Vadere — A simulation framework to compare locomotion models

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VADERE
Crowd Simulation

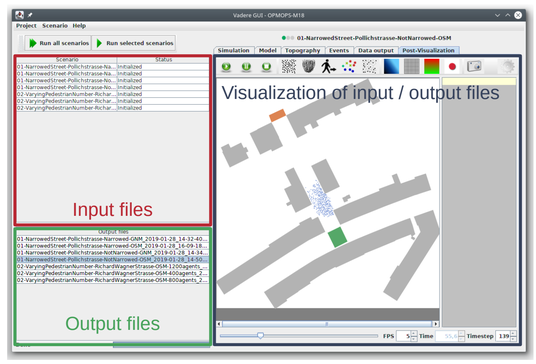
www.vadere.org

Research question

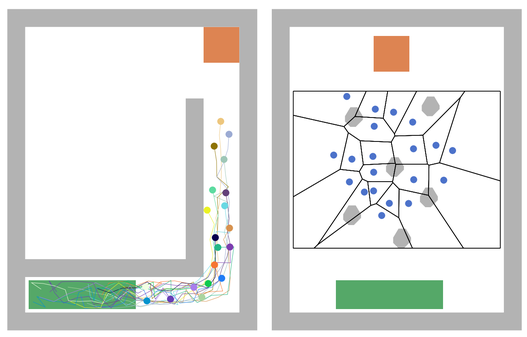
How to find the most accurate microscopic locomotion model to simulate a specific real-world scenario?

Vadere: Core features

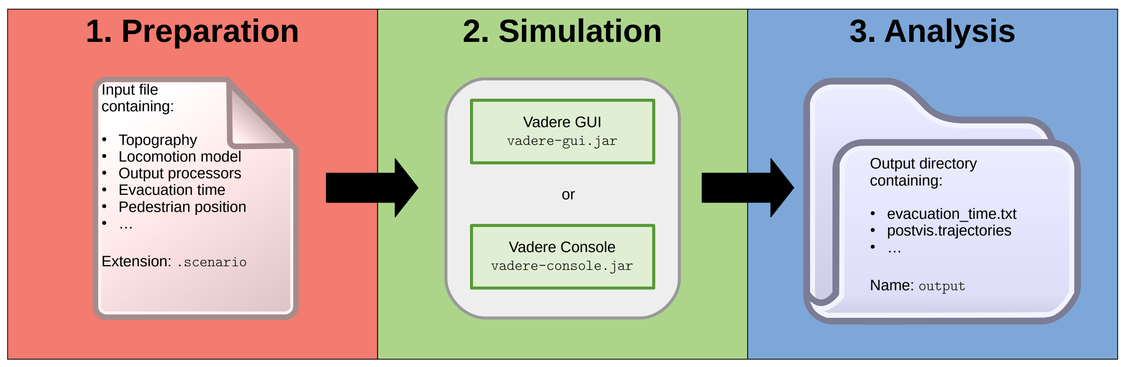
- Free and open source: `www.vadere.org`
- Easy-to-use GUI
- CLI for automation
- Shipped with different locomotion models:
  - Mature: Gradient navigation model (GNM), optimal steps model (OSM) [4], social force model (SFM)
  - Experimental: Behavioral heuristics model (BHM) [3], Reynolds' steering, ...
- JSON-based input files
- Continuous integration / deployment pipeline



Vadere GUI features



Vadere: Running a simulation



Carry out all steps by using the Vadere GUI or, optionally, use 3rd-party software for **1** and **3** [2]

Acknowledgements

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GEFÖRDERT VOM Bundesministerium für Bildung und Forschung

References

[1] Boltes, M., Zhang, J., Seyfried, A., and Steffen, B. (2011). T-junction: Experiments, trajectory collection, and analysis. In *2011 IEEE International Conference on Computer Vision Workshops (ICCV Workshops)*, pages 158–165.

[2] Kleinmeier, B., Zönnchen, B., Gödel, M., and Köster, G. (2019). Vadere: An open-source simulation framework to promote interdisciplinary understanding. *submitted to Collective Dynamics*.

[3] Seitz, M. J., Bode, N. W. F., and Köster, G. (2016). How cognitive heuristics can explain social interactions in spatial movement. *Journal of the Royal Society Interface*, 13(121):20160439.

[4] von Sivers, I., Templeton, A., Künzner, F., Köster, G., Drury, J., Philippides, A., Neckel, T., and Bungartz, H.-J. (2016). Modelling social identification and helping in evacuation simulation. *Safety Science*, 89:288–300.

[5] Zhang, J., Klingsch, W., Schadschneider, A., and Seyfried, A. (2011). Transitions in pedestrian fundamental diagrams of straight corridors and t-junctions. *Journal of Statistical Mechanics: Theory and Experiment*, 2011(06):P06004.

