TU Wien Informatics

Agent Based Pedestrian Simulation in Visdom

Stefan Zaufl, BSc
Visual Computing

TU Wien Informatics
Institute for Visual Computing and Human-Centered Technology
Research Unit of Computer Graphics
Supervisor: Univ.Prof. Dipl.-Ing. Dr.techn. Eduard Gröller
Assistance: Dipl.-Ing. Dr. Jürgen Waser

1. Introduction

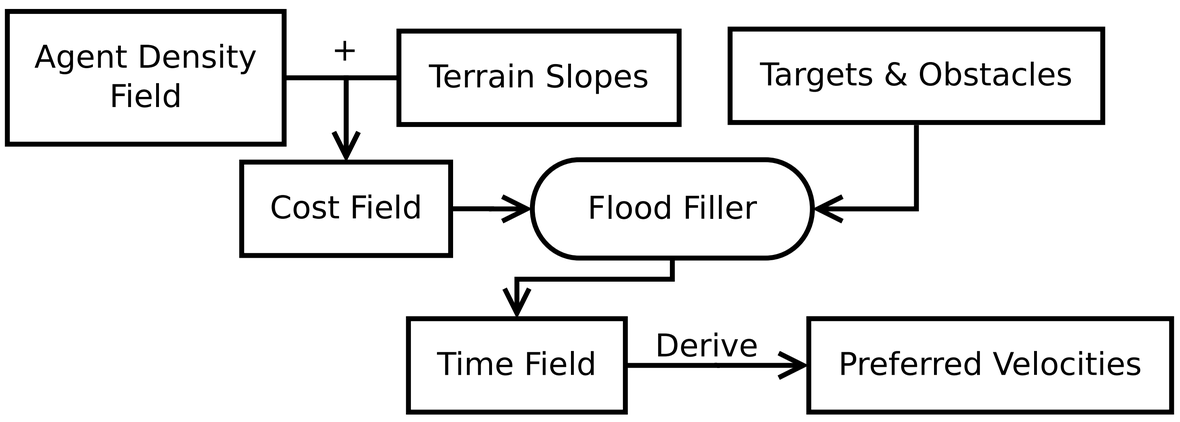
The overall goal of the work is to implement an agent based simulation that should resemble reality as close as possible, yet run in real-time to enable decision makers to respond to changes as fast as possible. Because the user has to make decisions based on the outcome of the simulation, both the visualization of the result and the interactions with the simulated world are important. As a result the interface should feature tools for the user that help identifying dangerous regions in the simulated area, track the path of individual agents, investigate the flow of agents in a bottleneck and change the simulation to discover other threats or solutions in dangerous situations. In our work the framework Visdom [1] is used to control and display the simulation.

