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Time-series prediction based on global fuzzy measure in social networks

Key words: Time-series network, Fuzzy network, Fuzzy Markov chain

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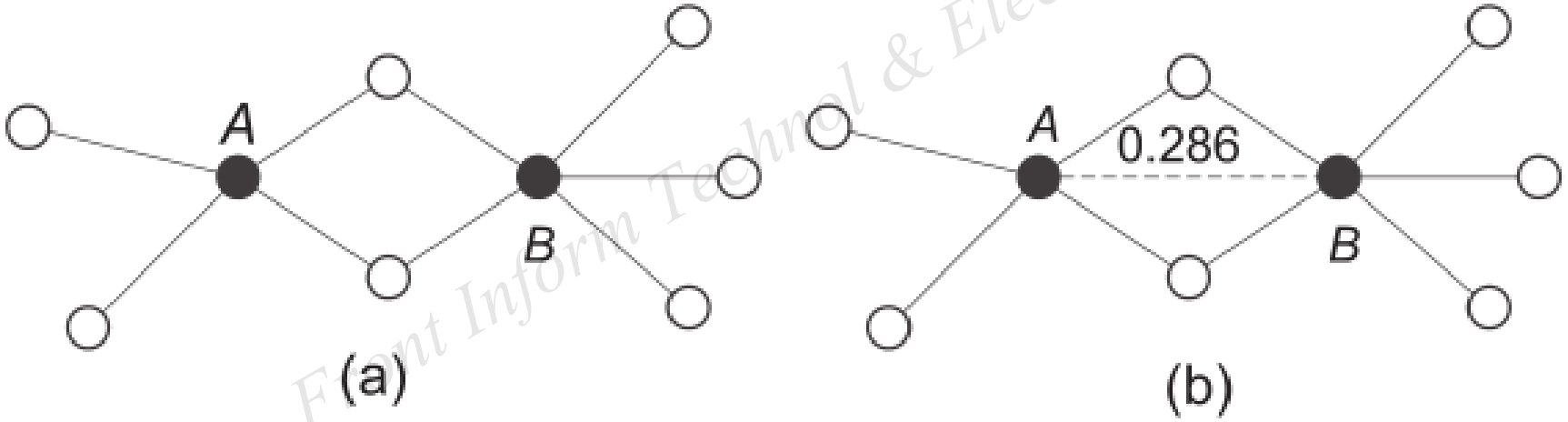
Introduction

- Most measurements of SNA methods are certainty oriented, while in reality, the uncertainties in relationships are widely spread to be overridden.

- To resolve the problem, fuzzy concept is introduced to model the uncertainty, and a similarity metric is used to build a fuzzy relation model among individuals in the social network.

- The trend of fuzzy network evolution is analyzed and predicted with a fuzzy Markov chain in this work.

Difference between a traditional network and a fuzzy network



Measurement results (1)

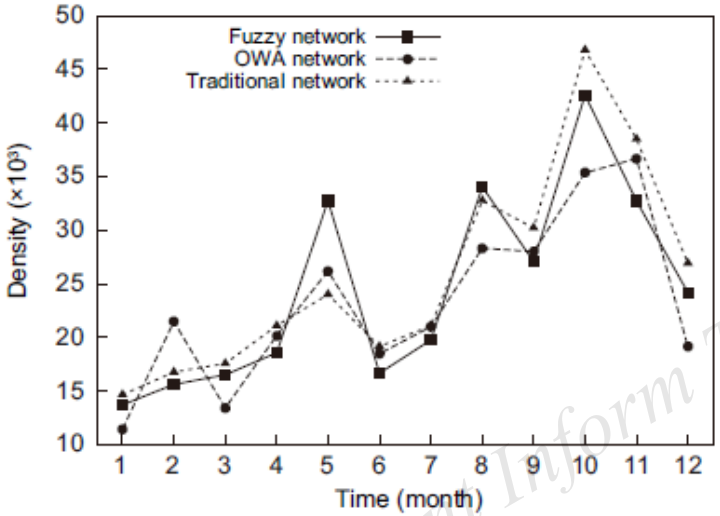


Fig. 3 The difference in density among the traditional network, fuzzy network, and OWA network (Enron)

