How Do People Queue – A Study Of Different Queuing Models

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When observing crowds, an interesting aspect is the queuing behavior of people. Many different situations force people to queue: Waiting for a ticket counter, lining up for a train or bus, queuing in front of bottlenecks or simply waiting at a supermarket checkout. Such queues can be categorized into three main classes: (a) Organized queues: flexible demarcation tapes or barriers dictate the formation of a queue, (b) Queues in front of bottlenecks: Queues which naturally form in front of bottlenecks and (c) Unorganized queues: Queues which form without demarcation utilities (Fig. 1a)

For the first type of queues a lot of research has been done, inspired from classical queuing theory ([1], [2]). Here, the objective is to predict queue lengths and waiting times to make decisions about service provisions. Thus, a one-dimensional approach is sufficient, since the formation of the queue is given by the demarcation. The focus lies on waiting times and queue lengths.

The second type of queue was examined by Koester [3]. The authors state that people do not queue naturally in "mush-room"-shaped formations in front of bottlenecks. However, that is what most simulation models produce. In fact, the authors posit that pedestrian queue loosely in front of bottlenecks.

For the third type of queues we propose an agent-based model which allows approaching agents to line up at the end of the queue with a certain derivation from the queuing direction. This leads to a dynamic formation of queues. The update process is done individually: Each agent knows his predecessor, when the agent in front moves forward, he as well moves forward - with a certain relaxation time. The model produces livelike results for individuals as well as for groups and has been visually validated.

The full contribution covers a thorough investigation of existing queuing models, including the presentation and validation results of the newly proposed model.

(a) Queuing at the Eiffel Tower

(b) Queuing Model for Type 1

(c) Queuing Model for Type 3

References

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