STRATEGY OF COMPETITION BETWEEN TWO GROUPS

AN INFLEXIBLE CONTRARIAN OPINION MODEL

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OUTLINE

- What is Sociophysics ?
- The basic question we want to answer from opinion models
- Our motivations
- Inflexible Contrarian Opinion model
- Simulation Results
- Conclusions
- What can we do next?

What is Sociophysics ?

- Quantitative laws in the collective properties of a large number of people.
- Quantitatively understand how precise regularities arise out of the apparently erratic behavior of single individuals.

衔接

- Recently transf l declaration of principles to a c
- Opinion dynamics, cultural dynamics, language dynamics, crowd behavior
- *Using methods form statistical physics to solve social problems.*

1: The basic question people want to answer from opinion models

Disorder

Order

2: Why social dynamics are interested to Physicists? What is our advantage?

challenge:

Topology of the interaction network. Traditional statistical physics usually deals with structures whose elements are located regularly in space (lattices) or considers the simplifying hypothesis that the interaction pattern is all to all, thus guaranteeing that the mean-field approximation is correct.

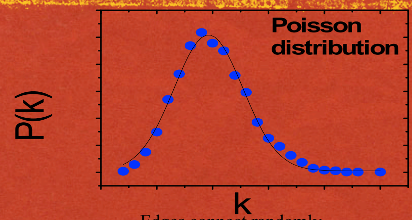
This is hardly realistic in a social context. Much more plausible interaction patterns are those denoted as complex networks.

关系讲清楚。

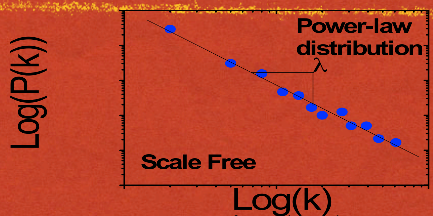
Disorder
Real Human Network

Different Networks

- ER networks: Random Graphs, degree follows a poisson distribution.
- SF networks: degree follows a power law distribution.



Edges connect randomly



Preferential Attachment

Albert-László Barabási

Some Important Definitions for networks

- Size of a network (N) : total # of nodes

- Giant Component (GC) :A set of connected nodes, in the sense that a path exists between any two of them.
  - Size of the GC S_1 : total # of nodes in GC
  - Define: $s_1 = S_1/S$

- Threshold Function $P_c(N)$, such that many properties of the networks exists with probability 0 if $P < P_c$, and with probability 1 if $P > P_c$.

HISTORY OF OPINION MODEL

3: The milestones in the history of opinion model (Agent-based modeling)

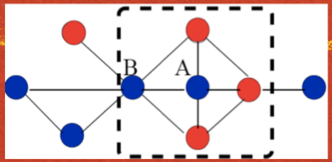
Voter Model (Holley and Liggett 1975): The agents imitate their neighbors

Majority Rule Model (S. Galam *et al*, 2002)

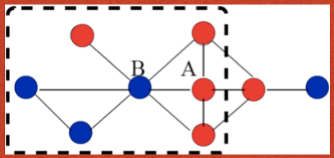
Consensus opinion models

Nonconsensus Opinion Model (J. Shao *et al*, 2009)

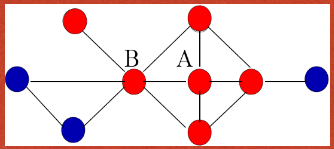
- The Nonconsensus Opinion Model (NCO)