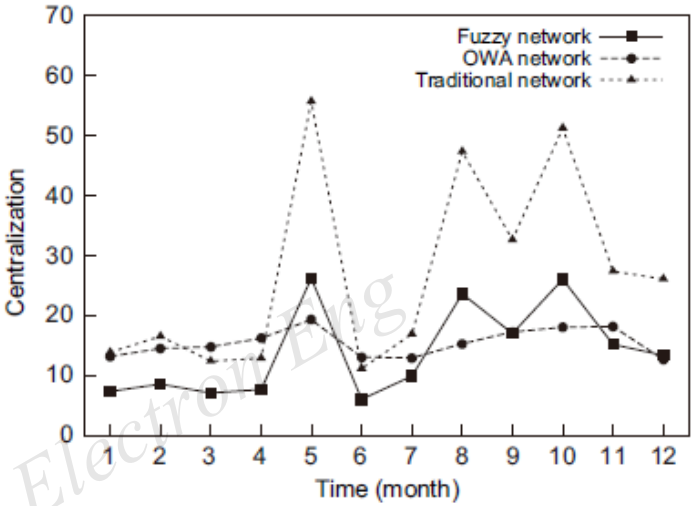


Fig. 4 The difference in centralization among the traditional network, fuzzy network, and OWA network (Enron)

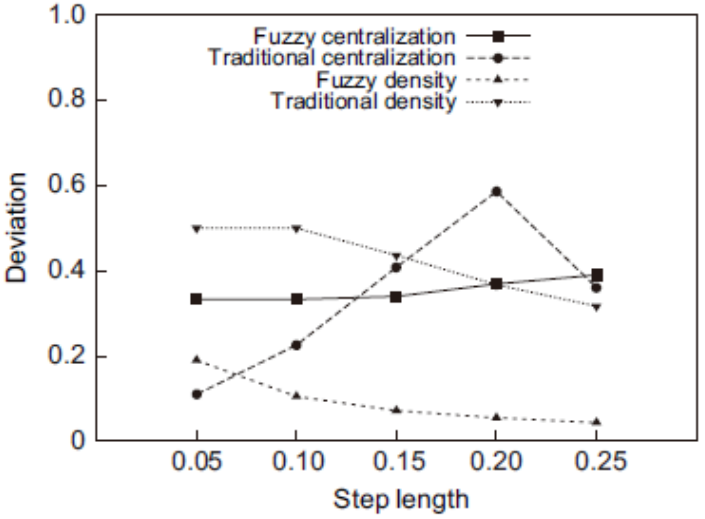


Fig. 7 The difference in deviation between the traditional network and the fuzzy network (Enron)

Measurement results (2)

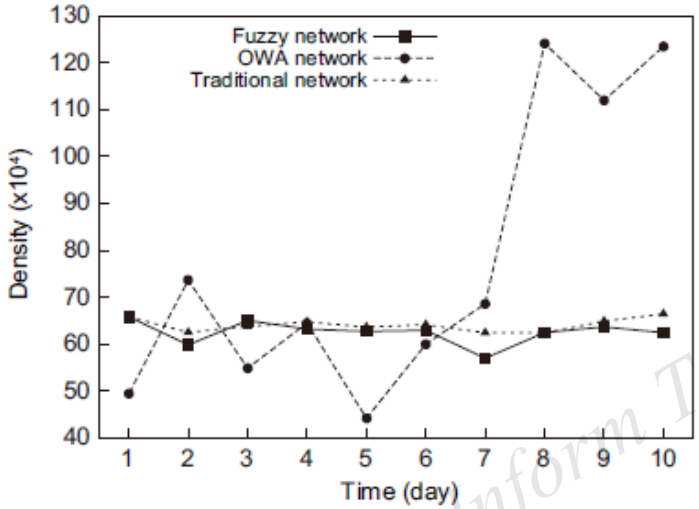


Fig. 5 The difference in density among the traditional network, fuzzy network, and OWA network (10-day call)

