMMARY OF THE REPORT

Characterizing the root system is a complex task due to its hidden nature. Some methods already exist to enable the visualization of the root system like, for example, the rhizotrons available in GrowScreen-Rhizo 1 platform in Jülich Plant Phenotyping Centre [1].

Today there is no software which enables an automatic analysis of roots growing in soil environment. There are tools which allow a semi-automatic analysis such as Smartroot [2] or Rootnav [3]. However, none of these is working without user inputs or manual annotations / corrections. Therefore, the challenge is to develop algorithms which permit to increase the throughput in root image analysis, with the objective in the best case to reach fully automatic root detection and extraction of root traits. Towards this aim, the main bottleneck of a full automation is to achieve a perfect segmentation of the root system from the background.

Agro Innovation International is the innovation and research division of the Roullier Group. It has a long expertise in the study and the development of efficient fertilizers improving crop growth. The R&D Centre (*Centre Mondial de l'Innovation Roullier, Saint-Malo, France*) which opened 3 years ago includes state of the art equipment in various fields: molecular biology, biochemistry, chromatography, mass spectrometry, microscopy and agronomy with 1200 m² of greenhouse facilities including a phenotyping platform. Agro Innovation International develops for its own purposes and for sharing with academic partners new algorithms for image analysis. However, although the new algorithms based on artificial intelligence are extremely powerful, they require a lot of annotated data to be developed. This proposal aims to design a fully automated root segmentation and analysis software based on our algorithms and data and expertise of Jülich Plant Phenotyping Center.

This TA project should lead us to new perspectives in plant science research, especially for root monitoring. Indeed, for a R&D Centre specialized in plant nutrition, the characterization of the root system is a must have to better understand the plant behaviour under different stimuli and under new fertilizers.