Security Horazions

67

Vol. 18
Summer 2025
P.P: 33- 40

Research Paper

Received:
2024-08-28
Revised:
2025-05-17
Accepted:
2025-05-19
Published:
2025-05-19

ISSN: 2538-1857
E-ISSN: 2645-5250

Improving the agent-based modeling method of social unrest with a focus on government legitimacy

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Abstract

Introuction

The study of social unrest from various perspectives is a concern of the Intelligence society. The aim of these studies is to understand the reasons and factors that underlie their control and to achieve their predictive power.

Methodology

The Epstein model is the most accepted factor-based model for modeling social unrest, which has undergone numerous improvements since its introduction. Epstein's model of rebellion against a central authority considers two types of agents moving randomly in a square grid: the protesting population and the authority population, i.e. the police. Both groups act according to the rules of behavior set out in the model. Civilians will become active participants in public violence if their discontent (symbolized by G) exceeds the risk of arrest by a certain threshold, symbolized by T.

In this article, we will first provide a comprehensive review of all the work that has improved this model. Then, the intended improvement to the model will be described and the output of the implemented model will be examined. In this paper, the innovation applied is to change the government legitimacy parameter gradually during the modeling. In the standard model, this parameter is determined once and fixed by the user, which is not the case in the real world, and the government legitimacy can increase or decrease over a period of time, in the eyes of the people (in the model, the agents). In the modeling, this parameter is made

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Publisher: Imam Hussein University

dynamic and removed from the static state and the modeling output is examined.
The modeling is performed in the Netlogo platform environment. Netlogo is the most widely used and powerful agent-based modeling platform. This platform, in addition to the coding capability, also provides a graphical interface. Here, to test the idea, all the parameters of the standard model and the enhanced model have been made the same.

Result

The modeling results in this study show that the most important parameter in reducing the number of active protesters and prisoners is the government legitimacy parameter. Also, it was seen in the modeling that by improving the Epstein model and changing the legitimacy parameter from 0 to 1 and vice versa, the number of peaceful and non-protesters will reach the highest number. Therefore, by focusing on this parameter, the necessary macro-management can be applied in the face of the riot scene.
It can be seen that the number of imprisoned citizens is higher compared to peaceful and active citizens. This means that the number of ordinary citizens – who first became active fighters and, due to the low level of legitimacy of the government, increased their activity and were eventually arrested – is at the highest level.
Also, in places with a low number of peaceful citizens, the legitimacy of the government is at its highest. On the other hand, as legitimacy decreases as the model progresses, the number of peaceful citizens decreases and the number of arrested protesters (black line) increases. And also, the effect of increasing the density of the police force is only manifested in the minimum number of peaceful citizens that coincides with the maximum number of imprisoned citizens. This means that with a high density of police presence, the number of peaceful people does not decrease below a certain level, and on the other hand, the number of prisoners does not increase above a certain level.

Discussion

In the model presented in this article and other previous models, an attempt is made to create a higher similarity with the real behavior of protestors by using more parameters or changing the parameters in a way that is more consistent with the real world, but there is

still a distance from the real behavior of people in a social unrest, and this is due to the limitations of the basic model and the lack of adding more parameters to the model (in subsequent improvements).

Epstein's model attempts to simplify complex human behavior, but the real motivations of people in social unrest are much more diverse and complex than what can usually be implemented in models. The psychological, cultural, and historical factors that influence people's decision-making are difficult to quantify.

Human behavior in conditions of social unrest arises from a combination of numerous psychological, social, cultural, and situational factors that make it difficult to model. Factors such as individual emotions (anger, fear, solidarity), personal history, group identities, and cultural values all influence a person's decision to participate in the unrest. Despite its ability to simulate collective behavior, Epstein’s model faces limitations in quantifying these qualitative factors. Individual differences in tolerance thresholds, risk-taking tendencies, and susceptibility to influence from others also complicate the prediction of behavior. Furthermore, the dynamics of human decision-making are based on learning and adaptation, which change over time, and individuals may react differently to similar situations. This inherent uncertainty in human behavior poses a fundamental challenge to the definitive modeling of social chaos. It seems that generative agent-based modeling can overcome some of these limitations with its approach to more realistic modeling of human behavior.

Conclusion

Since its introduction in 2002, Epstein's model has been tested with numerous empirical data from various riots and its accuracy has been observed to be close to reality (Frank et al., 2022). Since its introduction, numerous ideas and improvements have been made to the standard model, which have led to an increase in the predictive power of the model.

In this article, by making the value of the government legitimacy parameter dynamic, which is a static and constant value in Epstein's initial model of social unrest, it was observed that the atmosphere of protest and chaos is completely dependent on the value of this parameter, in such a way that when the value of this parameter is dynamically increased, the number of protesting

citizens decreases and tends towards the minimum number. Also, the number of peaceful (non-protesting) citizens also tends towards the maximum value. This maximum value in the model represents citizen satisfaction.

It was also observed that increasing the number of police in the improved model will also have a small effect, but not as much as making the value of the government legitimacy dynamic.

This study shows how, in the real world, and by focusing on what parameters, social unrest can be prevented or the chaos that has occurred can be controlled as much as possible, and a forward-looking view of the chaos can be taken.

The change in the standard model is because in the real world, this parameter does not have a linear and constant value and will fluctuate in different periods, depending on the governance conditions.

In subsequent studies, the government legitimacy parameter can be enriched based on other micro-parameters that are seen in various studies in this field.

Keywords: social unrest; modeling; agent-based modeling

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