Norm Emergence in Multi-Agent Systems After Network Integration

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INTRODUCTION

Norm Emergence?

In **human societies**:
"unwritten law", customs
In **multi-agent system**:
the agreement of an action to reach coordination in pure coordination games

Network Integration?

In real life, integration is also commonly seen in various scenarios: **merging two departments into one unit, mergers and acquisitions between companies**, etc.[1]

we study **the effects of integration with another network during norm emergence**.

METHOD

Pure Coordination Games

Agent 1 / Agent 2	Action 1	Action 2
Action 1	Rewarded	Punished
Action 2	Punished	Rewarded

Conformity[2]

(Conformity of a network $G = (V, E)$)

$$\gamma = 1 - \frac{1}{\log_2|A|} H(a|G)$$

$$s.t.\ H(a|G) = -\sum_{a \in A} p(a|G) \log_2 p(a|G)$$

Integration Algorithm[1]

Step 1. connect all the nodes in the center set of network G_1 with all the nodes in the center set of network G_2.

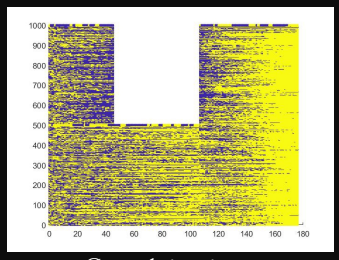
Step 2. keep building new edges between the two nodes that are in the end of the longest path, making the path become a circle until the diameter fulfill the requirement.

we especially investigate the influence of the number of alternate actions.

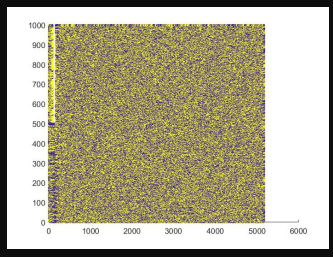
RESULTS

Basic Settings

We use two random networks with 500 nodes in each, and set the goal diameter of the new network as the average of the original networks. The norm emergence will be stopped once they reach a certain conformity, then the integration happens. After the integration, the process of norm emergence will continue as a new whole network.



General situation

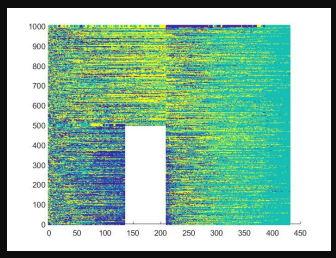


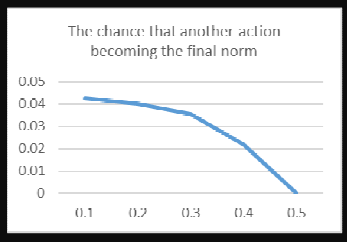
Chaos

Increasing Alternate Actions

After increasing it to 3, the possibility that the final norm is not one of the two original norms in the two networks before integration arises.

The chance of appearance of this situation is quite low, and it decreases when the original conformities increase





(integrate at conformity 0.2, 3 available actions)

CONCLUSION

In conclusion, increasing alternate actions can increase the chance of chaos in a certain level, and rise the problem of a third action becoming final norm. To solve these problems, integrating when the norms in the two original networks are more stable is helpful.

This work is just a shallow one, there are still a lot of factors to investigate how they affect the norm emergence after an integration of two networks.

REFERENCES

[1] J. L. Anastasia Moskvina, "Integrating Networks of Equipotent Nodes," in Nguyen H., Snasel V. (eds) Computational Social Networks. CSoNet 2016. Lecture Notes in Computer Science, Springer, 2016.
[2] H.-f. L. Shuyue Hu, "Achieving Coordination in Multi-Agent Systems by Stable Local Conventions under Community Networks," 2017.