

# GYM4REAL: A BENCHMARK SUITE FOR EVALUATING REINFORCEMENT LEARNING IN REALISTIC DOMAINS

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## MOTIVATION

Can we **really** trust the widely used RL benchmarks when it comes to solving control problems in **real-world safety-critical scenarios**?

### DAMENV

**Goal:** plan the water release to satisfy the daily water demand while preventing the reservoir from exceeding its maximum capacity and causing overflows.

$$\min \sum_{t=1}^T \left( \sum_{f=1}^F w_{f,t} + c_t \right)$$

**Simulator:** mathematical model of a water reservoir system influenced by a configurable lake model.

**Data:** historical daily records of water level, demand, and inflow in the period from 1946 to 2010.



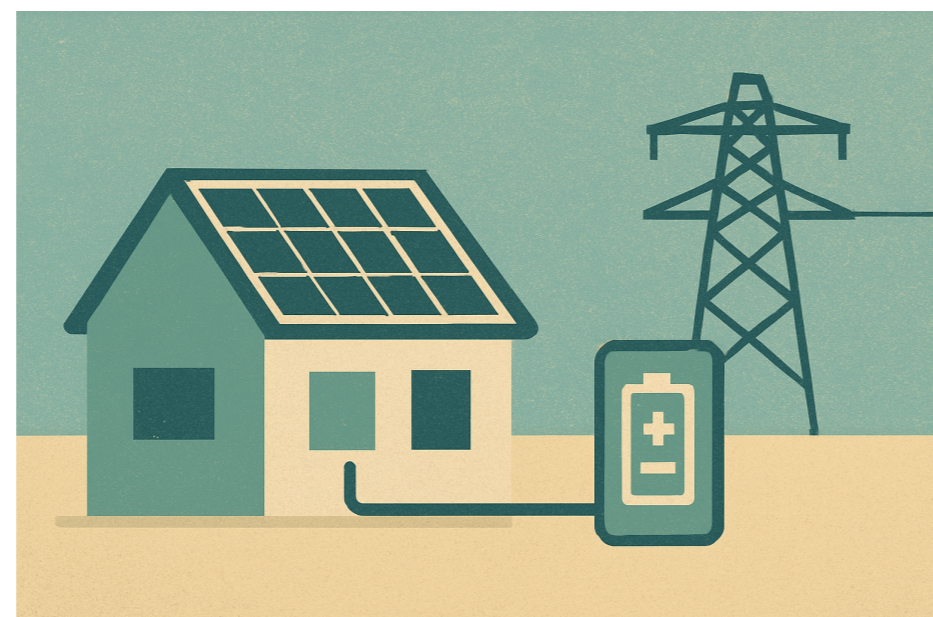
### MICROGRIDENV

**Goal:** optimize the energy management by minimizing trading and battery costs.

$$\max \sum_{t=1}^T [r_{\text{trad}}(a_t) + r_{\text{deg}}(a_t)]$$

**Simulator:** digital twin of a battery integrated with exogenous realistic signals.

**Data:** real-world data of renewable energy generation, consumption and market prices.



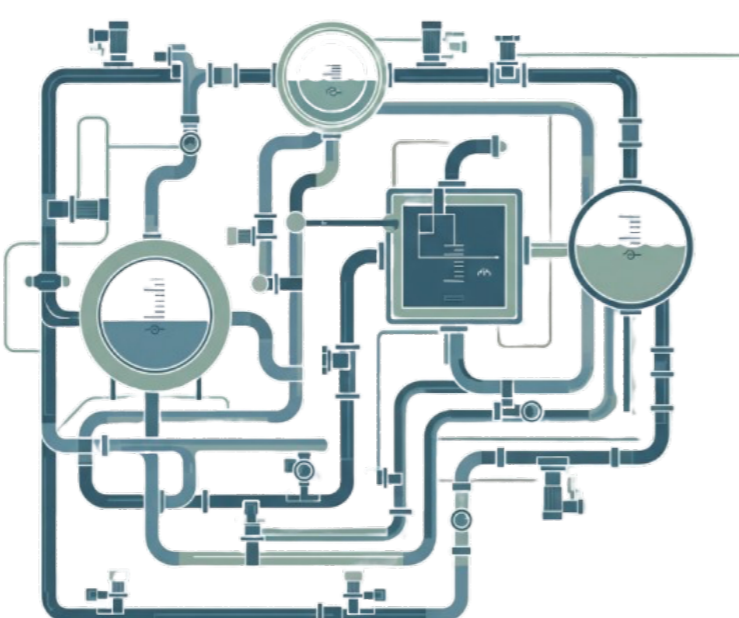
