IoT Sensor Gym: Training Autonomous IoT Devices with Deep Reinforcement Learning

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Controlling IoT Sensors Like Games
Current IoT solutions often rely on manual, static configurations or fine-tuned algorithms that fail to suit all nodes of large-scale IoT systems.

Deep reinforcement learning proved to be effective in training autonomous agents, for instance to play games. Agents are able to make complex decisions and learn in non-stationary environments. This enables scalable solutions for heterogeneous devices to act optimally in dynamic and non-stationary environments.

A Framework for Training IoT Devices
We built the IoT Sensor Gym as an extension to the OpenAI Gym framework. Sensor Gym provides an environment specific to constrained IoT devices, with an emphasis on their energy budget.

IoT devices are simulated using a variety of models which can be combined and configured to match various use cases.

Example: Duty-Cycle Optimization
We trained RL agents using the PPO algorithm to control solar-powered IoT nodes autonomously [1] and designed a reward function reflecting the application goals of an IoT system:

- Utilizing as much of the incoming solar energy as possible.
- Operating without failing by depleting its buffer.
- Having a duty cycle with low variance to ensure steady data collection.

References