RAPID DETECTION OF VIRUSES IN LARGE CONTACT NETWORKS

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In this talk we consider the problem of detecting a virus propagating through a contact network. We are interested in large social networks graphs with thousands or perhaps millions of nodes. The objective is to place a constrained number "honeypots" at a subset of nodes in order to either minimize the expected time until detection or maximize the probability of detection by a certain time. The decision problem can be formulated as a stochastic integer program which is inherently intractable. However, under a variety of virus propagation models, the objective function can be shown to be sub- or super-modular, justifying the implementation of greedy and lazy greedy heuristics. We also investigate solution via Monte Carlo approximation methods. To obtain realistic problem instances we mined a database containing sampled call data, for millions of users, from one of Asia's largest service providers. From a giant component of 1.2 million callers, we sub-sampled smaller networks via a modified k-core procedure in order to test our proposed solution methodologies. We also investigated various connectivity properties of this social network as the k-core size and sampled time interval was varied.