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Rapid 3D reconstruction of plants and the benefits for phenotyping and robotics

Phenotyping offers the horticultural sector a powerful tool for optimising plant performance and productivity. For effective use in industry phenotyping needs to be fast, accurate and objective. Using very fast, camera-based volumetric intersection techniques, full, accurate 3D plant models can be produced. Algorithms incorporating expert knowledge of plant physiology allow traits such as plant volume, plant architecture, number of leaves, internode length, individual leaf sizes, and leaf angles. to be objectively measured from these models.

Full 3D plant models offer more benefits to the horticultural sector. Accurate 3D information about the exact location of plant parts such as stems or individual leaves can be used for vision-guided robotics to automate manual labour. Using robots for time consuming, dull and repetitive horticultural tasks, for example grafting or planting cuttings, will improve reliability and objectivity, and can increase production capacity.

At the Wageningen University and Research Centre several research projects are currently exploring the potential of full 3D plant models for both phenotyping and robotics applications. These projects span the full spectrum from long-term academic research to industrial applications. To elaborate the future perspective of research and development in this field a number of examples will be discussed.