Simulation of Information Spreading in a Facebook Network

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Social Networks

Facebook, Twitter, Instagramm, Tumblr, Google+ ....

Fundamental Questions

- Are there relevant differences in the time evolution of the homogeneous SIR-model and the agent-based model?

- Are there individuals which are more important to the spreading of information (Influentials)? Can they be recognized in the sense of position and connectivity in the network?

Reaction Equations

In the SIR-model as well as in the Agent-based model, the following set of "reaction equations" was used
(I: Ignorant, S: Spreader, R: Stifler):

$$I + S \xrightarrow{\lambda} 2S \tag{1}$$

$$S + R \xrightarrow{\alpha} 2R \tag{2}$$

$$S + S \xrightarrow{\alpha} S + R \tag{3}$$

Homogeneous SIR Model

Mathematically this can be expressed as a set of differential equations:

$$\frac{\mathrm{d}i(t)}{\mathrm{d}t} = -\lambda \cdot s(t)i(t) \tag{4}$$

$$\frac{\mathrm{d}s(t)}{\mathrm{d}t} = \lambda \cdot s(t)i(t) - \alpha \cdot s(t)[s(t) + r(t)] \tag{5}$$

$$\frac{\mathrm{d}r(t)}{\mathrm{d}t} = \alpha \cdot s(t)[s(t) + r(t)] \tag{6}$$

Agent-Based Model

Flowchart??

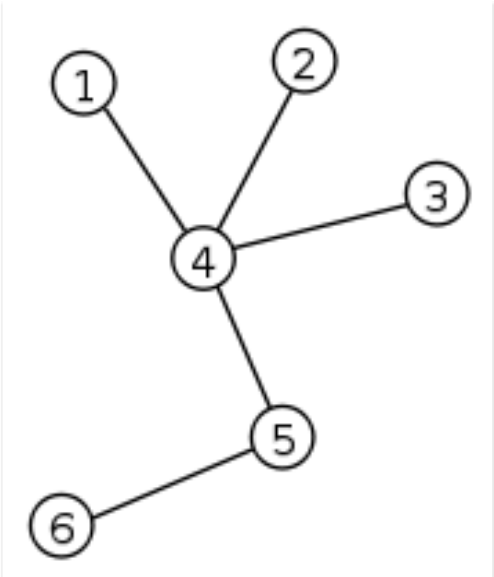
Characteristics

- Real facebook network
- 384 Induviduals

Video
inklusive plot Spreader, stifler etc?

