Reinforcement Learning Based Continuous Control for Autonomous Navigation

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I. Abstract

This abstract presents a project on **Reinforcement Learning (RL) based continuous control for autonomous navigation**. The primary goal is to train robotic agents to reach target locations while avoiding obstacles using RL algorithms such as Deep Q-Network (DQN), Proximal Policy Optimization (PPO), Deep Deterministic Policy Gradient (DDPG), and Soft Actor-Critic (SAC). The simulation environment is a 2D continuous world created with PyGame, Gymnasium, or PyBullet, where the agent perceives distance to obstacles, angle to the target, and collision feedback. Performance is evaluated based on metrics such as time to reach the goal, collision count, and convergence rate. Comparative analysis demonstrates differences between on-policy (PPO/A2C) and off-policy (DDPG/SAC) algorithms. Additionally, the framework is extended to a self-driving car simulation, focusing on lane-keeping and overtaking tasks, evaluated through lap time, lane deviation, and collision frequency. The study emphasizes discrete vs. continuous control trade-offs and showcases RL's potential for adaptive navigation systems.

II. References

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