VOL. 6 • 2018 • NO. 4

# NETWORK SCIENCE



Sished online by Cambridge University Press

### **Network Science Editorial Team**

EDITORS	Andrea Galeotti, Economics, University of Essex, UK
Ulrik Brandes, Computer Science and Mathematics, ETH Zurich,	David Hunter, Statistics, Pennsylvania State University, USA
Switzerland	Yoshihisa Kashima, Psychology, University
Ronald Breiger, Sociology and Political Science, University of	of Melbourne, Australia
Arizona, USA	Peter Key, Mathematics, Microsoft Research, UK
Noshir Contractor, Communication, Management, and Computational Social Science, Northwestern University, USA	Laura Koehly, Psychology, Nationl Human Genome Research Institute, USA
Laura Koehly, Psychology, Public Health, and Medicine,	Eric Kolaczyk, Statistics, Boston University, USA
National Human Genome Research Institute, USA	David Krackhardt, Public Policy, Business, Carnegie-Mellon
Marta Gonzalez, Physics, UC Berkeley, USA	University, USA
Filippo Menczer, Information Science, Indiana	David Lazer, Information Science, Political Science, Northeastern
University, USA	University, USA
Fernando Vega-Redondo, Economics, Bocconi University, Italy	<b>Roger Leenders</b> , Business, Organization Studies, Tilburg University, Netherlands
Stanley Wasserman (Coordinating Editor), Statistics and	Kristina Lerman, Computer Science, ISI and University of
Behavioral Science, Indiana University, USA	Southern California, USA
	Mark Lubell, Political Science, Environmental Policy, University
ASSOCIATE EDITORS	of California, Davis, USA
Sinan Aral, Information Science, Management, New York	Winter Mason, Psychology, Cognitive Science, Stevens Institute, USA
University, USA	James Moody, Sociology, Duke University, USA
Alain Barrat, Physics, CNRS, France	Sue Moon, Computer Science, Korea Advanced Institute of
Yann Bramoulle, Economics, Aix-Marseille University, France	Science and Technology, Republic of Korea
<b>Dirk Brockmann</b> , Computer Science, Applied Mathematics, Northwestern University, USA	Romualdo Pastor-Satorras, Mathematics, Physics, Polytechnic University of Catalunia, Spain
Nicholas Christakis, Sociology, Medicine, Public Health, Yale	Bernice Pescosolido, Sociology, Indiana University, USA
University, USA Jonathon Cummings, Business, Duke University, USA	Richard Rothenberg, Public Health, Epidemiology, Georgia State University, USA
Padraig Cunningham, Computer Science, University College	Olaf Sporns, Psychology, Neuroscience, Indiana University, USA
Dublin, Ireland	Douglas Steinley, Psychology, Statistics, University
Matthew Elliott, Economics, California Institute of	of Missouri, USA
Technology, USA	Adam Szeidl, Economics, Central European University, Hungary
Christos Faloutsos, Computer Science, Data Mining,	Zoltan Toroczkai, Physics, University of Notre Dame, USA
Carnegie-Mellon University, USA	Marco van der Leij, Economics, University of Amsterdam,
Katherine Faust, Sociology, University of California, I	Netherlands
rvine, USA	
James Fowler, Political Science, Public Health, Genetics,	MANAGING EDITOR
University of California, San Diego, USA	Ann McCranie, Sociology, Indiana University, USA

#### **Network Science**

*Network Science* is an important journal for an important discipline - one using the network paradigm, focusing on actors and relational linkages, to inform research, methodology, and applications from many fields across the natural, social, engineering and informational sciences. Given growing understanding of the interconnectedness and globalization of the world, network methods are an increasingly recognized way to research aspects of modern society along with the individuals, organizations, and other actors within it.

The discipline is ready for a comprehensive journal, open to papers from all relevant areas. *Network Science* is a defining work, shaping this new discipline. The journal welcomes contributions from researchers in all areas working on network theory, methods, and data.

SUBSCRIPTION INFORMATION

Network Science (ISSN: 2050-1242) is published four times per year, in March, June, September, and December by Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA.

The subscription price of Volume 6 (2018) including delivery by air where appropriate (but excluding VAT), is  $740.00 (\pounds 462.00)$  for institutions print and online;  $701.00 (\pounds 438.00)$  for institutions online only.

Orders, which must be accompanied by payment, may be sent to a bookseller, subscription agent or direct to the publisher: Cambridge University Press, Journals Fulfillment Department, Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA; or Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge CB2 8BS, UK. Alternatively, you can place an order online at <cambridge.org/nws>.

For single issues, please contact customer\_service@cambridge.org.

#### ADVERTISING

For information on display ad sizes, rates, and deadlines for copy, please visit the journal homepage at <journals.cambridge.org/nws> or contact ad\_sales\_cambridge.org.

INTERNET ACCESS

*Network Science* is included in the Cambridge Core service, which can be accessed at <cambridge.org/journals>. For information on other Cambridge titles, visit <www.cambridge.org>.

**ISSN:** 2050-1242

EISSN: 2050-1250

**Copyright** © **Cambridge University Press 2018.** All rights reserved. No part of this publication may be reproduced, in any form or by any means, electronic, photocopying, or otherwise, without permission in writing from Cambridge University Press. Policies, request forms and contacts are available at: cambridge.org/about-us/rights-permissions

Permission to copy (for users in the U.S.A.) is available from Copyright Clearance Center <a href="http://www.copyright.com">http://www.copyright.com</a>, email: <a href="http://www.copyright.com">info@copyright.com</a>. Postmaster: Send address changes to *Network Science*, Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA.

# **NETWORK SCIENCE**

## Volume 6

Number 4

# CONTENTS

Articles	
Existence of outsiders as a characteristic of online communication networks TARO TAKAGUCHI, TAKANORI MAEHARA, KEN-ICHI	
KAWARABAYASHI AND MASASHI TOYODA	431
A study of cascading failures in real and synthetic power grid topologies RUSSELL SPIEWAK, SALEH SOLTAN, YAKIR FORMAN,	
SERGEY V. BULDYREV AND GIL ZUSSMAN	448
Choosing the number of groups in a latent stochastic blockmodel for dynamic networks	
RICCARDO RASTELLI, PIERRE LATOUCHE AND NIAL FRIEL	469
Special Section: Using Network Analysis to Study Globalization, Regionalization, and Multi-Polarity Introduction to special section	
PHILIPPE DE LOMBAERDE, LELIO IAPADRE, ANN MCCRANIE AND LUCIA TAJOLI	494
Distance-varying assortativity and clustering of the international trade network ANGELA ABBATE, LUCA DE BENEDICTIS, GIORGIO FAGIOLO AND LUCIA TAJOLI	517
The evolution of oil trade: A complex network approach	
ANDREA FRACASSO, HIEN T. T. NGUYEN AND STEFANO SCHIAVO	545
Automotive international trade networks: A comparative analysis over the last two decades	
SARA GORGONI, ALESSIA AMIGHINI AND MATTHEW SMITH	571
The similarity of global value chains: A network-based measure ZHEN ZHU, GREG MORRISON, MICHELANGELO PULIGA,	
ALESSANDRO CHESSA AND MASSIMO RICCABONI	607
Addendum	633