Interacting Viruses in Networks: Can Both Survive?

Alex Beutel
Carnegie Mellon University
abeutel@cs.cmu.edu

B. Aditya Prakash
Carnegie Mellon University
badityap@cs.cmu.edu

Roni Rosenfeld
Carnegie Mellon University
roni@cs.cmu.edu

Christos Faloutsos
Carnegie Mellon University
christos@cs.cmu.edu

How do we model competition between products?

Not perfect competition
Person can use both Chrome and Firefox

Previous work focused on simpler cases

Our Result: A phase transition exists where viruses can co-exists!

Given our SI_{I2}S model and a fully connected graph, there exists an $\epsilon_{\text{critical}}$ such that for $\epsilon \geq \epsilon_{\text{critical}}$, there is a fixed point where both viruses survive.

$$\epsilon_{\text{critical}} = \begin{cases} \frac{\sigma_1 - \sigma_2}{2 \sigma_1} & \text{if } \sigma_1 + \sigma_2 \geq 2 \\ \frac{1 - \sqrt{1 - 4 \sigma_1 \sigma_2}}{2 \sigma_2} & \text{if } \sigma_1 + \sigma_2 < 2 \end{cases}$$

Cooperating Viruses: $\epsilon > 1$

Piggyback Setting: Strong virus helps weak virus survive ($\sigma_2 < \sigma_1$)

Teamwork Setting: Neither virus can survive on its own ($\sigma_2 \leq \sigma_1 < 1$)

Real World Example: (data from Google Insights)

Prediction from our model:

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