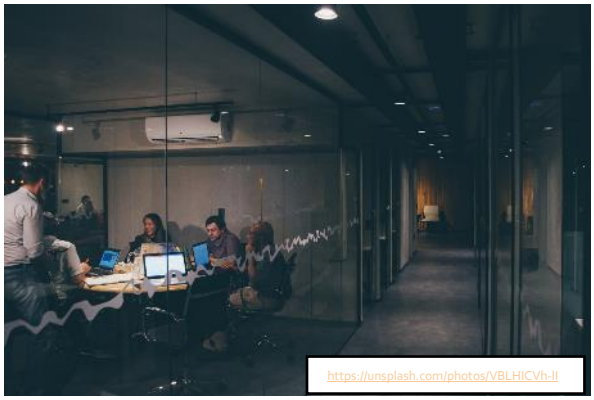
MASTER THESIS PROJECT

Interactive Reinforcement Learning to Incorporate User Feedback on a Smart Office

PROJECT DESCRIPTION

As reinforcement learning (RL) shows major results in many artificial domains, research is being done on applying these approaches to complex real-world problems. However, as these RL methods are embedded in a socio-technical context, where people interact with artificial agents, it becomes crucial that such interaction patterns are meaningful and consider individual preferences and limitations.



In this thesis, you will develop an RL agent to control the temperature in an office while incorporating users' feedback. User feedback towards comfort is required as comfort is a subjective and personal experience. How can we develop a learning system that interacts with users and considers all algorithms running in a smart office to maintain energy efficiency? When should the RL agent act on the user feedback? How do we evaluate user feedback? In addition, buildings and especially offices have many different users. How to aggregate individual's feedback and preferences? How to trade off comfort across individuals with different preferences?

This project will be developed at the Interactive Intelligence group in cooperation with PHYSEE.

Interactive Intelligence Group: The Interactive Intelligence (II) section focusses on socially interactive, intelligent agents. We research the intelligence that underlies and co-evolves during the repeated interactions of human and technology "agents" who cooperate to achieve a joint goal. Our research program aims for synergy and social interaction between humans and technology, to empower humans in their social context.

PHYSEE: We are a scale-up in Delft that focuses on the energy transition mainly in the built environment. We currently have a very diverse team of over 30 employees of many different backgrounds. We develop a software platform called SENSE which enables buildings to become more energy efficient and have increased comfort for the tenants. We use building physics simulations combined with sensor data streams to optimize the building energy usage while taking into account one of the most essential features of a building, the comfort that it brings to the users. These two fields, energy and comfort are often viewed as opposites but we believe that with the current technology they can be optimized simultaneously.

References and further reading

Vellei, M., Martinez, S., & Le Dréau, J. (2021). Agent-based stochastic model of thermostat adjustments: A demand response application. Energy and Buildings, 238, 110846.

Griffith, S., Subramanian, K., Scholz, J., Isbell, C. L., & Thomaz, A. L. (2013). Policy shaping: Integrating human feedback with reinforcement learning. Georgia Institute of Technology.

Warnell, G., Waytowich, N., Lawhern, V., & Stone, P. (2018, April). Deep tamer: Interactive agent shaping in high-dimensional state spaces. In Thirty-Second AAAI Conference on Artificial Intelligence.

PRACTICAL DETAILS

- Starting date: As soon as possible
- Location: TU Delft, Interactive Intelligence Group
- Daily supervisor: Luciano Cavalcante Siebert (TU Delft, II)
- Cosupervisor: Pim Rutgers (PHYSEE)

If you are interested in this position, please send your CV and a brief motivation to **L.CavalcanteSiebert@tudelft.nl**