2. Simulation Overview

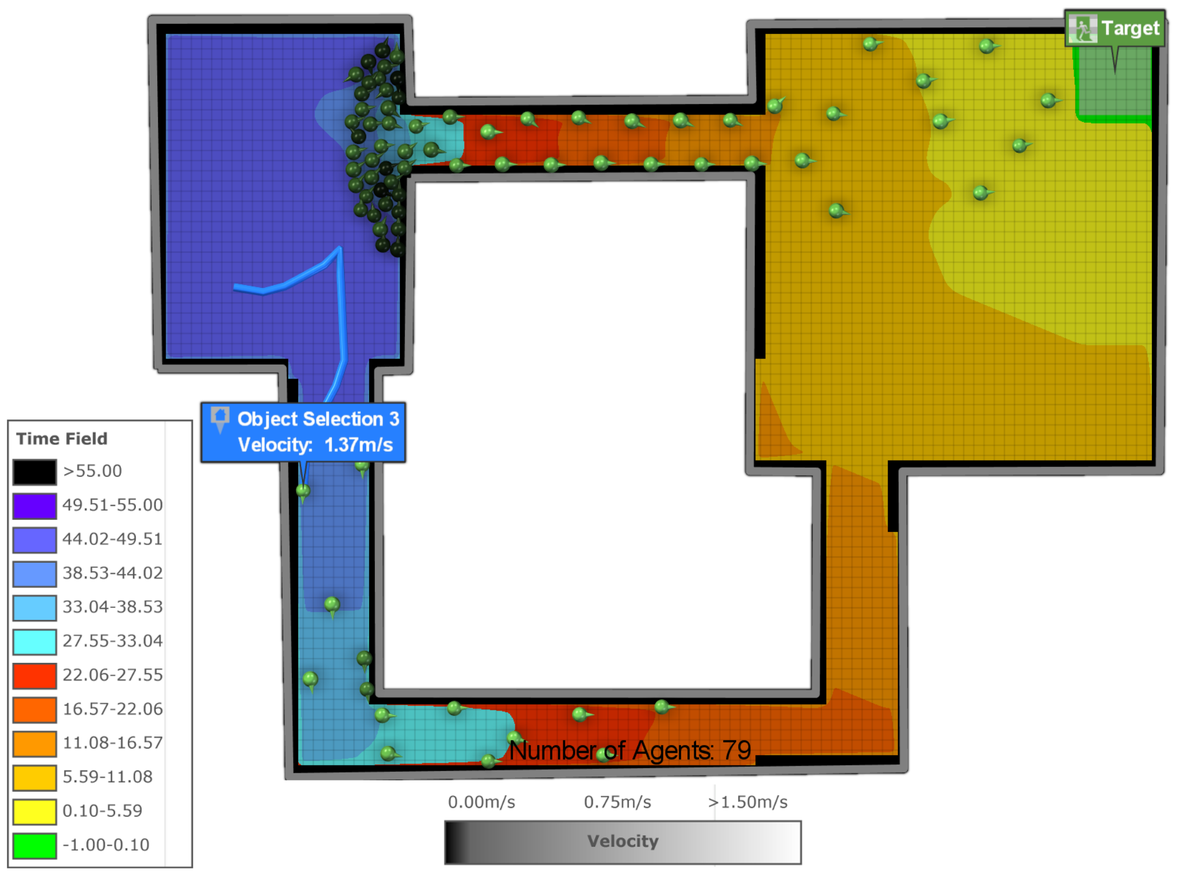
We will use two of the three layers of a pedestrian simulation as defined by Hoogendoorn and Bovy's [2]. The tactical and the operational layer are implemented using a quickest path model by Kreutz et al. [3] and the operational layer is using a variation of the ORCA algorithm by Curtis and Manocha [4].

The tactical layer gets target areas as an input and outputs a vector field, which defines the quickest paths (meaning the path with the lowest estimated travel time) from any point to a target area. The operational layer takes the direction defined by the tactical layer for each agent and moves all agents as closely as possible along this direction without letting agents collide with each other or static obstacles.

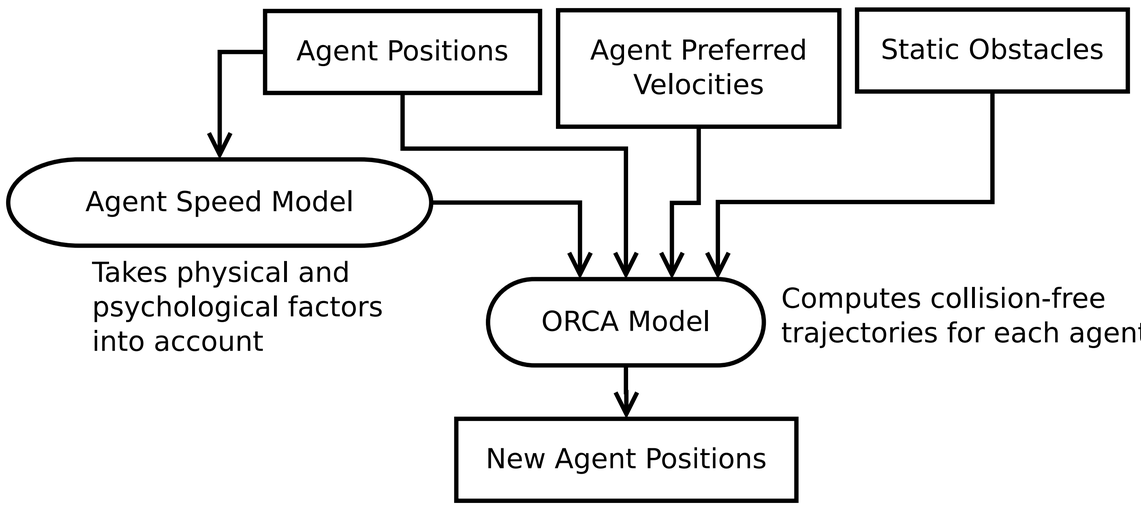
3. Tactical Simulation Layer



The figure to the right shows the time field of a room connected by two corridors and although the bottom corridor is the longer path, some agents choose it over the shorter path which is blocked by a congestion.

