**Paper Information**

**Authors**: Haiyue Ma, Siqi Wang, Shouwu Zhang, Song Ren, Heng Wang

**Title**: Map-less End-to-end Navigation of Mobile Robots via Deep Reinforcement Learning

**Type (journal/conference)**: Conference

**Publication Date**: 2023

**Number of Citations**: 2

**Contributors**

**Primary Reader**: Xinyang

**Proofreader**: Ben

**Research Focus**

Unlike the traditional mapped navigation strategies, the paper research how mobile robots can navigate using deep reinforcement learning without maps. It particularly focusses on end-to-end navigation in unknown environments. Research attempts to improve and evaluate the mobile robot’s obstacle avoidance and real-time decision navigation ability when it meets the dynamic and unpredicted condition.

**Technical Details**

**Models**: The authors build a deep reinforcement learning model named Long-Term TD3 integrated Long Short-Term Memory (LSTM) and TD3 (Twin Delayed DDPG) methods to enhance the robot’s ability to make better motion predictions by preserving past observations.

**Datasets**: The research frame deploys on robot TurtleBot3-Waffle-Pi, taking 2D-Lidar sensor as state representation involved a creative reward mechanism that considers for multiple navigation factors, addressing the issue of sparse rewards in RL. The state space is 76 dimensions and consists of 3 frames of time-stepped LiDAR data (24 dimensions per frame), target coordinates, linear and angular velocities of the robot.

**Training**: The LTD3 was used for end-to-end navigation training and compared to DDPG, PPO, and TD3,

**Key evaluation metrics**: Training Efficiency, Navigation Success Rate, Trajectory Smoothness

**Outcomes**

This paper demonstrates that the LTD3 model involved long-term memory capabilities have more effective performance for map-less navigation in dynamic environments than other DRL methods such as DDPG, PPO, and TD3.

Through substantial simulation experiments in Gazebo, LTD3 demonstrated smoother and more efficient trajectories, reducing detours and unwanted obstacle avoidance. The comparison tests show that LTD3 successes a 96.5% success rate in static environments, higher than TD3 (95%), PPO (77.5%) and DDPG (70.5%) and 83.5% in dynamic scenarios, exceeding the performance of other algorithms.