Cumulative Infections

Tree



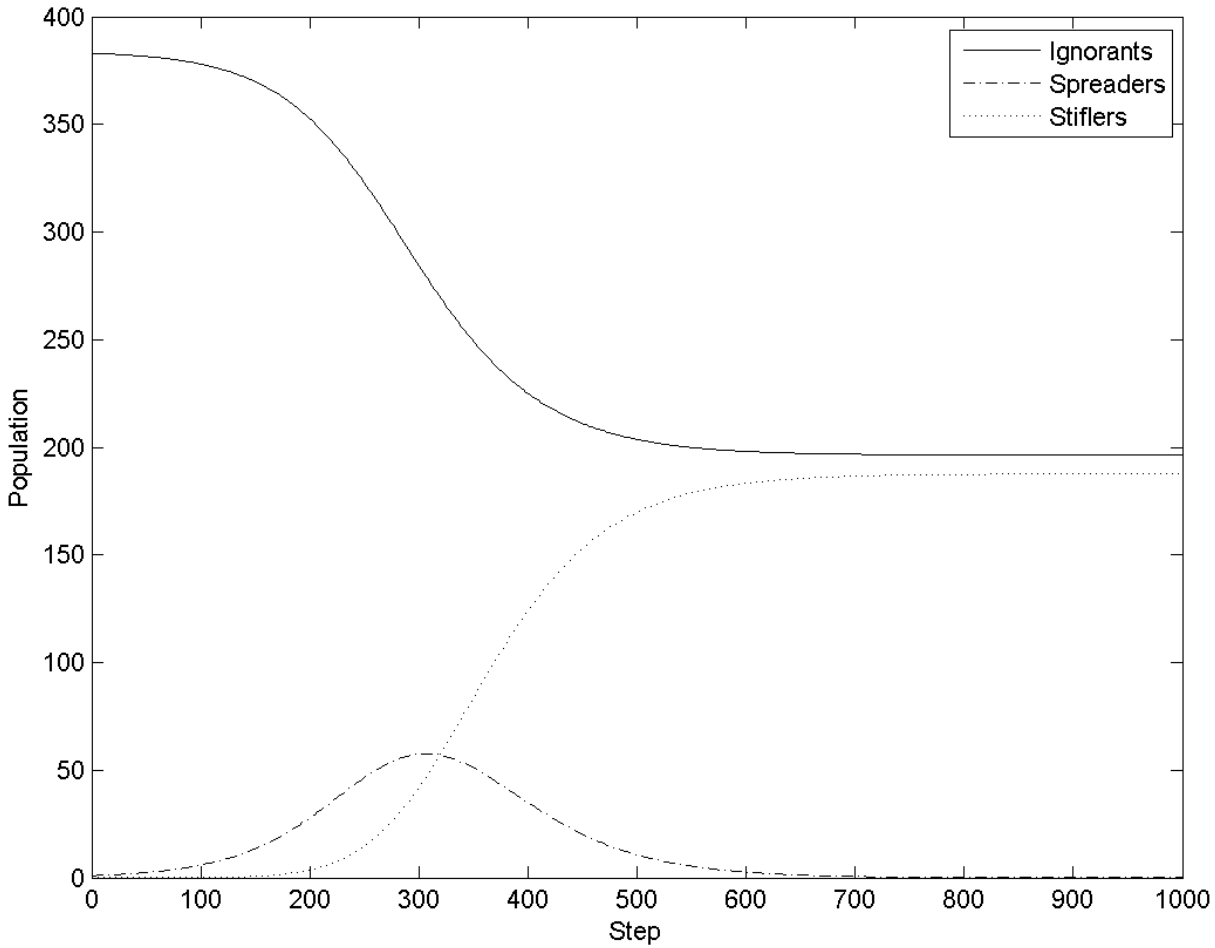
Infectpath

6	5
5	4
4	1
4	2
4	3

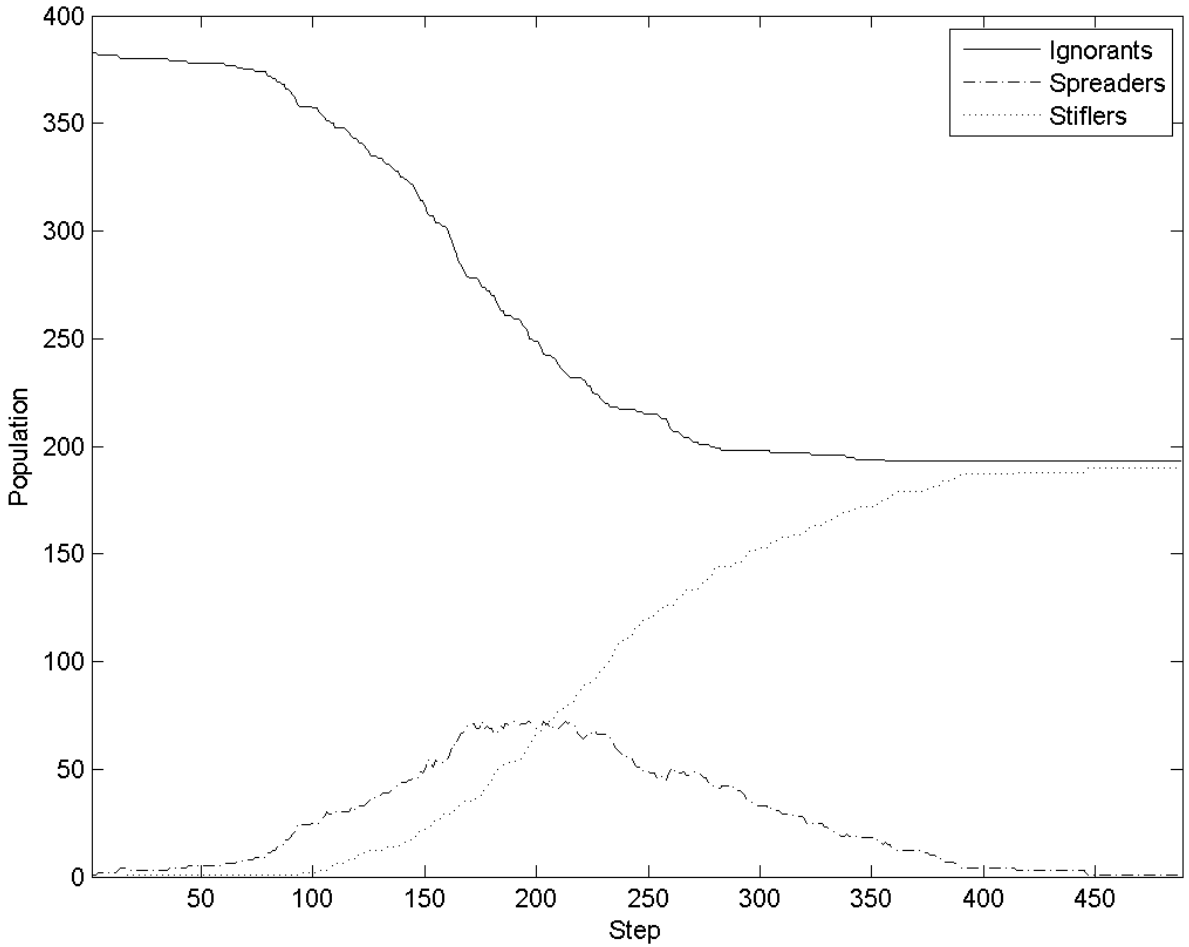
