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Goodness of fit for log-linear network models: dynamic Markov bases using hypergraphs

**Elizabeth Gross[1] · Sonja Petrović[2] ·
Despina Stasi[2]**

Abstract Social networks and other sparse data sets pose significant challenges for statistical inference, since many standard statistical methods for testing model/data fit are not applicable in such settings. Algebraic statistics offers a theoretically justified approach to goodness-of-fit testing that relies on the theory of Markov bases. Most current practices require the computation of the entire basis, which is infeasible in many practical settings. We present a dynamic approach to explore the fiber of a model, which bypasses this issue, and is based on the combinatorics of hypergraphs arising from the toric algebra structure of log-linear models. We demonstrate the

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✉ Sonja Petrović
 Sonja.Petrovic@iit.edu

 Elizabeth Gross
 elizabeth.gross@sjsu.edu

 Despina Stasi
 despina.stasi@gmail.com

[1] Department of Mathematics and Statistics, San José State University, One Washington Square,
 San Jose, CA 95192, USA

[2] Department of Applied Mathematics, Illinois Institute of Technology, Rettaliata Engineering
 Center room 208, 10 West 32nd Street, Chicago, IL 60616, USA

approach on the Holland–Leinhardt p_1 model for random directed graphs that allows for reciprocation effects.