CS 103: Lecture 15 Diffusion of Innovations

Dan Sheldon

December 1, 2015

Announcements

- HW 6 out today, due next Tuesday

Diffusion of Innovation

facebook

myspace
a place for friends

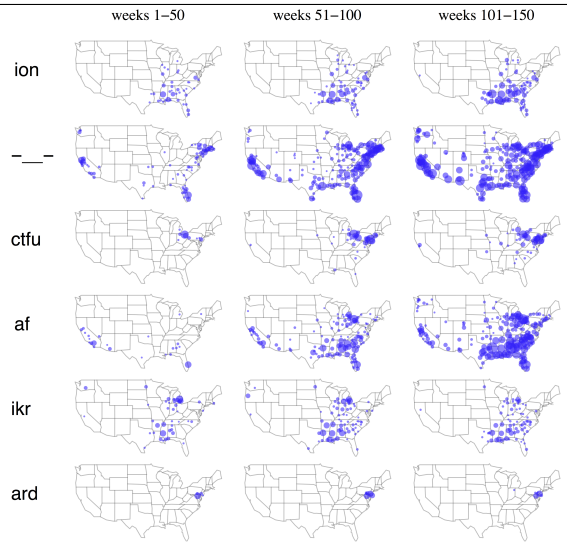
Diffusion of Innovation

Other examples

- Measurement units (metric vs. English)
- Greetings
- Drive on left/right
- Emoticons
- **Language**

Diffusion of lexical change in social media

- Eisenstein, O'Connor, Smith, Xing (2014)
- 107M Twitter messages from 2009–2012



Questions

- How do innovations spread?
- When will they:
  - take over the whole network?
  - fizzle out quickly?
  - spread but they co-exist with other technology?

A Simple Model

Majority rule: I will switch if at least half of my friends switch

Example on board

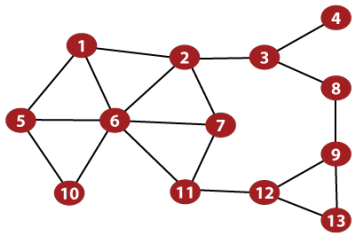
Discussion

- Innovation spreads, but meets natural boundary
- Tightly knit clusters
- Outcome: technologies coexist

Modeling goals

- Decision-making process
- Consequences for spreading behavior in the network

Exercise



- 5 and 6 are initial adopters; majority adoption rule
- Which nodes adopt the technology?
- Remove one edge so only four nodes adopt (total)

Networked Coordination Game

Each node plays a coordination game on each edge. **Board work**

Recap

	X	Y
X	x,x	0,0
Y	0,0	y,y

- X = new
- Y = old
- Node should adopt X if at least $y/(x+y)$ fraction of neighbors adopt X

Clusters

Some new technologies spread but then coexist with old technologies. What limits their spread? **Tightly-knit clusters.**

Definition: an r-dense cluster is a subset S of nodes such that each node in S has at least r fraction of its neighbors inside S

Example on board

Clusters = Barriers to Adoption

Claim (informal): if no one inside a dense cluster adopts new technology, it will not enter the cluster

Claim (formal): If S is a $(1-q)$-dense cluster and no one inside adopts technology, then diffusion with threshold q will not enter S

Proof on board

Clusters = Only Barrier to Adoption

Can spread of innovation stop for another reason (other than dense clusters)? **No**

Claim: suppose innovation spreads according to threshold rule with threshold q and then stops. Let S be the set of nodes that did not adopt. Then S is a $(1-q)$-dense cluster.

Proof: exercise / on board