Deep Reinforcement Learning Driven SLAM and Navigation System for Airport Robots

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Abstract

A DRL-driven SLAM and Navigation System for airport robots could enable robots to find the most efficient paths, reducing travel time and increasing productivity. However, to solve the practical challenges, our team has devoted to increasing the accuracy and improving the algorithm performance.

1 SLAM Technology

SLAM (Simultaneous Localization and Mapping) in navigation is an important and complex topic. It is one kind of technology that allows a robot or an automated navigation system to localize its own position and build a map of the environment while exploring it. SLAM is extensively employed in dynamic navigation, e.g., unmanned vehicles, and indoor robots. However, it also faces numerous challenges, including maintaining accuracy in dynamic environments and computational performance optimization.

About the main applications of SLAM in the field of navigation are as follows:

1. Self-driving cars
2. Indoor robotic navigation
3. Drones
4. Augmented Reality (AR) and Virtual Reality (VR)
5. Exploration and search and rescue operations

2 Deep Reinforcement Learning

2.1 Theoretical foundation

Deep Reinforcement Learning (DRL) is an advanced field in Artificial Intelligence that combines the principles of deep learning and reinforcement learning. It is a powerful method for training algorithms to make a range of decisions by interacting with complex, uncertain environments. It can help with high-dimensional data and complex environments, and is able to adapt to changing environments, learning the best strategies through continuous feedback.

3 Integration of DRL with SLAM:

3.1 Experiment Procedure

This table below provides a streamlined overview of the steps involved in a research project, from defining the question to reporting the results.

Step	Description
Define Research Question	Clearly articulate the specific problem or question to be addressed.
Literature Review	Review existing research to identify gaps and understand previous DRL applications.
Research Design	Choose an appropriate experimental design that aligns with the research question.
DRL Model Selection/Development	Select or develop a suitable DRL model for the task.
Data Collection	Gather or generate relevant data for training and testing the model.
Model Training and Experimentation	Train the DRL model and conduct experiments to test the hypothesis.
Data Analysis	Analyze experimental results using appropriate statistical methods.
Interpretation and Reporting	Interpret results in relation to the research question and report findings.

3.2 Innovation Idea