SIRD Model over Small World, Scale Free Graphs

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1 Introduction

TOBEADDED

2 Literature Review

2.1 Graph Theory

Graph Theory is the study of networks (graphs will be referred to as networks from now on) where vertices (we will also from this point forwards we will be referring to vertices as nodes) are connected by edges, see APPENDIX for a further explanation.

2.2 Small World Graphs

In May 1967 Professor of Psychology at the Graduate School and University Center of the City University of New York, Stanley Milgram ran an experiment to see if a person living in Omaha, Nebraska could get a parcel to a stockbroker in Boston, Massachusetts (Milgram 1967). In his experiment he found the average path length to reach the stockbroker was 5.5, which created the term six degrees of separation (however Milgram's experiment had flaws which puts the exact number into doubt). This idea of having such a small average path length for such numerous nodes is a hallmark of a small world graph.
A Small world graph is formally defined by the following property: $L \propto \log N$ where L is the average shortest path length of the network and N is the total number of nodes (Watts and Strogatz 1998). Several models exist to generate small world graphs such as the Watts-Strogatz Model.

2.3 Scale Free Graphs

In networks that appear in the real world such as the internet and social groups, there exists nodes known as "hubs" (a node that has a higher degree then the average of the graph). This is an important property encapsulated in Scale-Free Graphs.
Scale-free Graphs are formally defined by the following power law: $P(k) \sim k^{-\gamma}$, k is the degree of a vertex, $P(k)$ is the probability of a node having degree k and γ is a parameter determined by the graph typically $2 < \gamma < 3$ (Onnela et al. 2007).

2.4 Barabasi-Albert Model

In 1999, Albert-László Barabási and Réka Albert developed the Albert-Barabási Model which generates small world, scale free graphs by a process of preferential attachment.

2.5 SIRD Model

TODO

3 Mathematical Methods

TODO

4 Analysis

TODO

5 Evaluation

TODO

References

Milgram, Stanley (1967). "The small world problem". In: *Psychology today* 2.1, pp. 60–67.

Onnela, J-P et al. (2007). "Structure and tie strengths in mobile communication networks". In: *Proceedings of the national academy of sciences* 104.18, pp. 7332–7336.

Watts, Duncan J. and Steven H. Strogatz (June 1998). "Collective dynamics of 'small-world' networks". In: *Nature* 393.6684, pp. 440–442. ISSN: 1476-4687. DOI: 10.1038/30918. URL: https://doi.org/10.1038/30918.