Vrije Universiteit Brussel

Proposal bachelor thesis

Title: Morphing user profiles for smart thermostats

Promotor: Ann Nowé

Includes preparation course: Yes

Context

Most people leave the house at one temperature and forget to change it. Smart Thermostats learns your schedule, programs itself and adapts the learned profile as such that it lowers the heating (and cooling) bills.

Historical user data analysis can show that a family is usually out on weekdays from 8am till 5.30 pm and mostly at home in the weekend. On Wednesday afternoon however the son is at home for half hour, from 1pm till 1:30pm. Without the morphing, the user profiling would tell the controller that the desired temperature should be reached whenever someone is expected to be at home, including the Wednesday's afternoons when the son is at home for only half an hour. The smart thermostat will, based on this information, determine the optimal temperature trajectory to realize the desired temperature whenever someone is at the house and reducing the temperature as efficient as possible when no one is in the house. The aim of the morphing is to explore when an adaptation that leads to an improvement in terms of efficiency (e.g. reduce of cost) is still acceptable for the user.

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Morphing is the refinement process of the usage profiles based on an exploration of the user preferences. In reinforcement learning, several techniques exist that generalize the learned hypothesis across several situations. The challenge is to find the right technique so the knowledge learned throughout the

different days can be transferred to other profiles taking into account the representations of the user profiles and the aforementioned used preferences.

In this project it is up to you to learned and investigate several reinforcement learning techniques and their exploration strategy to find a good suitable technique for morphing the user profiles.

Preparatory course bachelor thesis

In terms of the preparation course you will need to study relevant chapters of the book by Sutton R. and Barto A., “Reinforcement Learning: An Introduction”. We will also present some relevant papers concerning the zone heating case.