Royal Statistical Society: Series A, 2025, pp. 1–1

doi: DOI HERE
Advance Access Publication Date: Day Month Year
Discussion Comment

DISCUSSION COMMENT

Killick, Wilson, Chen and Lund's contribution to the Discussion of 'New tools for network time series with an application to COVID-19 hospitalisations'

Killick, R.,[1,*] Wilson, J.,[2] Chen, X.[3] and Lund, R.[3]

[1]School of Mathematical Sciences, Lancaster University, Lancaster, LA1 4SH, UK, [2]Department of Statistics, University of San Francisco, California, USA and [3]Department of Statistics, University of California, Santa Cruz, California, USA

[*]Corresponding author. r.killick@lancs.ac.uk

FOR PUBLISHER ONLY Received on Date Month Year; revised on Date Month Year; accepted on Date Month Year

Abstract

As an eclectic mix of network and time series researchers, we read this paper with enthusiasm. Broadening traditional time series concepts to network series is long overdue; the insights here, especially with its COVID-19 hospitalization example, is invaluable.

While the paper views the data as a time series on a fixed network, a common alternative regards the network itself as a realisation from a distribution of random graphs on its nodes and edges (Goldenberg et al., 2010; Kolaczyk and Csárdi, 2014)). These models, particularly latent space, exponential random graph, or stochastic block models (Hoff et al., 2002; Wilson et al., 2017; Lee et al., 2020; Wilson et al., 2019) may prove useful in incorporating node- or edge-based covariates in the model. Is it possible to generalize GNAR models to account for this uncertainty? Perhaps a Bayesian hierarchical model, where the series is constructed as mentioned, but the network has a prior set, for example, via an ERGM distribution?

On network choices: the authors employed an unweighted graph where small distances between trusts induced an edge, while larger distances do not. The presented GNAR model seems to require binary edges based on the construction of Z^r. Can this work be extended to weighted edges, for example, by using the distance between trusts instead of a binary threshold? Such a construction would likely capture more of the variability in the data.

With traditional time series, moment estimators for the autocorrelations (ACF) and partial autocorrelations are biased, with bias corrections depending on the true model. Are the NACF and NPACF here similarly biased (potentially under certain model forms)? Also, the NPACF is used visually in the hospitalizations application to justify a first order autoregressive (AR(1)) structure and stage one for its neighbours. For this application, the "cut-off" for an AR(1) is clear; however, other applications may be more nebulous. Is there an analogous theoretical construction for the 95% confidence bounds for zero correlation mimicking the traditional ACF/PACF setting? Perhaps this could be incorporated into the Corbit plot as a horizontal line in the legend, or a specific color below the threshold?

References

A. Goldenberg, A. X. Zheng, S. E. Fienberg, E. M. Airoldi, et al. A survey of statistical network models. *Foundations and Trends® in Machine Learning*, 2(2):129–233, 2010.

P. D. Hoff, A. E. Raftery, and M. S. Handcock. Latent space approaches to social network analysis. *Journal of the american Statistical association*, 97(460):1090–1098, 2002.

E. D. Kolaczyk and G. Csárdi. *Statistical analysis of network data with R*, volume 65. Springer, 2014.

J. Lee, G. Li, and J. D. Wilson. Varying-coefficient models for dynamic networks. *Computational Statistics & Data Analysis*, 152:107052, 2020.

J. D. Wilson, M. J. Denny, S. Bhamidi, S. J. Cranmer, and B. A. Desmarais. Stochastic weighted graphs: Flexible model specification and simulation. *Social Networks*, 49:37–47, 2017.

J. D. Wilson, N. T. Stevens, and W. H. Woodall. Modeling and detecting change in temporal networks via the degree corrected stochastic block model. *Quality and Reliability Engineering International*, 35(5):1363–1378, 2019.