Tools for Gossip

Bachelor's Project Thesis

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Abstract:

1 Introduction

Gossip protocols are protocols that describe the way rumors—or, more generally, secrets—are shared in multi-agent environments. The goal of the protocols is to communicate all secrets to all agents. A lot of research has been done in this field, starting with research on the spread of infectious diseases (Kermack & McKendrick, 1927).

The definition of the gossip problem generally used nowadays was first introduced in 1972 by Hajnal et al.[*] In short, agents are represented as nodes in a graph, with the edges representing a "call"— that is, one agent transferring all of their secrets to another agent. When all agents can contact all other agents, Hajnal et al. proved that this can be done in $2n - 4$ calls, where n is the number of agents.

The problem as formulated above requires the oversight of a central authority in order to know whether all agents know all secrets. However, there are many applications where this is not feasible or desirable[†]. Another problem is that it often cannot be guaranteed that all agents can contact all other agents. This has led to the sub-fields of *distributed gossip*, addressing the first issue, and *dynamic gossip*, addressing the second. The combination of these fields, where there is no overseer and not all agents can contact all other agents, is called *distributed dynamic gossip*.

1.1 Notation

This notation used in this paper is based off of the notation used in Van Ditmarsch et al. (2018)

2 Method

References

Hajnal, A., Milner, E. C., & Szemerédi, E. (1972). A cure for the telephone disease. *Cana-dian Mathematical Bulletin*, *15*(3), 447–450. https://doi.org/10/cpr4cv

Kermack, W. O., & McKendrick, A. G. (1927). A contribution to the mathematical theory of epidemics. *Proceedings of the Royal Society of London*, *115*(772), 700–721. https://doi.org/10.2307/94815

van Ditmarsch, H., van Eijck, J., Pardo, P., Ramezanian, R., & Schwarzentruber, F. (2018). Dynamic gossip. *Bulletin of the Iranian Mathematical Society*, *45*(3), 701–728. https://doi.org/10/cvpm

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[*]TODO: Tijdeman (1971) might have been earlier, but I have not been able to find a pdf of that paper. It is referenced in Van Ditmarsch et al. (2018) though.

[†]TODO: maybe find a citation for this? Or just explain it better

A Appendix