Time 0, Initial Condition



Time 1



Time 2

Final Stable State

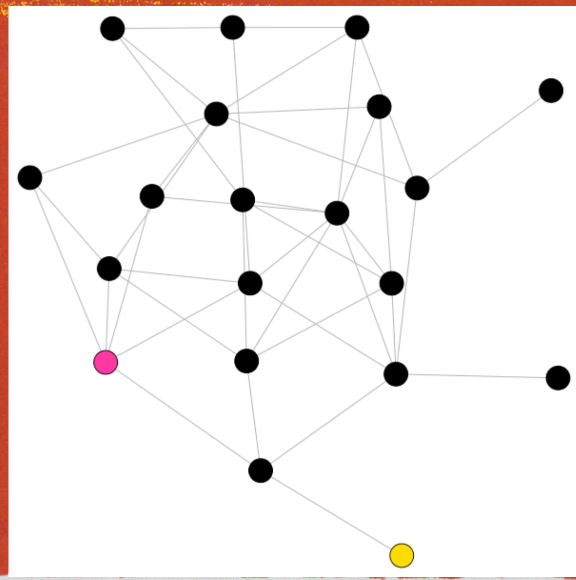
OUR MOTIVATION

Mac VS PC

INFLEXIBLE CONTRARIAN OPINION MODEL

- **Inflexible contrarian**: a node which changes its opinion to take the opposite opinion of its local majority and will keep that opinion forever
- In our model, only one group will send out inflexible contrarians.

INFLEXIBLE CONTRARIAN OPINION MODEL



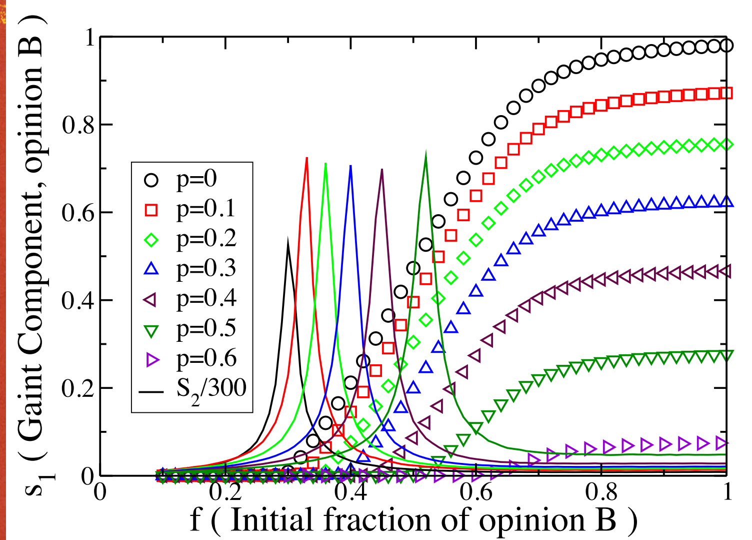
INFLEXIBLE CONTRARIAN OPINION MODEL

Two Methods to Choose Inflexible Contrarian
(A wants to change the opinion of B)

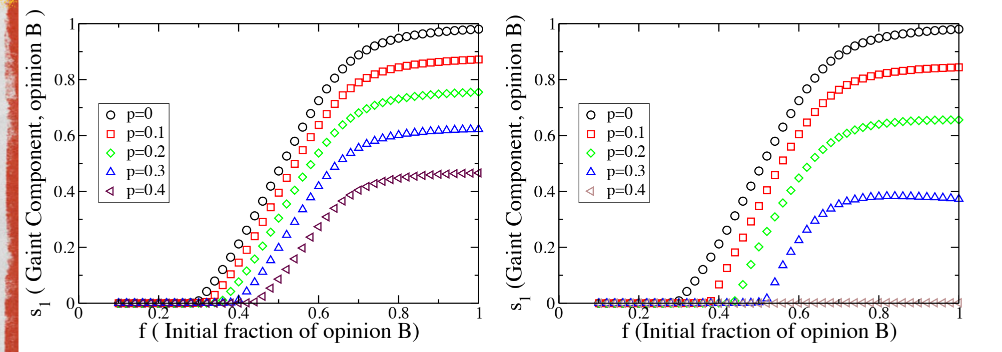
I. Random Method:
Randomly choose p percent of the nodes in state B to become inflexible contrarians

II. Targeted Method:
Choose top p percent of the nodes in state B, according to their degree, to become inflexible contrarians.

