

# CS258 Final Project Proposal

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**Project Title:** Learning to Survive in a dual-objective environment

**Introduction:** We propose to design a lightweight 2D gridworld to study **Dual-Objective Reinforcement Learning**. In this environment, an agent must balance two competing goals: **Efficient Navigation** (reaching a designated goal) and **Resource Collection** (gathering reward items), while avoiding obstacles. Rather than optimizing for a single task, the agent must learn policies that find optimal trade-offs between these two distinct objectives.

## Work Scope:

- **Simplified Environment Design:** To minimize development time, we will implement a basic 2D gridworld. The state space will use a compact representation encoding the agent's position relative to the goal, nearest items, and static obstacles.
- **Dual-Objective Formulation:** We will focus on the conflict between:
  - Task Completion: Reaching the goal position as quickly as possible.
  - Maximization: Deviating from the optimal path to collect reward items.
- **Reward Mechanism Investigation:** Addressing the challenges of dual-objective rewards, we will experiment with different scalarization techniques to combine these two terms, specifically comparing Linear Scalarization and Reward Scheduling.
- **Algorithm Implementation & Analysis:** We will adapt PPO (Proximal Policy Optimization) to this dual-objective setting. The core analysis will focus on how different reward combination schemes affect the agent's final policy and convergence speed.

**Expected Outcomes** We expect to demonstrate how different reward shaping techniques influence the agent's behavior—ranging from "greedy" collectors to "efficient" navigators. This project aims to provide hands-on insight into the stability of RL when facing conflicting reward signals, without the overhead of a complex simulation environment.