A Diagnosis System to Find Map Escape Bugs in Metaverse System using Reinforcement Learning

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Abstract

In this paper, we introduce a diagnostic system based on reinforcement learning to detect and prevent map escape bugs within metaverse environments. The proposed system employs reinforcement learning techniques to identify map escape bugs by controlling avatars' movements within the metaverse space. Additionally, we present a reinforcement learning diagnostic system for larger metaverse spaces that utilize the Region divide and conquer approach based on spatial structures to diagnose map escape bugs efficiently.

Keywords: Metaverse, Map Escape Bug, Reinforcement Learning

1 Introduction

Metaverse is an immersive media environment that applies to various content such as communication and economic activities in a 3D virtual environment [1]. Within a metaverse environment, a user places significant importance on interacting with remotely participating users, including moving their avatars, conveying emotions, engaging in voice communication, or chatting.

Nonetheless, a user's avatar interacting with the metaverse map can sometimes lead to a map escape bug [2]. A map escape bug is an anomaly wherein a user's avatar inadvertently strays into a restricted map, resulting in unintended consequences for users and metaverse developers. Firstly, this can lead to prematurely disclosing maps not intended to be accessible yet. Secondly, users ensnared by map escape bugs may be unable to progress through specific events within the metaverse. Lastly, some users might exploit these bugs to gain an unfair advantage in games and competitive events within the metaverse.

We present a diagnosis system to find a map escape bug to address this issue. The proposed method leverages a metaverse avatar agent developed using reinforcement learning techniques and considers the metaverse space's three-dimensional structure.

2 Proposed System

Figure 1 illustrates the architecture of the map escape bug diagnosis system within the metaverse, as proposed in this paper. Within the metaverse environment, avatar agents employ a combination of actions,

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Figure 1: System Overview

including movement, rotation, jumping, and crawling, to detect map escape bugs within the virtual map. For implementing the metaverse environment, we utilized Unity's ML Agent, designed to facilitate exploration through reinforcement learning based on the proximal policy optimization (PPO) framework. The proposed system introduces a novel approach called the "region divide and capacitor method." This method effectively divides the survey areas and determines the sequence for conducting searches. It considers the metaverse maps' three-dimensional nature, their substantial size, and the varying accessibility based on event dynamics. Through this method, the reinforcement learning agent can successfully detect map escape bugs while undergoing the reinforcement learning process, even in the case of expansive maps.

3 Conclusion and Future Work

This study introduced a diagnosis system to find map escape bugs rooted in reinforcement learning, designed to identify and explore map escape bugs within the metaverse. The proposed method enables reinforcement learning agents to efficiently navigate and inspect metaverse spaces by partitioning them into distinct areas, facilitating the detection and resolution of map escape bugs within the intricate three-dimensional metaverse environment. In future research, we aim to expand the capabilities of this system to detect a broader range of bugs and anomalies.

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