Simulation Results on ER networks (Random Method)



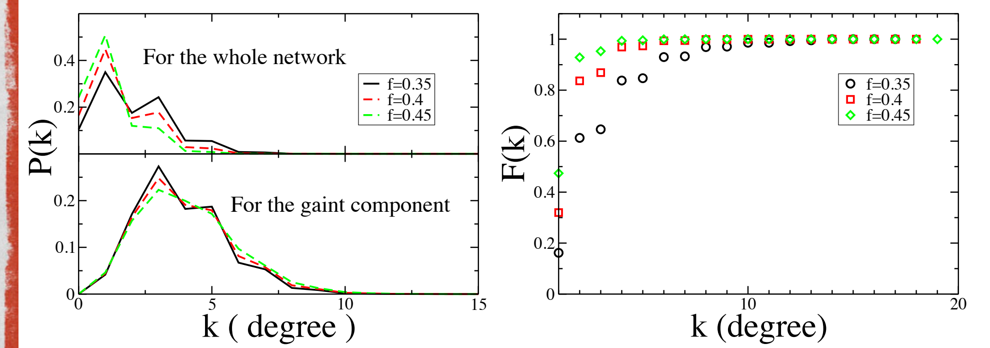
Simulation Results on ER networks



Random Method

Targeted Method

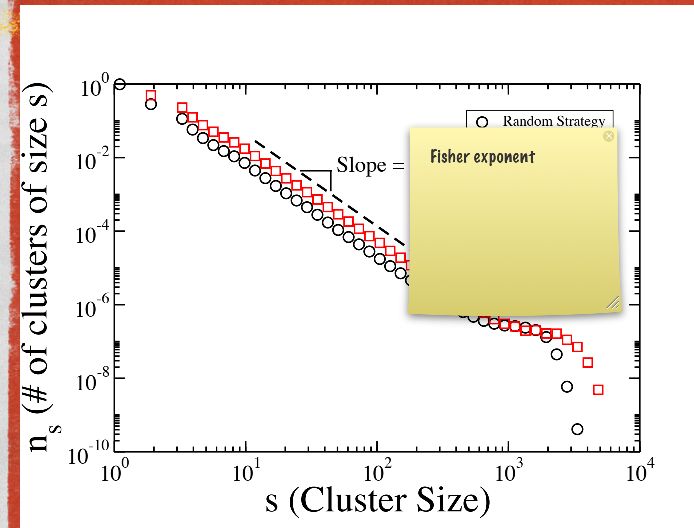
Simulation Results on ER networks



P(k) Degree Distribution

F(k) = # of nodes with degree k in the largest cluster / total # of nodes with degree k

Simulation Results on ER networks
(Universal Scaling Law)

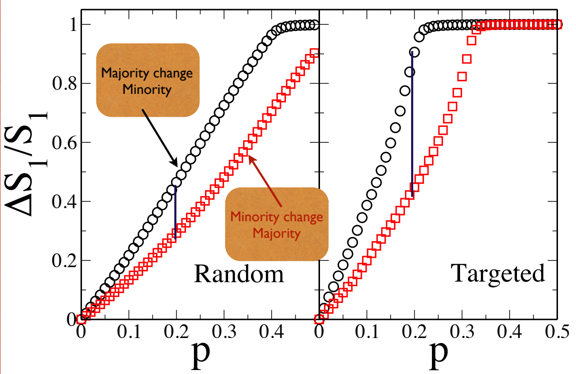


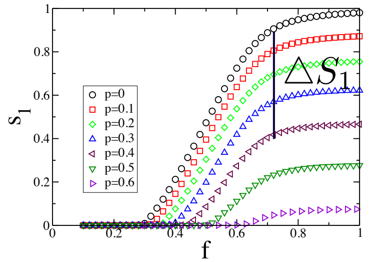
Cluster Size Distribution at Criticality

$$n_s \propto s^{-\tau}$$

ICO Model is in the same universality class as regular percolation

Simulation Results on ER networks





Majority have advantage over Minority

Majority VS Minority

SIMULATION RESULTS

ER VS Scale Free networks

1. Both the random and targeted methods are more efficient for SF networks. For the same value of p, SF networks have larger value of f_c.

2: Targeted method are even more efficient for SF networks than ER networks, due to the presence of large hubs.

CONCLUSIONS

- Inflexible contrarians do work efficiently in two groups competition.
- Comparing the two methods, the targeted method is more efficient than the ramdom one.
- When using the both strategies, majority will have advantage over minority.
- Both Strategies are more efficient on SF networks than ER networks.

