FROM HUMAN BEHAVIOR TO THE SPREAD OF MOBILE PHONE VIRUSES

Abstract

by

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Percolation theory was initiated some 50 years ago as a mathematical framework for the study of random physical processes such as the flow of a fluid through a disordered porous medium. It has been proved to be a remarkably rich theory, with applications from thermodynamic phase transitions to complex networks. In this thesis I discuss the applications of percolation theory to understand the diffusion process of mobile phone viruses. I apply the methodologies that are widely used in statistical physics to uncover the underlying statistical laws of human behavior and simulate the spread of mobile phone viruses in a large population. I find that while Bluetooth viruses can reach all susceptible handsets with time, they spread slowly due to human mobility, offering ample opportunities to deploy antiviral software. In contrast, viruses utilizing multimedia messaging services (MMS) could infect all users in hours, but currently a phase transition on the underlying call graph limits them to only a small fraction of the susceptible users. These results explain the lack of a major mobile virus breakout so far and predict that once a mobile operating system's market share reaches the phase transition point, viruses will pose a serious threat to mobile communications.

These studies show how the large datasets and tools of statistical physics can be used to study some specific and important problems, such as the spread of mobile phone viruses.