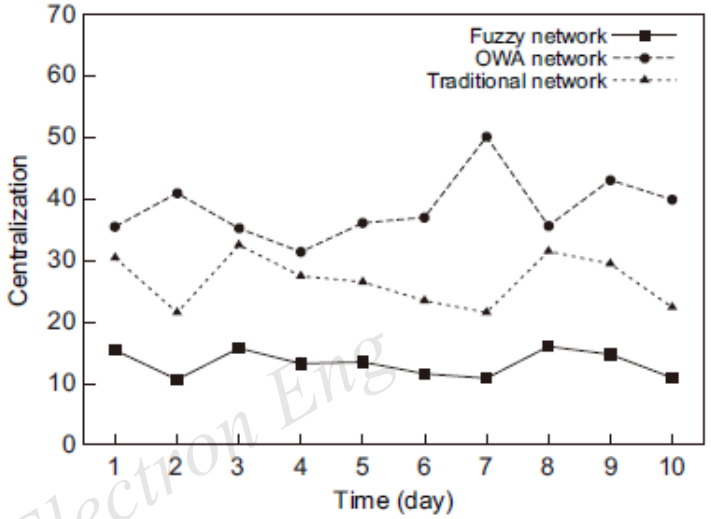


Fig. 6 The difference in centralization among the traditional network, fuzzy network, and OWA network (10-day call)

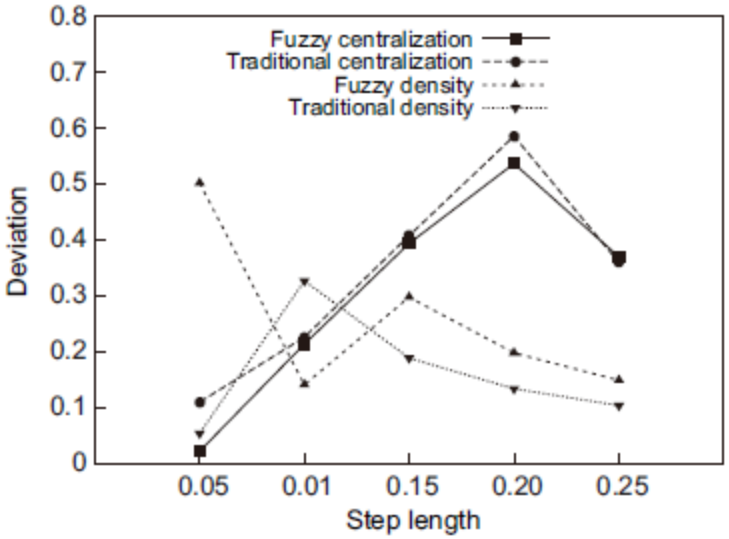


Fig. 8 The difference in deviation between the traditional network and the fuzzy network (10-day call)

Measurement results (3)

