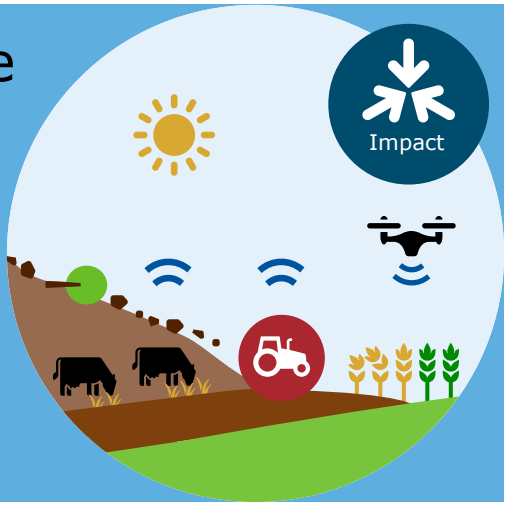
Use AI to improve climate change adaptation of smart greenhouse

New AI techniques for greenhouses that can adapt to climate change

Emerging DS/AI methods



WAGENINGEN
UNIVERSITY & RESEARCH

Data Driven Discoveries in a changing climate (D3C2)

Objective: This project aims to adapt greenhouses to the effects of climate change using AI.

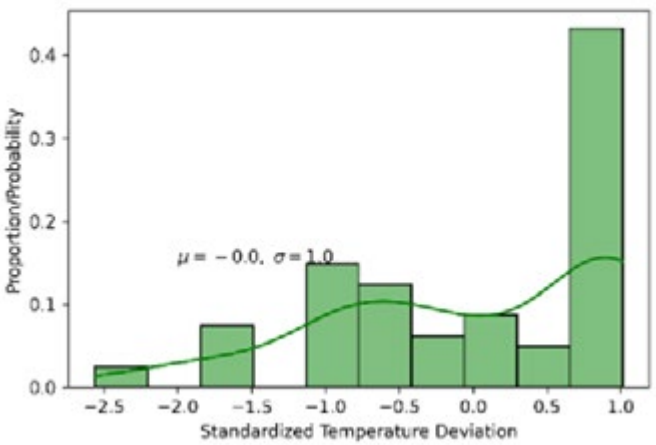
Activities and results

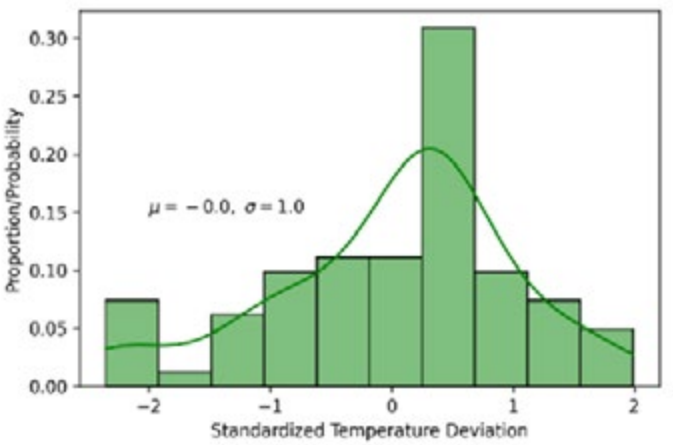
In this project, we research how to adapt greenhouses to climate change, such as temperature, humidity, and light intensity. Compared to traditional greenhouse control approaches, we research how to use AI techniques to discover the optimal structural configuring parameters for greenhouses that can adapt to climate change. Specifically, we use Deep Reinforcement Learning to learn and control the position and temperature of heaters for optimising the heating performance of a greenhouse.

We optimise the temperature of the greenhouse by moving heaters to optimal positions. Figure left shows a high deviation of temperature before using our approach, which means the temperature of a normal greenhouse is uneven. Figure right shows a low deviation of temperature after using our approach, which means the temperature of the greenhouse becomes more optimal.

Achievement

We found out that moving heaters could be an efficient solution to decrease the energy cost of greenhouse and adapt to climate changes in the future. Without this investment programme, we could not have initiated this research topic. AI can effectively learn the dynamic environmental temperature and dynamically control the position of greenhouse heaters. This approach can be leveraged to control many other greenhouse structures and parameters in the future.





Outlook

With the horticulture group, we are discussing the possibility to extend this idea to a research programme.

Deliverables

We are writing a paper based on this study.

Lessons learned

We learned several lessons:

- We learned much about how to use AI for smart greenhouses.
- The WUR Horticulture and Plant Physiology Group believes this topic is worth further exploring.
- It is hard to implement real-world experiments about using AI for horticulture.
- It is hard to find a student who is good at AI and has much knowledge about greenhouses.
- All our existing experiments are based on simulation. We still do not know whether our solution can be implemented in a real-world greenhouse.

Contact

Dr. Qingzhi Liu
Assistant Professor (project manager)
qingzhi.liu@wur.nl

Wageningen University & Research
P.O. Box 47
6700 AB Wageningen
The netherlands
T +31 317 48 07 00
www.wur.eu

Project members
Durrotun Nashihin