```
cum_infections=
[0 0 0 3 4 5];
```

Differences in Time Evolution

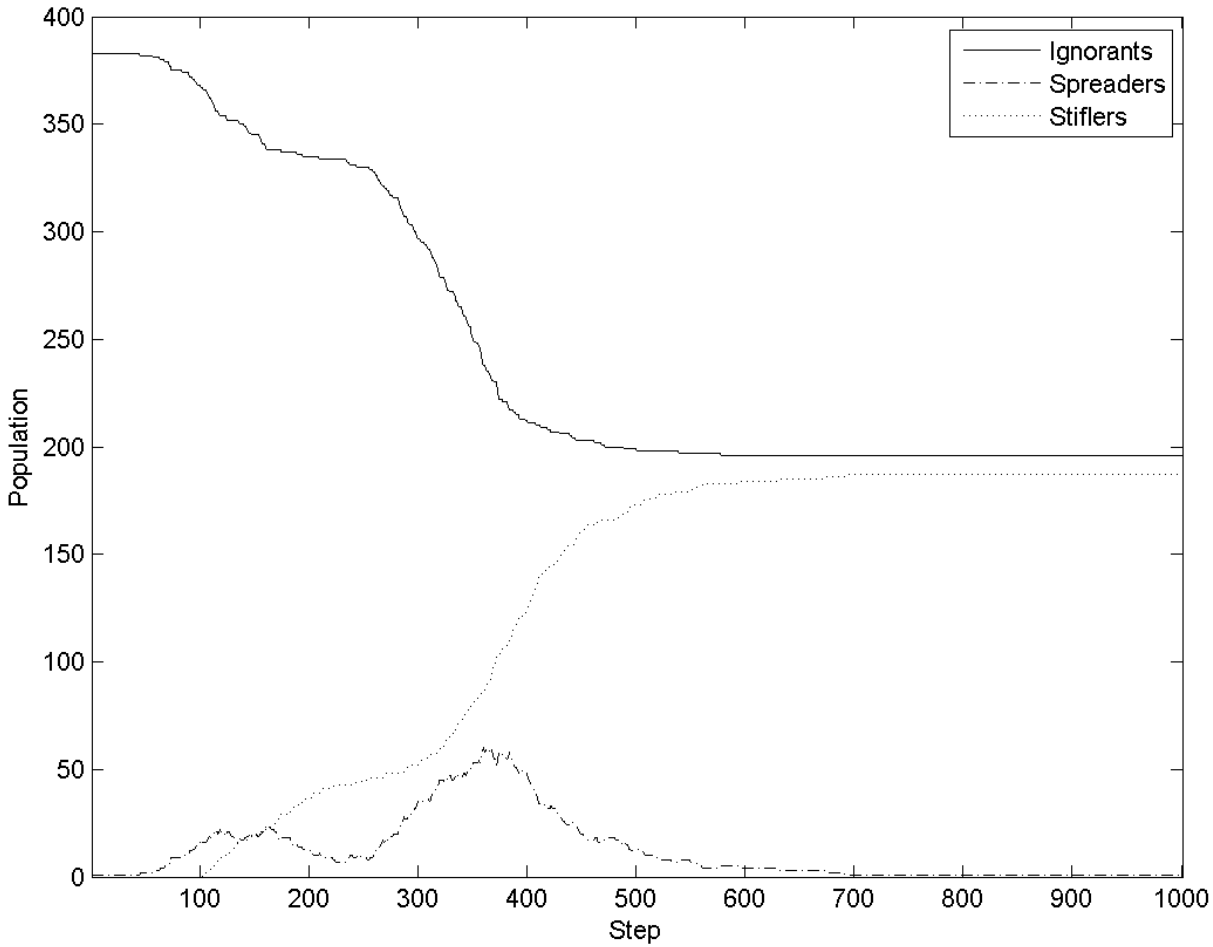
SIR-Model