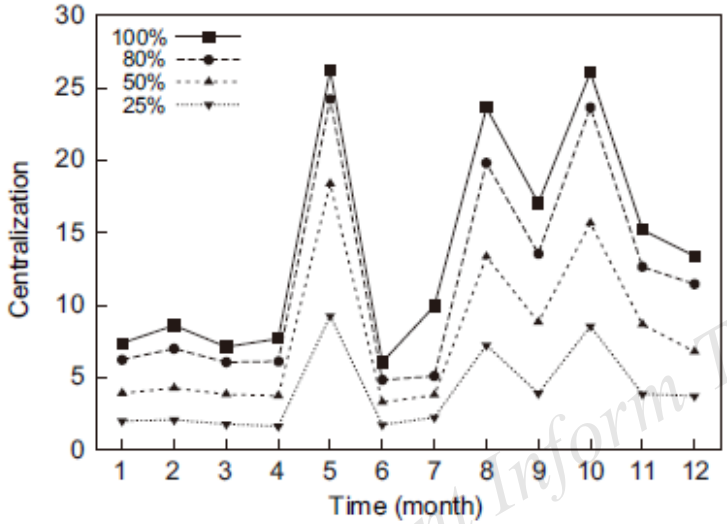


Fig. 11 The centralization at different network sizes

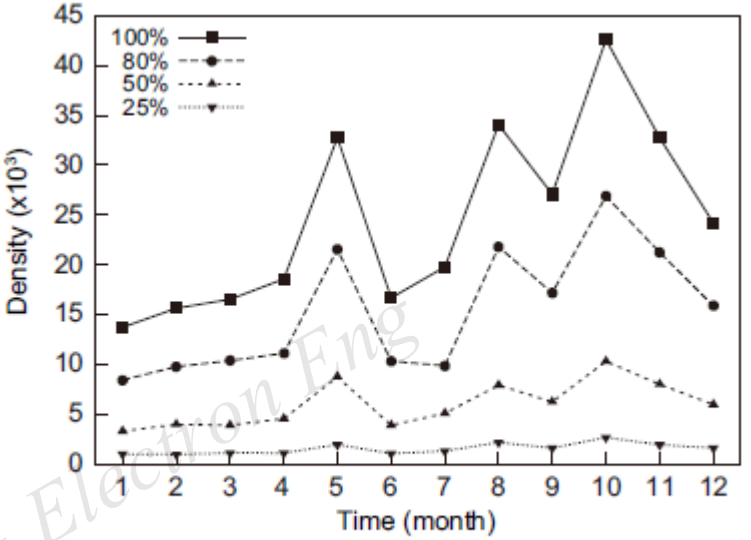


Fig. 12 The density at different network sizes

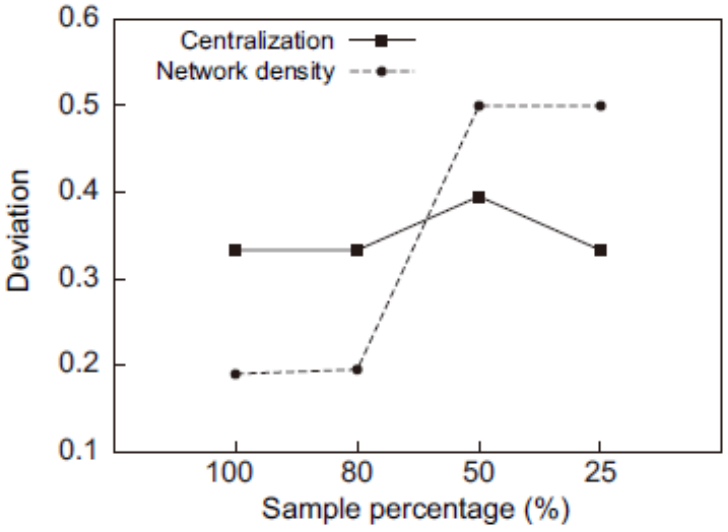


Fig. 13 The deviation at different sample percentages

Performance comparison

Table 2 The prediction of density in the fuzzy network

Step length α	Maximum status	Range	Deviation δ
0.05	A_4	29.1–39.8	0.190
0.10	A_4	29.1–38.6	0.105
0.15	A_4	29.1–37.4	0.072
0.20	A_4	29.1–36.2	0.055
0.25	A_4	29.1–34.9	0.044

Table 3 The prediction of density in the traditional network

Step length α	Maximum status	Range	Deviation δ
0.05	A_5	<35.5	0.500
0.10	A_5	<35.5	0.500
0.15	A_5	<35.5	0.436
0.20	A_5	<35.5	0.367
0.25	A_4	30.6–41.9	0.317

Conclusions

- It is found that there is facility and advantage in the prediction of a fuzzy time-series network measure with the fuzzy Markov chain model.
- The fuzzy network has more superiority than the traditional network in describing the network evolution process.