Modelling the spread of viruses

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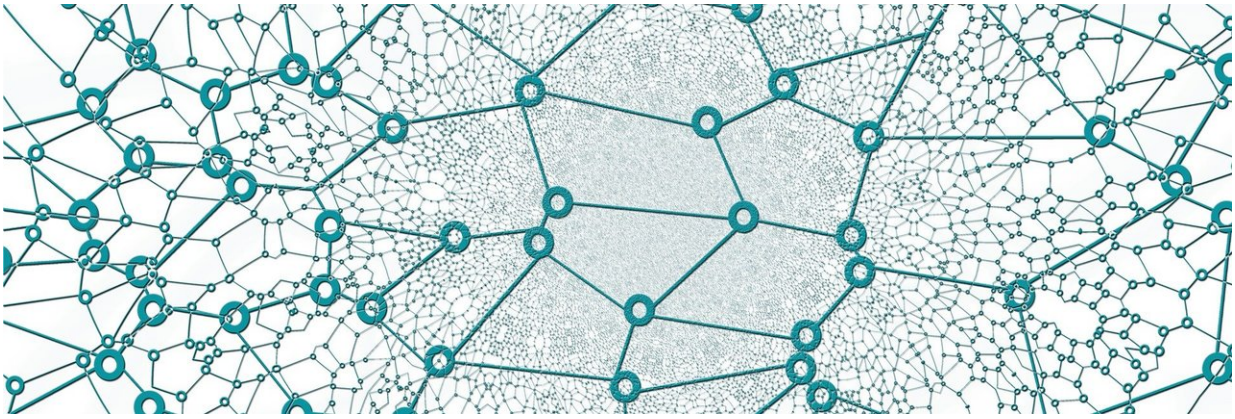

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New research published in the *International Journal of Mathematics in Operational Research* plots a new route for viral propagation in a computer network.

Anis Rezgui of Ecole Polytechnique de Tunisie and Carthage University in Tunisia has examined an earlier approach to studying the way a virus spreads through a network and found that approaches based on stochastic ordinary differential equations. A second approach, a microscopic approach based on a Markov chain has many similarities with SODEs but can take into account the interconnections between nodes in the network and so provide a clear picture of propagation.

Computer security is a multi-billion dollar industry but money aside it is such an important part of the modern world that it must be the focus of much research out of necessity. Rezgui explains that modeling viral propagation through a computer network has been modeled historically in the same way that we model biological viruses, epidemiologically, in other words. There have been two major types of model used, deterministic and stochastic ones each with pros and cons.

This new work focuses on the latter but introduces a novel approach based on the aforementioned Markov chain, which offers a rigorous way to model viral propagation mathematically. It allows researchers to understand the global behavior of the network when exposed to malware infection but homes in on the dynamics occurring at each node in the network alone. Such modeling is critical to understanding how a virus spreads and so offers insights into how it might be stopped in its tracks through network analysis. Incorporating a model into an antivirus system might ultimately be able to halt a novel, or zero-day, infection when the viral signatures are not known beforehand and the virus is starting to spread.

It is perhaps a whimsical notion that such modeling when applied to human society might allow biologists and epidemiologists to spot a new and emerging pathogen, such as a coronavirus, before it spreads widely and to stop infection of social nodes that would otherwise lead to a pandemic, for instance.

More information: Anis Rezgui, A model for viruses propagation throughout networks, *International Journal of Mathematics in Operational Research* (2022). DOI: 10.1504/IJMOR.2021.120036. www.inderscienceonline.com/doi … 04/IJMOR.2021.120036

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