Control methods for epidemic spread: a Cellular Automata approach

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In this work, we present two control measures for epidemic spread using a Cellular Automata (CA) model. We employ the CA framework to simulate the Susceptible-Exposed-Infected-Recovered (SEIR) epidemic model, where each cell in the CA grid represents an individual in one of the states: Susceptible (S), Exposed (E), Infected (I), or Recovered (R). Initially, we analyze a scenario with fixed individuals and we introduce two doses of vaccination [1]. Our simulations reveal that the time to start the vaccination campaign and the number of immunized individuals are more important than the interval between doses and vaccine efficacy. We also investigate the impact of random vaccine strategy, i.e., the vaccine is applied randomly overall individuals. In this strategy, we observed that a loss of doses occur reducing the effectiveness of the control method. To solve this problem, we simulate a situation where the population is pre-tested, and our results demonstrate that this method is more effective than random campaign. After that, we focus on the SEIR model without vaccination and explore the effects of mobility [2]. Our findings indicate that increase of mobility leads to a higher number of infections, whereas mobility restrictions act as a control measure. Additionally, if mobility restrictions are relaxed, the effects of a second wave of infections emerge. Therefore, our work contributes to understand how vaccination and mobility restrictions can be simulated using simple CA models.

References

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