Experiment setup

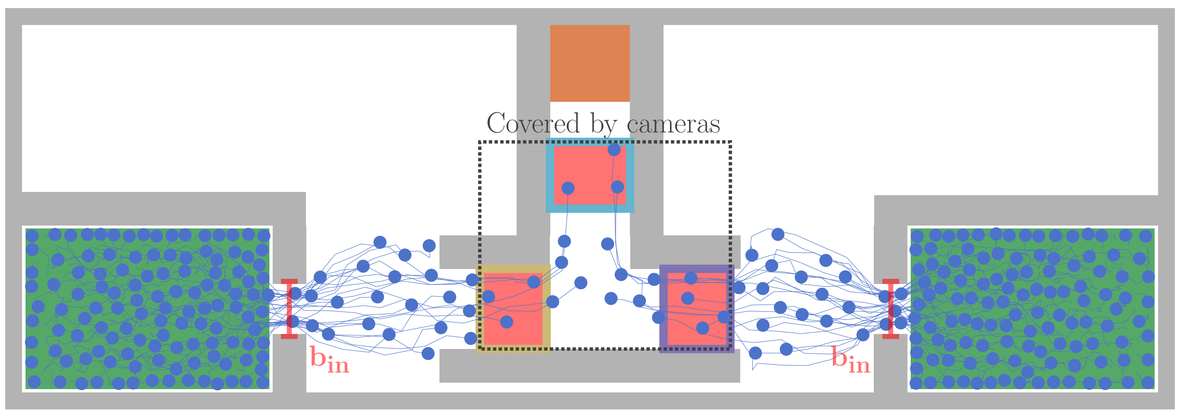
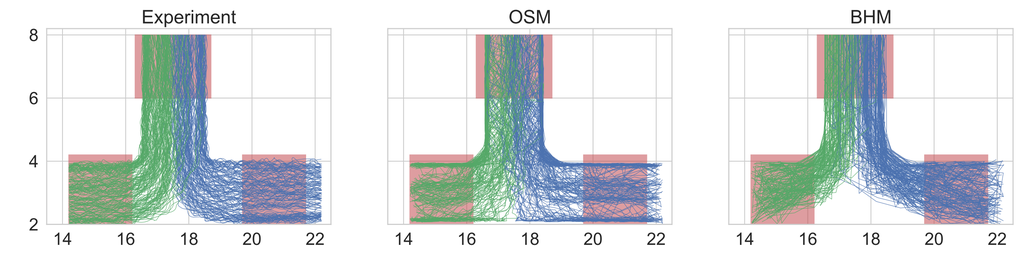


Illustration of the scenario presented in [5, 1]. Agents / pedestrians walk from the green region to their brown destination through the red measurement areas. The width of the entrance b_{in} is varied for each run.

How to compare locomotion models with Vadere

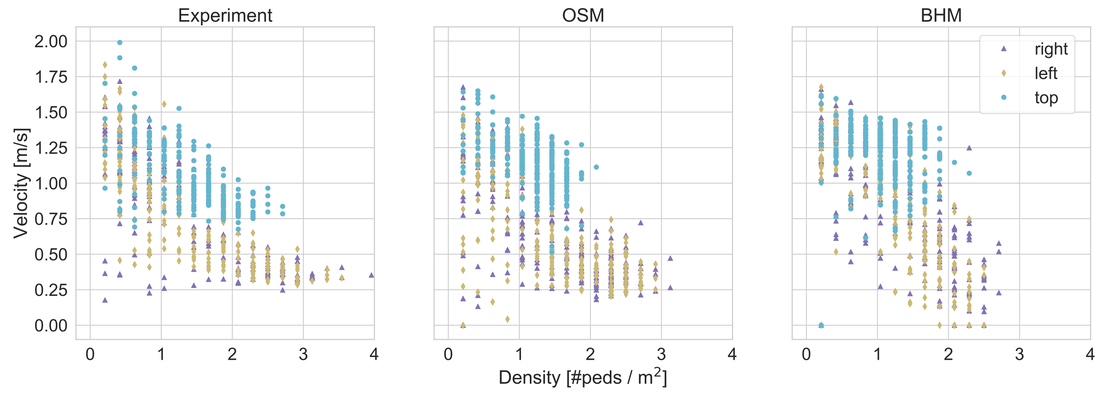
We compare trajectories of the T-junction experiment [5, 1] to trajectories generated by Vadere using the OSM and BHM.

- Trajectories:



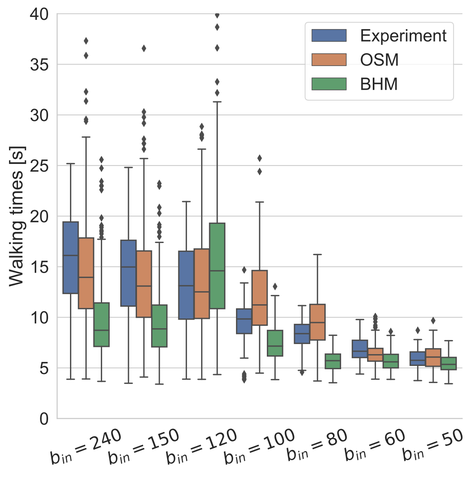
Trajectories for $b_{in} = \mathbf{1.50}\,[m]$. The three measurement areas are highlighted in red.

- Fundamental diagrams:

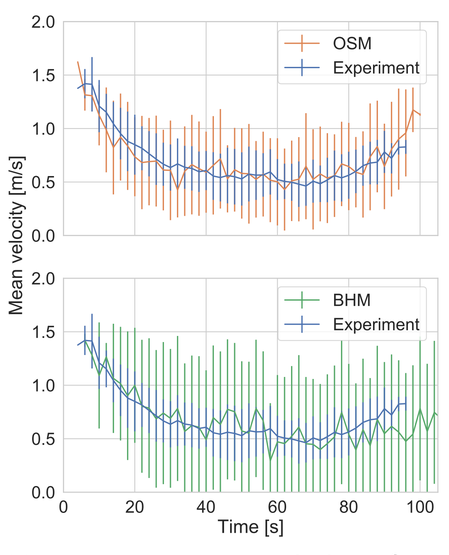


Compare model and experiment trajectories within the three measurement areas.

- Walking times and velocities:



Box plot of the time required by agents / pedestrians to go through the region covered by cameras depicted in the experiment setup. The plot whiskers extend to **1.5** of the interquartile range.



Mean and standard deviation of the velocity of all agents / pedestrians at different times for $b_{in} = \mathbf{1.20}\,[m]$.

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