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Shadow obstacle model for realistic corner-turning behavior in crowd simulation

Key words: Corner-turning behavior, Crowd simulation, Safety awareness, Rule-based model

Corresponding author: Gao-qi He
E-mail: hegaoqi@ecust.edu.cn

ORCID: http://orcid.org/0000-0001-8365-0970

Motivation

- Human crowd is a fascinating phenomenon in the real world. The simulation of human crowds has recently drawn increasing attention from experts in various types of fields.
- Current crowd simulation models are still inconsistent with the empirical observations because of the complexity of human behaviors.
- Corner-turning behavior is one of the problematic issues that have not been studied in depth. Although several studies on this topic exist (Watt,1993; Snook, 2000; Rojas *et al.,* 2013), only a few have considered the effect of human psychology and individual differences in this issue.

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Main idea

- Inspired by the observations that people tend to enlarge their viewing range to select a safer route when turning a corner, we present shadow obstacle (SO) model, which can generate a more realistic corner-turning behavior.

- The proposed model can be easily integrated into current local behavior models.

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Method

1. Introduce the concept of shadow obstacle and design the corner-turning rules according to the observation that people tend to enlarge their view range when turning a corner. The rules can
   (1) Determine whether the agent is turning the corner or not;
   (2) Compute the best velocity direction.
2. Establish a full crowd simulation framework by combining global navigation, local behavior, and physical collision together.
3. Carry out various experiments based on the proposed framework.

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Major results

- Our model can generate more realistic corner-turning trajectories.

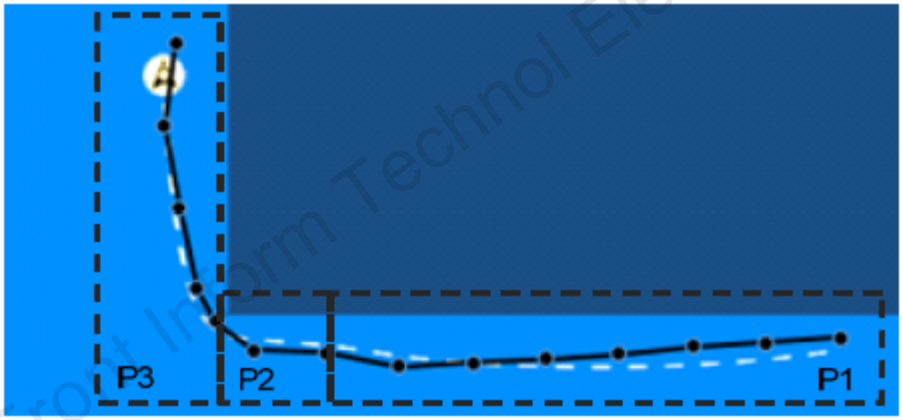
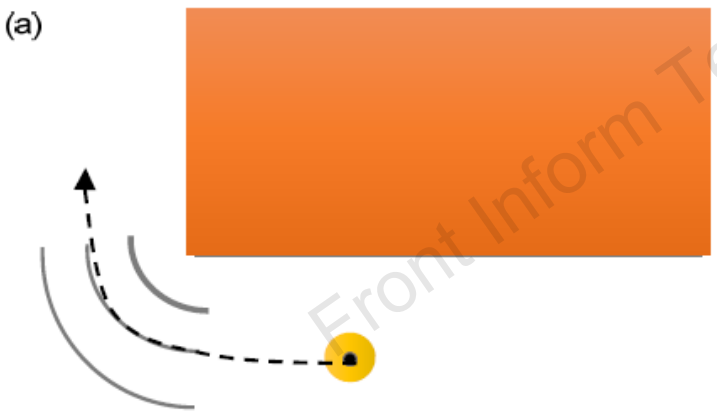


Fig. 9 Comparison of the trajectory reported in Hashimoto *et al.* (2013) (black) with the trajectory generated by the SO model (white)

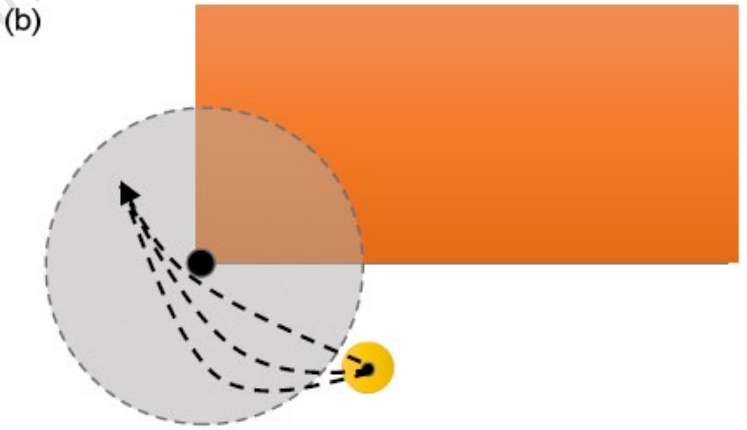
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Major results (Cont'd)

- Compared with Rojas's method, Our method takes human psychology and individual differences into account and the trajectories generated by our method are diverse and more natural.



Rojas's method



Our method

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Conclusions

- Inspired by the observations in a recent survey, this paper presents a novel model, the shadow obstacle model, to generate the realistic corner-turning behavior in crowd simulation.
- We implemented our model using a rule-based approach, and a corresponding framework was established to perform the full crowd simulation.
- We demonstrated the believability of our model through a series of simulations, including the comparisons with the real data and the parameter analysis of the proposed model.

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