



Proposal bachelor thesis

Title: Monitoring And Controlling Small Office Equipment Using Reinforcement Learning

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Includes preparation course: Yes / No (Select the correct option)

Context

Despite signs of recovery in the IT industry, many companies are more cost-conscious than they have ever been. Although IT departments have probably felt the crunch more than anyone else, a drain on the IT budget is continuing when offices are empty at night and at weekends. To estimate the savings potential, count the number of PCs in the company, multiply this by 60 and place a pound sign in front of the answer. According to government figures, this is the potential annual saving if you take a few energy-efficiency steps. Put another way, in a company with 200 PCs, turning off all the computers and monitors every night and at weekends would save £12,000 a year. Computers and monitors account for half the electricity used in an office and energy is being wasted every day, even by "energy saving" hardware. With every workstation on standby mode, the electricity meter continues to tick over at an alarming rate. Action Energy, a government-funded body, estimates that £90m is wasted annually by UK companies that leave computers turned on when not in use. Reducing this would produce a saving of one tonne of carbon dioxide emissions a year.

Source: <http://www.computerweekly.com/feature/Cutting-costs-Power-down>

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In this project, you will try to improve the way office devices are used by implementing a framework for monitoring the usage of small office devices, such as for instance printers, photo copiers or even beverage machines. You will work with appliance monitors to measure the energy usage of these devices and you will have to come up with a database system to store these measurements. Based on these readings, you will create a simulation environment, where a reinforcement learning agent can learn the optimal schedule, i.e. when to put the device on, off or in stand-by mode. This schedule is based on two criteria, i.e., on the one hand side you want a schedule that minimizes the energy consumption and on the other hand, you want to obtain a schedule that provides as little inconvenience to the user as possible. This inconvenience can be measured by monitoring if the user

switched on the device manually and was waiting for it to be operational. These two objectives are in essence conflicting objectives. On the research part of this project, the student will have to analyze and evaluate different reinforcement learning approaches on this setup using a thorough analysis of experimental results. Furthermore, the student will investigate multi-objective techniques in order to come up with different optimal trade-off solutions. In the end, there is a possibility to implement the learned control policy in real-life at the COMO lab.

Preparatory course bachelor thesis

- Selected chapters of Reinforcement Learning: An Introduction by R. Sutton and A. Barto
- Selected papers on multi-objective optimization and multi-objective reinforcement learning.