Project Proposal -

RL-IoT：Towards IoT Interoperability via Reinforcement Learning

Motivation:

In information systems, the presence of IoT devices is exponentially growing and most of them are custom devices: they rely on proprietary protocols, often closed or poorly documented. Here we want to interact with such devices, by learning their protocols in an autonomous manner.

Goal:

In the referenced paper, the author proposes RL-IoT, a system that explores how to automatically interact with possibly unknown IoT devices. Leveraging reinforcement learning to recover the semantics of protocol messages and to take control of the device to reach a given goal, while minimizing the number of interactions. Assume we know only a database of possible IoT protocol messages, whose semantics are however unknown. RL-IoT exchanges messages with the target IoT device, learning those commands that are useful to reach the given goal. With properly tuned parameters, RL-IoT learns how to perform actions with the target device, a Yeelight smart bulb in the case study.

Interested Exploration Direction:

1. Compare and evaluate the performance of 4 RL algorithms: SARSA, Q-learning, SARSA(λ) and Q(λ) in the case study.
2. Find the optimal sequence of commands to control the device and discover multiple solutions. (It's more than likely that there are multiple solutions to reach a single goal)
3. Perform parameter tuning to achieve the optimal performance of each RL algorithm.

Reading list:

[1] Referenced paper (RL-IoT: Reinforcement Learning to Interact with IoT Devices):
https://arxiv.org/abs/2105.00884
[2] Implementation of RL algorithms in TCP toycase scenario:
https://github.com/giuliapuntoit/RL-tcp-toycase
[3] SARSA implementation example:
https://www.geeksforgeeks.org/sarsa-reinforcement-learning/?ref=rp
[4] How to evaluate RL algorithms:
https://towardsdatascience.com/reinforcement-learning-temporal-difference-sarsa-q-learning-expected-sarsa-on-python-9fecfda7467e
[5] Yeelight smart bulb: https://us.yeelight.com/