### WATERDISTRIBUTIONSYSTEMENV

**Goal:** foster network resilience by maximizing the DSR while minimizing the overflow risk.

$$\max \sum_{t=1}^T [r_{\text{DSR}}(a_t) + r_{\text{of}}(a_t)]$$

**Simulator:** hydraulic analysis framework Epanet providing mathematical solvers.

**Data:** synthetically generated residential water demand datasets using STREaM.

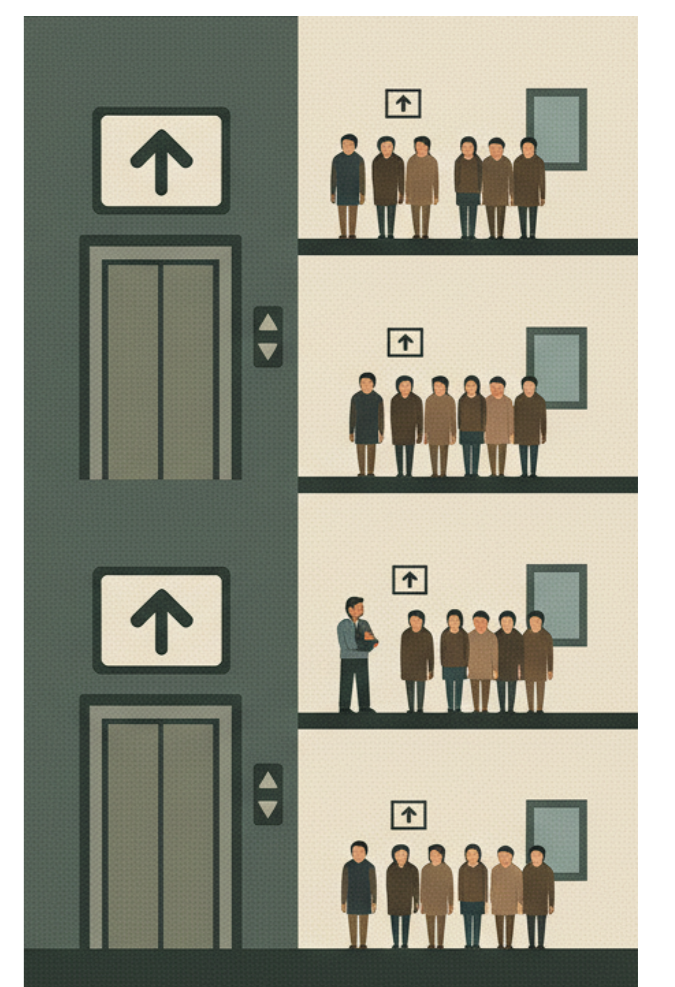


### ELEVATORENV

**Goal:** minimize the cumulative *waiting time* of all transported passengers within a time period

$$\min \sum_{t=1}^T \left( \sum_{f=1}^F w_{f,t} + c_t \right),$$

**Data:** passenger arrival profiles are synthetically generated using a Poisson process, with the arrival rate uniformly sampled for each floor independently.

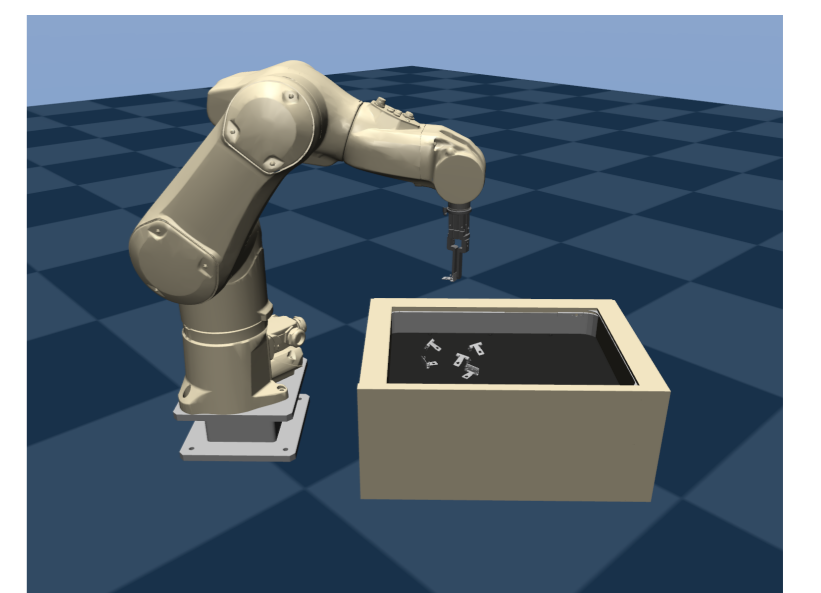


### ROBOFEEDERENV

**Goal:** hierarchical task aimed to

1. determining the *picking order* of the objects
2. identifying the precise *grasping point* on each object for successful pickup and placement

**Simulator:** Mujoco robotic world + top-bottom robot viewpoint.



### TRADINGENV

**Goal:** learn a profitable intra-day strategy dealing with non-stationary markets and low signal-to-noise ratio.

**Data:** historical foreign exchange time-series relative to the EUR/USD currency pair.



Paper



GitHub