Agent-based Model similar as SIR

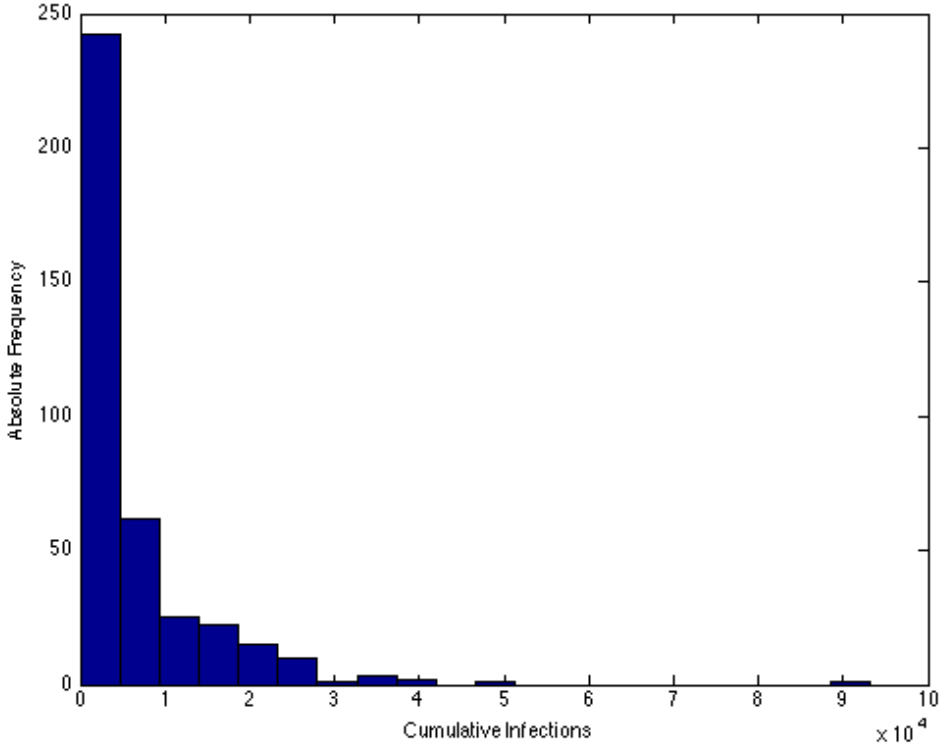


Agent-based Model shows significant difference (two local max)



