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Evolution of Clusters

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OVERVIEW

The project aims at simulating the evolution of a general social network. We model this on the basis of various parameters including but not limited to how open a person is to make new connections, what effect does time have on friendships/relations, how are people influenced by their connections. We model all of this mathematically and run the simulation for different parameter values.

GOALS

1. The primary goal is to observe how clusters break, merge and develop over time.
2. The secondary goal is to arrive at a result that could predict how our society would be divided or united on the basis of their mentality. We expect to narrow down to a generalized result about how our social networks might look in future.

QUESTIONS TO BE ADDRESSED

1. How does the community structure of societies evolve over time?
2. Do different communities merge together to form larger communities easily?
3. Or, are new communities born from the existing communities more?
4. How much time do these changes take?
5. What factors influence the merger and division of communities(like open-mindedness, strength of previous friendships, influence of new friendships etc.)?

Why are these questions important?

- Since the 19th century there has been rapid globalisation and the world has got integrated in many ways. The economies, trade, cultures of various countries have influenced each other and have changed over time. This change has had a very strong

impact on the community structure of the world. Thus it is important to understand the rules and patterns that govern these changes.

- The workforce of multinational corporations is composed of people belonging to a large number of different communities, if they are able to devise methods to merge the communities in their workforce their overall productivity would increase which would help them increase their profits.

- The patterns observed through this project might also help historians understand how new religions came up from existing religions and how some religions became extinct over time.

Thus there is an inevitable need to understand the patterns and rules which govern the evolution of societies and communities within them.

WORKING

Initialization

We start with a randomly generated graph on the basis of clustering coefficient and edge probability.

Mathematical modelling

We perform certain number of iterations, possibly large enough and on each iteration:

- We check for clusters and observe how size of clusters change over time (time steps, rather)
- We iterate through all the nodes and on the basis of common characteristics (described by a feature vector), we determine the probability of them becoming friends with possibly different weights assigned to each of the characteristics by calculating the “weighted” inner product of their vectors. If the result crosses some predefined threshold, a new edge (connection) is established between them.
- Also, there is a minimum threshold for a friendship to continue, if the result of a ”weighted” inner product is less than that, the existing connection is broken.
- The characteristic vector is changed on the basis of connections of each node that influence it. This is done depending majorly on two factors α and γ. α denotes how vulnerable each node is to social influence and γ denotes how time affects connection strength (do older friends have more influence or the recent ones). α is a characteristic of each node but whether to keep γ generic or particular to each node will be decided upon later.

INFERENCES

After a certain number of iterations (large enough), we see how the network looks in comparison to how it was initially.

Also, we will observe patterns throughout the simulation and expect some surprising results to appear.

PROJECT DELIVERABLES

To discover and present the patterns of social network evolution with time - how clusters break, merge and develop over time based on different characteristics of the people and communities.

APPLICATIONS IN REAL-LIFE

Connecting communities

Using results from the simulation, we can form strategies to increase the chances of merging different communities. It can also help in speeding up the process of merging. If successful, it would be a great tool for eradicating caste and race based discrimination.

Predicting future social structure

On simulation with well thought parameters that describe the current situation, we can predict how the social structure might appear in the future - Will it be more divided? Will we see convergence of thoughts? Will there be transfer of thoughts from one part of the society to another?