Weekly Report

This report addresses the accomplishments of the goals set out for the week from January, 22nd to January 29th.

These goals stemmed from **Theme 1.3**, namely, to implement algorithms into city-learn or different simulators and evaluate the performance for each algorithms. The challenge we were facing and that we sought to overcome by addressing these goals was an excessively long training time, if we were to use the methods traditionally employed in Reinforcement Learning projects.

According to emerging literature on the field, Meta-Reinforcement Learning is a promising approach when it comes to speeding up the learning process. The two main algorithms for Meta-Reinforcement Learning are Model-Agnostic Meta-Learning (MAML) and Probabilistic Embeddings for Actor-Critic Meta Learning (PEARL), and we set out to investigate whether any one of them could be applied in our particular problem.

This led us to postpone the following goals for the previous week:

1. To study and to learn about Meta-Learning, from general concepts to the specifics of the MAML and PEARL approaches;
2. To experiment with the *garage* package in Python, that allows you to implement MAML and PEARL meta-reinforcement learning algorithms;
3. After completing goals 1 and 2, to figure out how we could use "MAML/PEARL + Garage" to accelerate the learning process, thus tying up these goals with Theme 1.3.

The **first goal** (to study and to learn about Meta-Learning, from general concepts to the specifics of the MAML and PEARL approaches) was accomplished. We have decided not to move on with the PEARL approach, but rather to pursue exclusively with the MAML approach. The reason for this is that MAML is a less complex approach to Meta-Reinforcement Learning, therefore being easier and faster to train. Besides, if Meta-Reinforcement Learning proves of little value, MAML will tell us that before PEARL does. Moreover, for the sake of Theme 1.4 (publishing our findings in a journal), MAML is sufficiently a state-of-the-art technique. Hence, after accomplishing our first goal, our understanding is that we should proceed with Meta-Reinforcement Learning, but that we should focus on the MAML algorithm, and not pursue any endeavors with the PEARL algorithm.

The **second goal** was also met, with the caveat that we only implemented the MAML algorithm. The fact we decided not to implement the PEARL algorithm, however, does not constitute a failure to achieve this goal, but rather a conscious decision that we would not pursue it, due to the reasons explained previously.

Concerning the **third goal**, we did not go as far as to actually implementing the MAML algorithm on our problem of interest. Upon studying Meta-Reinforcement Learning in greater detail, it became clear to us that we'll need additional data in order to implement it in our problem. Hence, it wouldn't even be possible to accomplish our third goal without discussing beforehand how such data is supposed to be collected in the first place. We had this discussion, and decided the best approach was to use different kinds of buildings as sources for such data. Our rationale is that learning how to manage electricity in a commercial building, a residential building, or an factory, are all sufficiently similar problems, while at the same time not being the exact same problem (the peak of demand for a residential building might not match that of a commercial building, for example). Hence, we need to collect data from these different types of building

before we may actually tackle our third goal. This has therefore become our goals for the next week.

During this week, we accomplished a fourth goal. It was not originally listed as a goal, but since it was done, it should be reported. This goal was creating an open-source repository on GitHub and uploading our source-code to this repository. This ties up to Theme 1.4, which is all about showing our project to the world.