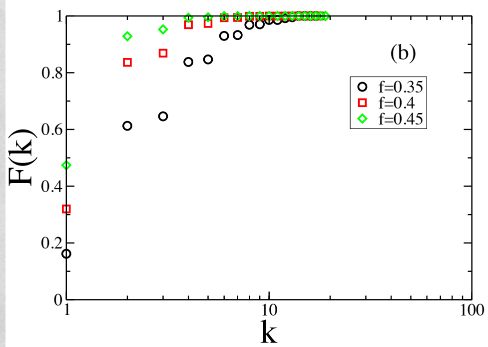
WHAT'S NEXT?

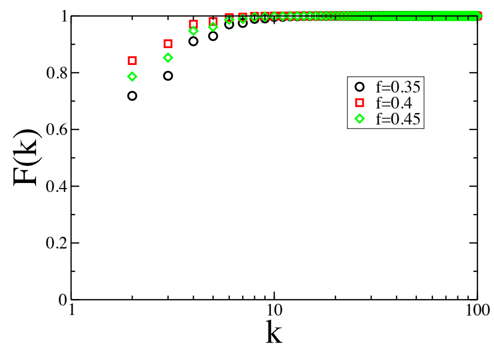
- Both groups can send out inflexible contrarians at the same time (The competition between contrarians)
- Change inflexible contrarians into flexible contrarians (For example, the inflexible contrarians will stay inflexible for a time period, then after that it will go back to normal flexible people)

Thank you !

SIMULATION RESULTS

ER VS Scale Free networks

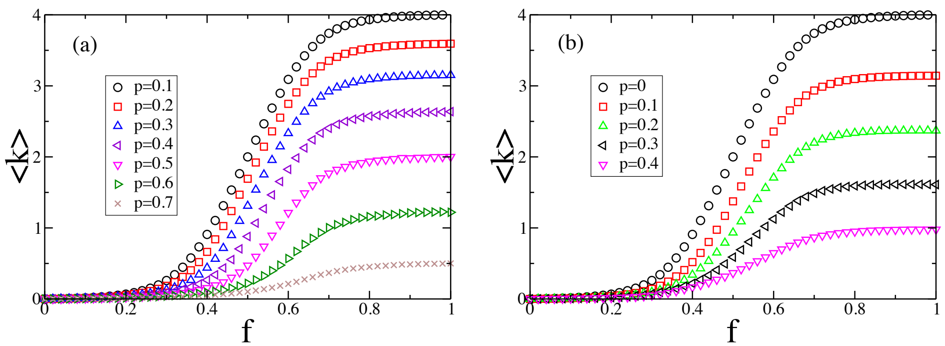




ER network

SF network

SIMULATION RESULTS

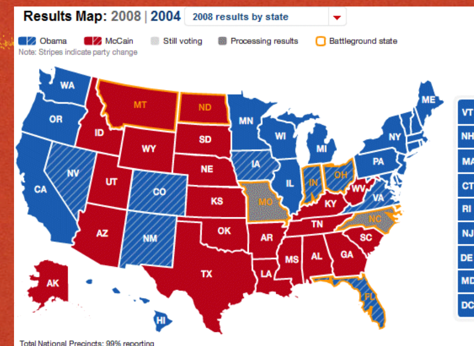


Random Method

Targeted Method

MOTIVATION

PRESIDENTIAL MATERIAL:
Barack Obama
John McCain



Results Map: 2008 | 2004
2008 results by state
Obama
McCain
Still voting
Processing results
Battleground state
Note: Stripes indicate party change
Total National Precincts: 99% reporting

Bribe

What is Sociophysics ?

- quantitative laws in the collective properties of a large number of people.

- quantitatively understand how precise regularities arise out the apparently erratic behavior of single individuals.

- Recently study of social dynamics within the framework of statistical physics has transformed from a philosiphical declaration of principles to a concrete research.

- opinion dynamics, cultural dynamics, language dynamics, crowd behavior

- *Using methods form statistical physics to solve social problems.*

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