

## KEYNOTE TALK

Wednesday, October 23, 2024 at 1:30pm

### Synthetic Data and Plant Phenotyping

Mik Cieslak

GreenMatterAI GmbH

**Abstract:** Computer vision in agriculture benefits from diverse labeled datasets, with synthetic images offering enhanced accuracy, diversity, and cost-effectiveness compared to real ones. This talk explores the generation of synthetic plant images using advanced procedural models, from individual plants in controlled environments to fields under varying conditions. I will discuss the importance of biologically accurate models and the role of model calibration in improving deep neural network training. Additionally, I will present findings showing that networks trained on a mix of real and synthetic data outperform those trained on solely real or synthetic datasets, with improved generalization. Nonetheless, a domain gap remains between real and synthetic images, and I will address potential solutions for bridging this gap.



**Speaker Bio-Sketch:** Mik Cieslak is a Senior Research Scientist at GreenMatterAI GmbH, a startup providing synthetic data for various industries including precision agriculture. He received a PhD in mathematics from the University of Queensland (2010, Australia), and completed postdoctoral fellowships at the Institut National de la Recherche Agronomique - Plants and Cropping Systems in Horticulture (2012, France) and in the Biological Modeling and Visualization Laboratory at the University of Calgary (2015). Before joining GreenMatterAI, he was a Senior Research Associate in the Biological Modelling and Visualization Laboratory in the Department of Computer Science at the University of Calgary (2024). He is an expert in computational plant modelling and worked on the mechanistic modelling of plant development in the scope of the Plant Phenotyping and Imaging Research Centre based at the

University of Saskatchewan (2024). His current work includes a study of the diversity of phenotypes observed in closely related plants, methodological advancements in plant modelling, and the use of computer-generated models as annotated data for training neural networks for image-based phenotyping and vision-related agricultural tasks.