INCORPORATING BEHAVIORAL FEEDBACK VIA INFORMATION INDEX INTO EPIDEMIC INTEGRAL MODELS

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ABSTRACT

Epidemic modelling has traditionally relied on differential equations to describe the spread of infectious diseases. However, these models often overlook the complex feedback mechanisms introduced by human behavior in response to disease outbreaks. To address this gap, we propose an integral approach that incorporates behavioral feedback through an information index. The information index represents the delayed response of individuals to the evolving epidemic, capturing how public awareness and perception influence behavior over time. This delay is modelled using memory kernels, which characterize the persistence of information in the population's collective memory. Building upon the foundational model by Kermack and McKendrick, we formulate the force of infection as an integral equation, where the current infection rate depends on the entire history of past infections, weighted by the memory kernel. This approach allows for a more accurate representation of how past experiences and accumulated information influence current behaviors and, consequently, the dynamics of disease transmission. Our analysis demonstrates that the inclusion of memory effects can lead to new dynamical behaviors, such as oscillations, which are not captured by standard models. These behaviors have significant implications for understanding the long-term evolution of epidemics and for designing effective intervention strategies that consider the temporal aspects of behavioral responses. Numerical simulations illustrate how different memory kernels, such as Erlang distributions, influence the stability and oscillatory patterns of the epidemic. This research is conducted in collaboration with Eleonora Messina and Claudia Panico from the University of Naples Federico II [1,2, 3].

REFERENCES

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