

ESCAPE: a city-scale evacuation agent-based simulation framework

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Abstract

Partial or total horizontal evacuation of populations in urban areas is an important protection measure against a natural or technological risk. However, casualties during massive displacement in a context of stress and in a potentially degraded environment may be high due to non-compliance with instructions, accidents, traffic jams, incivilities, lack of preparation of civil security or increased exposure to hazards. Working on evacuation plans is therefore fundamental in avoiding casualties caused by improvisation and in promoting self-evacuation whenever possible. Since it is impossible to re-create the conditions of a crisis on the ground to assess such evacuation plans, there is a need for realistic models in order to evaluate them using simulations.

In this paper, we present the ESCAPE software framework that helps in the development of such plans and testing them. In particular, ESCAPE, which uses the GAMA open-source platform as a core component, provides an agent-based simulation tool that supports simulation of the evacuation of a city's population at fine temporal and geographical scales. The framework was developed such that it works for a wide range of scenarios, both in terms of hazards, geographical configurations, individual behaviors and crisis management.

The ESCAPE project gave birth to improved mobility modeling (car, bus, bikes, pedestrians), connection to census and mobility surveys to generate realistic population generation, individualized perception of space for thousands of agents and an improved connection to OpenMole for exploration and optimization, many of which have been integrated into GAMA. In order to show its adaptability, two applications are presented, one concerning the evacuation of the city of Rouen (France) in the context of a technological hazard and the other pertaining to the evacuation of the city of Saumur during a flash flood event [1].

References

- [1] Eric Daudé, Kevin Chapuis, Patrick Taillandier, Pierrick Tranouez, Clément Caron, Alexis Drogoul, Benoit Gaudou, Sebastien Rey-Coyrehourq, Arnaud Saval, and Jean-Daniel Zucker. Escape: Exploring by simulation cities awareness on population evacuation. In *ISCRAM*, 2019.

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