AI for Energy-Efficient Homes: Balancing Convenience and Privacy

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May 25, 2024

Introduction

Learn more about how AI could be used to optimize home systems while respecting the privacy of the residents.

More about the Project

In this study, we explore the possibilities of using Artificial Intelligence (AI) to optimize home systems, such as heating. This could potentially save vast amounts of money and also lower the environmental impact from homes. Integrating occupancy detectors with other systems in homes could also make everyday life more comfortable and efficient. It is, however, important to reach a balance between this convenience and privacy, which motivated the chosen approach.

In order to take privacy concerns into account, the data used to create the occupancy detector was sensor data from Minut AB, a company known for their privacy-friendly home monitors. Creating something useful from this data seemed to require more than manual identification of connections between the input features, such as humidity and sound level, and whether the space studied was occupied or not. The chosen approach was two types of state of the art AI methods: standard Deep Neural Networks (DNNs) and Long Short-Term Memory (LSTM) networks, which are able to capture long term dependencies in time (needed to, for instance, tell whether someone is at home hours after everyone has gone to bed) without explicitly looking very far backwards in time. Both methods were clearly better than plain guessing, the DNN approach being the most successful, but due to various reasons, such as low quality of parts of the dataset, more work needs to be done to meet the high demands on features in smart home systems.

Although not yet optimal for home system applications, this project demonstrated that more complex AI models, such as LSTM, do not always outperform simpler ones like DNNs as well as helped in laying a foundation for future work creating smart homes with equally smart privacy.