

PROVA 1 - B

QUESTION 1:

Explain in your own words what Reinforcement Learning is. In your answer, be sure to mention the following concepts: a) Agent; b) Environment; and c) Reward. Give an example that is a good example of Reinforcement Learning use to solve problems inside the energy industry. Please provide me with an EXCELLENT technical paper on this problem, one that is different from those selected by other students.

QUESTION 2:

The *epsilon-greedy strategy* is a random exploration strategy because we use randomness to select the action. First, we use randomness to choose whether to exploit or explore. Intuitively, early on when the agent hasn't experienced the environment enough is when we'd like it to explore the most; while later, as it obtains better estimates of the value functions, we want the agent to exploit more and more. The mechanics are straightforward: start with a high epsilon less than or equal to one, and decay its value on every step. This strategy, called *decaying epsilon-greedy strategy*, can take many forms depending on how you change the value of epsilon.

So, write a simple Python algorithm, using *decaying epsilon-greedy strategy*, to solve the problem of a real-time energy management system for smart homes equipped with rooftop photovoltaics, energy storage systems, and smart appliances. The algorithm aims to minimize the energy cost while ensuring user comfort. You need to consider, among other things, the SoC-related degradation cost and the Depth-of-Discharge (DoD)-related degradation cost for charge/discharge cycle. Consider to this problem the outdoor temperature, irradiation and real-time hourly electricity prices (RTP). Remember that your smart home can purchases electricity from the utility grid or, on the contrary, sells electricity to utility grid. The price of electricity sold to utility grid is 0.9 times of the RTP.

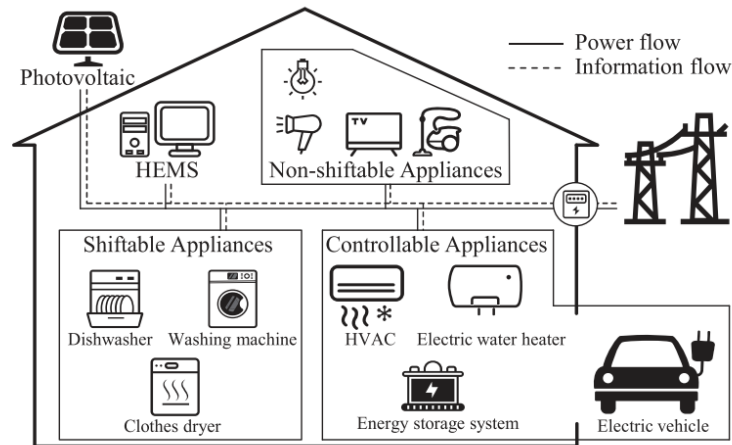


Fig. 1. Architecture of a smart home.