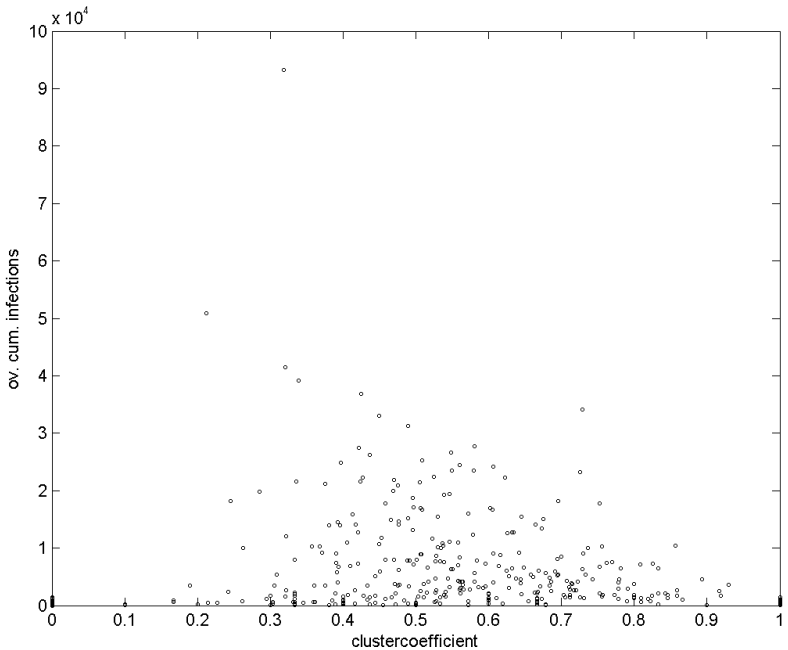
Influentials

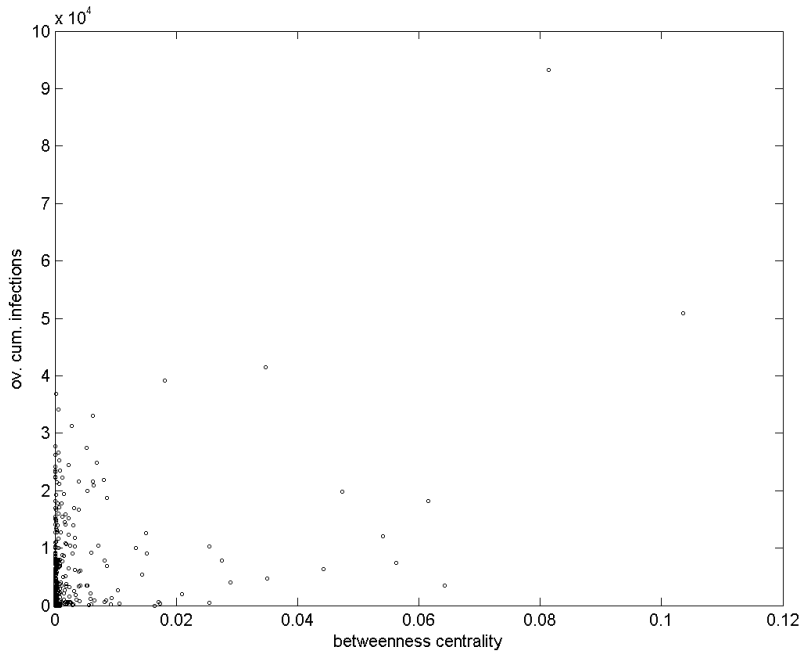
Do influentials exist?



Influentials

Can we determine influentials from the characteristics of our network? (Clustercoefficient, Betweenness centrality)





Summary

- Under certain circumstances the population profiles of the agent-based model differs significantly from those of the homogeneous model.

- Individuals being more important for information spreading, in terms of cumulative infections, were found. The betweenness centrality might be used to roughly predict those especially influential individuals.

The End