Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Lecture with Computer Exercises:
Modelling and Simulating Social Systems with MATLAB

Project Report

Simulation of Information Spreading in a Facebook Network

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Agreement for free-download

We hereby agree to make our source code for this project freely available for download from the web pages of the SOMS chair. Furthermore, we assure that all source code is written by ourselves and is not violating any copyright restrictions.

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2 Individual contributions

3 Introduction and Motivations

Everyone is on facebook
Commercials are personalized, the flow of info is interesting for companies
Are there "more important" persons in typical facebook network?

important questions (does the inhomogeneity of the real network influence the "total" evolution? are there "influentials"?)

4 Description of the Model

The process of information spreading has many similarities with epidemiology, so the well known SIR-model was adapted[1]. The “susceptibles”, are not aware of the information and are called “ignorants” within this work. “Infected” individuals know about the information and are willing to share it with other people, in other words they spread it and are therefore called “spreaders”. The adaptation of the epidemiological term “recovered” is not that straightforward because it is not entirely clear, what that means in this context but they can be looked at persons that are aware of the information but don't want to tell it others. They are called "stiflers".

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):

$$\begin{cases} I + S \xrightarrow{\lambda} 2S & (1) \\ S + R \xrightarrow{\alpha} 2R & (2) \\ S + S \xrightarrow{\alpha} S + R & (3) \end{cases}$$

The main difference to the standard SIR-model is that spreaders don't become stiflers spontaneously but this this change is only induced by meeting an other spreader or stifler. Also it can be shown that for $\frac{\lambda}{\alpha} > 0$, i.e. for any positive rate, the number of stiflers is non-zero for large times. That means that there is no epidemic threshold as in the standard SIR-model.

4.1 Homogeneous SIR model

In the mathematical treatment of the model in a homogeneous system, the set of differential equations is expressed in terms of the densities $i(t) = I(t)/N$, $s(t) = S(t)/N$ and $r(t) = R(t)/N$.

$$
\begin{cases}
\dfrac{\mathrm{d}i(t)}{\mathrm{d}t} = -\lambda \cdot s(t)i(t) & (4) \\
\dfrac{\mathrm{d}s(t)}{\mathrm{d}t} = \lambda \cdot s(t)i(t) - \alpha \cdot s(t)[s(t) + r(t)] & (5) \\
\dfrac{\mathrm{d}r(t)}{\mathrm{d}t} = \alpha \cdot s(t)[s(t) + r(t)] & (6)
\end{cases}
$$

4.2 Agent-based model

To convert the reaction equations into an agent-based model, time was discretized and each time step

5 Implementation

5.1 The Network

how did we get the network?

how did we get the coordinates with gephi?

how was the code implemented? (how detailed does this have to be? references to matlab files?)

6 Simulation Results and Discussion

most important question!

7 Summary and Outlook

References

[1] A. Barrat, M. Barthlemy, A. Vespignani. Dynamical Processes on Complex Networks. Chapter 10.