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News

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February 25, 2025

Two Wageningen University AI studies will have a platform during one of the world's top conferences on AI. In the first study, reinforcement learning was used to provide a cost-effective solution for farmers to determine when to fertilise their crops. The second study contributed to a hybrid model that maps the effects of temperature increase on the phenology of cherry trees.

The bar is set high during the AAAI Conference on Artificial Intelligence, which will be held in Philadelphia, from February 25 to March 4. The organisation accepted only a small fraction of the scientific articles submitted. Two of these come from the new AI chair group at Wageningen University & Research. Professor Ioannis

Athanasiadis is quite proud of this: “AI is developing extremely fast. The fact that these two studies are accepted at this selective conference shows that WUR can bring important expertise to the global discussions on AI development.”

Fertilise or don't fertilise

The first study focused on the question of whether AI can help farmers decide to fertilise their land – or not. Senior AI researcher Michiel Kallenberg explains: “One of the consequences of over-fertilisation is that nitrogen that is not absorbed by plants ends up in the environment. To prevent over-fertilisation, farmers can run tests to determine how much fertiliser a plant needs. AI can then incorporate this knowledge into a farmer's fertilisation schedule. The problem is that it is quite time-consuming and costly to get these tests done. This is why many farmers make decisions based on common sense. Or they simply fertilise the maximum amount allowed.”



AI can assist in creating a fertilisation schedule (Photo: Shutterstock)

Reinforcement learning

Kallenberg and his colleagues worked on an AI agent that determines the correct amount of fertiliser to be applied, while minimising the need for expensive field assessments. An existing crop model for winter wheat, developed by Wageningen scientists, forms the basis for this. "This model reflects the growth of the crop based on all kinds of variables, such as weather data and soil information. Then, with the help of the AI agent, we applied a large number of fertilisation strategies in a simulated environment. We used the technology of reinforcement learning for this. By learning through trial and error, the algorithm determines the optimal fertilisation strategy for a diverse range of conditions"

Next step: apple trees

Until now, the experiments have been conducted with computer simulations. Next, the researchers will test the AI agent in an upcoming field trial. An exciting step, as field conditions may present factors not encountered in simulations.

"In addition, we have trained another AI agent following a similar principle to optimise pesticide application", Kallenberg says. "This agent will be tested in an apple orchard, where the primary focus is pesticide use and disease management."



Betuwe apples (Photo: Laurens Tijink)

Computer simulations and nature

According to Athanasiadis, the study convincingly demonstrates how you can use AI to explore the potential of nature. “That is what the AI agent does: by connecting computer simulations with nature, we find new solutions to use fertiliser more effectively while maintaining high yields. This study shows how good AI can help us manage risks related to climate change and prepare for the future in simulated environments”

Cherry trees

He believes that what characterises the study is that the needs of the sector were the guiding principle. The same applies to the other study by his research group that was selected by the AAAI. It revolves around cherry trees. “In countries such as Japan, South Korea and the US, cherry tree blossom is of great cultural value. In addition, there is

a tremendous amount of knowledge about the phenology of these trees. This knowledge goes back thousands of years.”

Blossoming earlier and earlier

The cherry tree has traditionally marked the beginning of spring. Due to climate change, the blossoming period is occurring earlier and earlier in the year. Athanasiadis: “During the dormant period, a tree stops growing and stores this energy until a certain threshold is reached. Then the tree uses the stored energy to blossom. We see that the blossoming is happening earlier and earlier. But we cannot predict when it will happen because we simply cannot measure it physiologically. It is a hidden process.”



Blossom (Photo: Shutterstock)

Machine learning

To get a look at this hidden process, an AI model was developed,

powered by machine learning: “First of all, we conducted detailed research into various scenarios. We then linked existing biophysical process models to a neural AI network that we developed. We tested the operation of our hybrid model in an extensive case study in Japan, South Korea, and Switzerland.”

Better predictions

The results were surprising, says Athanasiadis: “The combination of biophysical process models and machine learning yielded better predictions than when the separate process models or AI models were used. It shows how great the added value can be when you link domain knowledge to the advantages of AI. By combining the best of both worlds, we can better understand how plants work.”

Reliable systems needed

He emphasises that there is still a lot of work to be done to translate these kinds of fundamental insights into AI solutions that can be used in practice. “The agri-food sector needs reliable systems for this. As Wageningen scientists, we can make a difference for the sector in this regard. AI is the talk of the town, and as Wageningen we must participate in a responsible way: We not only ensure that AI tools work, but we base them on the needs of the sector and the extensive knowledge of plants, animals, food and the environment at WUR, in order to translate them into targeted algorithms.”

WUR is also making [great strides with AI in other studies](#). For example, scientists in Wageningen recently developed a machine that uses AI to recognise and remove weeds. Other recent inventions include a robot that cuts off ripe fruit and a greenhouse that autonomously

regulates its own climate.

https://www.wur.nl/en/newsarticle/two-wageningen-ai-studies-featured-at-prestigious-aaai-conference.htm?_gl=1*12nb97i*_up*MQ..*_ga*MTAwMDk2Njk2NC4xNzQwNzMwMzQz*_ga_SZ1PQDSPJD*MTc0MDczMDM0Mi4xLjEuMTc0MDczMDQxNi4wLjAuMA..