The Mathematics of Social Networks – Influential Algorithms

Are net giant's attempts to provide us with relevant advertisement behind a divided and polarized society? During the last decades, science have made further breakthroughs in the study of social networks with help of mathematic models. New found knowledge shows promise in identifying where influence in a social network should be made.

We are living in the age of information, but also in the age of misinformation. In the attempt to give us interesting articles and relevant information to our interests, big data giants such as Facebook and Google filter their content for us – there should always be something interesting to read. The result is a bubble containing only the things that we agree with and what we want to hear. Everything outside this bubble is increasingly foreign and suspicious causing a distrust of our surroundings and neighbours. Imagine if it was possible to change this and somehow inform the misinformed, how would this be done?

Take the example of a social network such as Facebook, it is possible to represent this using a mathematical model with only one big matrix! This matrix contains all people and the influence they have over each other. Then imagine that every person has an opinion or knowledge represented by a number between zero and one. Zero being totally misinformed and one being entirely informed about a subject. Among the individuals there are some that are *stubborn*, which means that they won't change their opinion. In the model used we assume that all stubborn nodes are either fully misinformed or entirely informed. For all individuals that are not stubborn, their knowledge changes as they interact with everyone they are related to. This interaction takes place at every time step, for example every day or every week.

When the network has been represented as a mathematical model, it is possible to see what modifications to can be done to change the opinion or knowledge of people. A commonly studied method deals with finding a person to be radicalized and thus turned stubborn and fully informed. Then find the optimal person to be radicalized to collectively inform the maximum amount of people.

The work done by this thesis deals with the act of befriending two persons, whereof one already is stubborn and fully informed. The easiest way to do this would be to just try all possibilities and see which is best, but for large social networks it will be a very time-consuming process and is not viable. That is the reason why it would be very useful to have a mathematical formula which can calculate this, which is presented in this thesis. This formula calculates how much the knowledge change in the network when a person is befriended. Implemented as a computer algorithm it is a very powerful tool and lets us see exactly which option that produces the largest knowledge change.

Used in simulations, this tool shows great practical use with amazing results. For the future, it can be used in many different areas such as advertising, information campaigns or controlling the opinion of people.