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An Artificial Intelligence-Based Approach for Simulating Pedestrian Movement

Abstract:

This paper proposes a novel approach for simulating pedestrian movement behavior based on artificial intelligence technology. Within this approach, a large volume of microscopic pedestrian movement behavior types were collected and encapsulated into an artificial neural network via network training. The trained network was then fed back into a simulation environment to predict the pedestrian movement. Two simulation experiments were conducted to evaluate the performance of the approach. First, a pedestrian-collision-avoidance test was conducted, and the results showed that virtual pedestrians with learned pedestrian behavior can move reasonably to avoid potential collisions with other pedestrians. In addition, a critical parameter, i.e., defined as "reacting distance" and determined to be 2.5 m, represented the boundary of the collision buffer zone. Second, a pedestrian counterflow in a road-crossing situation was simulated, and the results were compared with the real-life scenario. The comparison revealed that the pedestrian distributions, erratic trajectories, and density–speed fundamental diagram in the simulation are reasonably consistent with the real-life scenario. Furthermore, a quantitative indicator, i.e., the relative distance error, was calculated to evaluate the simulation error of pedestrians' trajectories between the simulation and the real-life scenario. We considered the proposed approach to be capable of simulating human-like microscopic pedestrian flow.