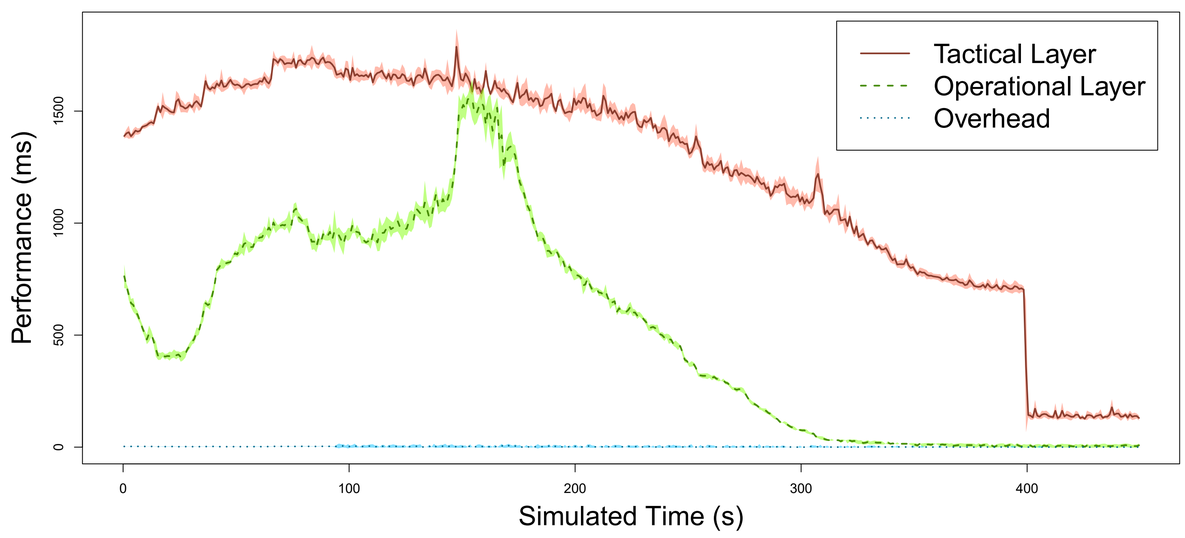


4. Operational Simulation Layer



5. Validation and Case Study

The model combination was validated against the RiMEA [5] Test Cases and by creating a real world scenario. For the real world scenario the Tanzbrunnen in Cologne was chosen. The figure on the left shows how approximatley 12000 agents are clearing the area. The figure on the bottom shows the performance of this simulation. The time on the left of the figure is the time it took to calculate one time step of 100 milliseconds of simulated time. The figure shows that the tactical layer is always the slowest part of the simulation.



[1] Visdom - Integrated Visualization. http://visdom.at/. [Online; accessed 10-November-2021].
[2] Serge P Hoogendoorn and Piet HL Bovy. Pedestrian route-choice and activity scheduling theory and models. Transportation Research Part B: Methodological, 38(2):169–190, 2004.
[3] Tobias Kretz, Andree Große, Stefan Hengst, Lukas Kautzsch, Andrej Pohlmann, and Peter Vortisch. Quickest paths in simulations of pedestrians. Advances in Complex Systems, 14(05):733–759, 2011.
[4] Sean Curtis and Dinesh Manocha. Pedestrian simulation using geometric reasoning in velocity space. In Pedestrian and Evacuation Dynamics 2012, pages 875–890. Springer, 2014.
[5] RiMEA e.V. - Richtlinie für Mikroskopische Entfluchtungs Analysen. https://rimea.de/. [Online; accessed 10-November-2021].

vr vis