Topic: Soul-like Gaming AI

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Abstract

1.   Problem/Goal

Our project aims to develop a reinforcement learning agent to defeat specific bosses in soul-like games. Soul-like games are focused on skill combinations and choices, precise execution, and sharp judgment. Training an agent to beat the final boss of Hollow Knight: Silksong, "Lost Lace" is our aim.

2.   Method

We will begin with a *Deep Q-Network (DQN)* for training, with *Proximal Policy Optimization (PPO)* as a backup for stability. The agent will learn through repeated gameplay to know the game status, operations, boss health, and boss skills. Our training environment will include two mods, *ShowDamage−HealthBar* mod to show the boss's health, and *StakesofMarika−RebirthAnywhere* for instantly reviving the playable character to speed up training.

We expect the reward system to provide positive feedback for successful attacks, survival time, and victory, while punishments are planned for taking damage, failing to attack, or losing the battle.

3.   Challenge

The newly released *Hollow Knight: Silksong* offers no prior AI benchmarks, requiring us to design the training pipeline, reward system, and stability measures from scratch. Despite selling over five million copies, only 0.8% of Steam players defeated the final boss, *Lost Lace,* which has three phases and over ten skills, creating unpredictable patterns that force the agent to generalize rather than memorize. Long battles and frequent resets also cause sparse rewards and high computational cost, making learning efficiency a challenge.

4.   Application

Our agent framework can be adapted beyond *Lost Lace* to other games and bosses with minor adjustments. The same methods could extend to robotics, autonomous driving, or industrial simulations, where agents must adapt and optimize under unpredictable conditions. Thus, the project serves both as a contribution to game AI and as a testbed for real-world problems.