



UNIVERSITY OF SASKATCHEWAN

Plant Phenotyping and
Imaging Research Centre

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GIFS

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UNIVERSITY OF SASKATCHEWAN PLANT PHENOTYPING AND IMAGING RESEARCH CENTRE

**Driving innovation in plant breeding
to help feed the world.**

The Plant Phenotyping and Imaging Research Centre at the University of Saskatchewan equips researchers with powerful Lenovo high-performance computing resources, helping them find new ways to solve food shortages.

Lenovo





According to the [UN's Food and Agricultural Organization \(FAO\)](#), an estimated 820 million people in the world are undernourished and facing chronic food deprivation. Experts believe this figure will continue to rise fueled by poverty, conflict and climate.

The number of extreme weather events, such as drought, floods and storms, has increased dramatically in recent decades, affecting agricultural productivity and contributing to shortfalls in food availability. As global temperatures continue to rise, the impact on agriculture is expected to worsen.

At a time when hunger is on the rise, so too is the world's population, which is expected to reach [9.8 billion by 2050](#). To produce enough food to feed this growing population, experts predict that we will need to increase agricultural productivity by 2% a year.

Emil Hallin, Senior Research Fellow at the Plant Phenotyping and Imaging Research Centre (P2IRC), a digital agriculture research center at the University of Saskatchewan, begins: "The planet has a limited amount of arable land. So, to increase agricultural productivity, we need to increase crop yields. To do that, we need to breed plants with higher yields and that are more resistant to drought and disease."



Funded by the Canada First Research Excellence Fund and managed by the Global Institute for Food Security, P2IRC is on a mission to revolutionize crop breeding. The institute uses image acquisition technologies and high-performance computing (HPC) to advance plant bioinformatics, genomics and crop phenotyping research.

Hallin elaborates: “My research focuses on the rhizosphere – the area of soil that surrounds and is directly affected by a plant’s root system. Until recently, plant breeding has almost exclusively been based on what grows above the ground. It is critical that we gain a better understanding of plant root systems and how roots interact with microorganisms in the soil because that’s where plants get most of their nutrients from. The roots are also key to a plant’s drought tolerance.”

“I use neutron imaging to study the architecture of root systems and the surrounding soil in situ by creating 3D images of the rhizosphere. This is done by compiling several thousand 2D images of the rhizosphere to create a 3D image. Next, I process the 3D image to remove any noise and get a good picture – it’s almost like taking an X-ray of a plant’s root system. Then, I can study the image to understand how the plant and the soil interact.”

Compiling thousands of high-resolution 2D images is an extremely compute-intensive task. As is processing the end 3D image, which typically took 48 to 72 hours to complete using a traditional desktop PC.

Hallin recalls: “It used to take me several days of processing and filtering to get the right level of image quality. Because it took so long, I could never dedicate as much time as I would have liked to actually studying them.”

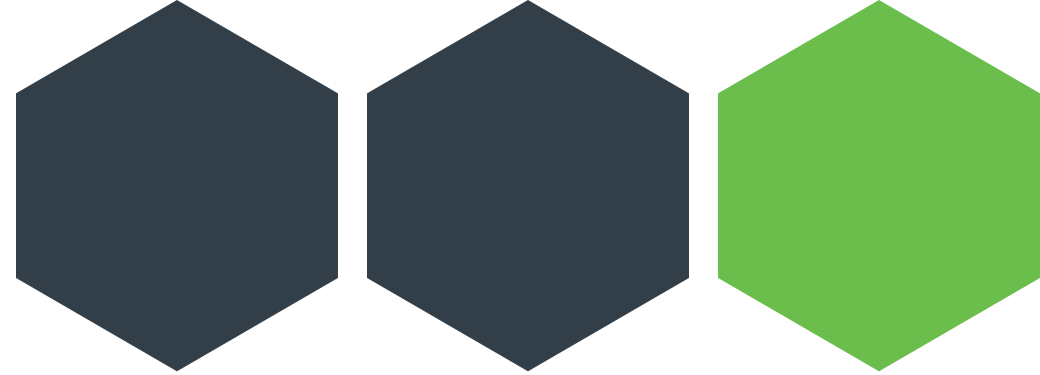


To support researchers like Hallin, P2IRC decided to invest in a new HPC infrastructure based on Lenovo ThinkSystem SR650 and SR850 servers. Equipped with powerful Intel® Xeon® Scalable CPUs and NVIDIA® Tesla® V100 GPUs, the Lenovo solution offers extremely high levels of performance – enabling researchers to process data much faster than was previously possible.

“Jobs that used to take several days are now finished in as little as six minutes, which gives me so much more time to focus on my research,” says Hallin. “Having access to the Lenovo infrastructure has completely changed the way that I work. Not only can I produce more images than before, I can also create sharper images so that I’m able to extract more precise and more meaningful information. I couldn’t be happier.”

With its new Lenovo HPC environment in place, P2IRC is breaking new ground in its research into plants, soil and how they interact, helping to uncover the insights needed to increase agricultural yields and develop crops hardy enough to withstand extreme weather conditions.

Hallin concludes: “We’re now better equipped to process and analyze data on everything from rhizospheres to plant genomes, all with the aim of figuring out ways to breed better, stronger plants. We believe that our research will help to resolve one of humanity’s greatest challenges: feeding the world.”



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– Emil Hallin, Senior Research Fellow, Plant Phenotyping and Imaging Research Centre, University of Saskatchewan



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