

Anticipation of the evolution of the criminality at the city scale through agent-based simulation

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Abstract

The evolution of criminality is a crucial question to design security policies at the city scale but is often left unexplored in main smart-city scenarios or simulators. Together with the ENSP¹ and the DCSP² in the context of the project MEGA, we built an agent-based simulation of the evolution of the criminality of the French city of Montpellier. Such simulation implemented on the Gama platform enables to demonstrate the interest of such a tool in order to explore potential scenarios and help design adapted policies. The simulation was built using existing police data concerning crimes, victims and criminals, that we used to generate an artificial synthetic population of 50 000 potential criminals distributed on the city of Montpellier at the IRIS³ scale. Such synthetic population corresponds to the statistics available from the police and enables as well to limit the population size in focusing on the potentially active part of the population in the simulation. We generated a synthetic social network among agents taking into account rough statistics concerning their location and age. From this population, the behavioral model of the agents leading them to commit crimes in the simulation is structured through three main components. The first one concerns the moral values and the opinion of the agent, influenced through his social network and that corresponds to his own moral position concerning crime (i.e., whether it is totally unacceptable or could be envisaged depending on the circumstances). The second component corresponds to a risk evaluation and captures roughly the risk of being caught and the consequences. The third component corresponds to the crime modalities: if the first two components are positive (pro-crime and low risk), then the agent elaborates a strategy in order to determine where and when to commit crime. Such modular architecture for the criminal behavior can be seen as oversimplistic, however it presents the advantage of capturing a large spectrum of behaviors (from social influence only, to pure risk evaluation or opportunistic behavior). It has also the advantage to enable and test quite different scenarios of actions from the police (from accompanying the criminals (therefore playing on moral/opinion dynamics), to playing on the consequences if found guilty, but also on more spatial strategies of distributing the police resources). Another main advantage of such model is that it is potentially quite easy to calibrate, as we can use different sources of data to calibrate independently each component. Finally using this model on Gama, we tested different scenarios in order to explore the potential of the proposed architecture. The designed scenarios were encouraging concerning the expressivity of the proposed model to envisage very diverse situations. To name a few, we explored scenarios concerning: the police resources and their spatial distribution, the impact of building a new stadium (that created crime opportunities), the support for juvenile offenders... In any case the aim of such scenarios is not to predict the evolution of criminality but rather by comparison with a base scenario to anticipate potential evolutions and help and test corresponding policies.

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³ Aggregated spatial units for statistical information