

11th International Conference on Geographic Information Science

GIScience 2021, September 27–30, 2021, Poznań, Poland
(Virtual Conference)

Part II

Edited by

Krzysztof Janowicz

Judith A. Verstegen



Editors

Krzysztof Janowicz

University of California, Santa Barbara, USA
janowicz@ucsb.edu

Judith A. Verstegen 

Wageningen University, Wageningen, The Netherlands
judith.verstegen@wur.nl

ACM Classification 2012

Information systems → Geographic information systems; Human-centered computing → Human computer interaction (HCI); Human-centered computing → Visualization; Theory of computation → Computational geometry; Computing methodologies → Machine learning; Information systems → Spatial-temporal systems

ISBN 978-3-95977-208-2

Published online and open access by

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <https://www.dagstuhl.de/dagpub/978-3-95977-208-2>.

Publication date

September, 2021

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <https://portal.dnb.de>.

License

This work is licensed under a Creative Commons Attribution 4.0 International license (CC-BY 4.0): <https://creativecommons.org/licenses/by/4.0/legalcode>.



In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.

Digital Object Identifier: 10.4230/LIPIcs.GIScience.2021.II.0

ISBN 978-3-95977-208-2

ISSN 1868-8969

<https://www.dagstuhl.de/lipics>

LIPICs – Leibniz International Proceedings in Informatics

LIPICs is a series of high-quality conference proceedings across all fields in informatics. LIPICs volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

Editorial Board

- Luca Aceto (*Chair*, Reykjavik University, IS and Gran Sasso Science Institute, IT)
- Christel Baier (TU Dresden, DE)
- Mikolaj Bojanczyk (University of Warsaw, PL)
- Roberto Di Cosmo (Inria and Université de Paris, FR)
- Faith Ellen (University of Toronto, CA)
- Javier Esparza (TU München, DE)
- Daniel Král' (Masaryk University - Brno, CZ)
- Meena Mahajan (Institute of Mathematical Sciences, Chennai, IN)
- Anca Muscholl (University of Bordeaux, FR)
- Chih-Hao Luke Ong (University of Oxford, GB)
- Phillip Rogaway (University of California, Davis, US)
- Eva Rotenberg (Technical University of Denmark, Lyngby, DK)
- Raimund Seidel (Universität des Saarlandes, Saarbrücken, DE and Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Wadern, DE)

ISSN 1868-8969

<https://www.dagstuhl.de/lipics>

■ Contents

Preface	
<i>Krzysztof Janowicz and Judith A. Verstegen</i>	0:vii
Conference Organization	
.....	0:ix
List of Authors	
.....	0:xiii

Regular Papers

Adaptive Voronoi Masking: A Method to Protect Confidential Discrete Spatial Data	
<i>Fiona Polzin and Ourania Kounadi</i>	1:1–1:17
Reproducible Research and GIScience: An Evaluation Using GIScience Conference Papers	
<i>Frank O. Ostermann, Daniel Nüst, Carlos Granell, Barbara Hofer, and Markus Konkol</i>	2:1–2:16
Comparison of Simulated Fast and Green Routes for Cyclists and Pedestrians	
<i>Christina Ludwig, Sven Lautenbach, Eva-Marie Schömann, and Alexander Zipf</i> ...	3:1–3:15
A Clustering-Based Framework for Individual Travel Behaviour Change Detection	
<i>Ye Hong, Yanan Xin, Henry Martin, Dominik Bucher, and Martin Raubal</i>	4:1–4:15
Will You Take This Turn? Gaze-Based Turning Activity Recognition During Navigation	
<i>Negar Alinaghi, Markus Kattenbeck, Antonia Golab, and Ioannis Giannopoulos</i> ...	5:1–5:16
Bicriteria Aggregation of Polygons via Graph Cuts	
<i>Peter Rottmann, Anne Driemel, Herman Haverkort, Heiko Röglin, and Jan-Henrik Haurert</i>	6:1–6:16
Coordinated Schematization for Visualizing Mobility Patterns on Networks	
<i>Bram Custers, Wouter Meulemans, Bettina Speckmann, and Kevin Verbeek</i>	7:1–7:16
Harmonious Simplification of Isolines	
<i>Arthur van Goethem, Wouter Meulemans, Andreas Reimer, and Bettina Speckmann</i>	8:1–8:16
Navigating Your Way! Increasing the Freedom of Choice During Wayfinding	
<i>Bartosz Mazurkiewicz, Markus Kattenbeck, and Ioannis Giannopoulos</i>	9:1–9:16
Terrain Prickliness: Theoretical Grounds for High Complexity Viewsheds	
<i>Ankush Acharyya, Ramesh K. Jallu, Maarten Löffler, Gert G.T. Meijer, Maria Saumell, Rodrigo I. Silveira, and Frank Staals</i>	10:1–10:16
User Preferences and the Shortest Path	
<i>Isabella Kreller and Bernd Ludwig</i>	11:1–11:15



Map Matching for Semi-Restricted Trajectories <i>Timon Behr, Thomas C. van Dijk, Axel Forsch, Jan-Henrik Haunert, and Sabine Storandt</i>	12:1–12:16
Automated Georeferencing of Antarctic Species <i>Jamie Scott, Kristin Stock, Fraser Morgan, Brandon Whitehead, and David Medyckyj-Scott</i>	13:1–13:16

■ Preface

This second volume contains the full paper proceedings of the 11th International Conference on Geographic Information Science (GIScience 2021) that was scheduled to be held in Poznań, Poland, 27–30 September 2021, after last year’s conference was postponed due to the widespread outbreak of COVID-19. Given that the pandemic persisted through 2021, the organizing committee decided to hold an online conference instead.

Overall, we received 85 submissions, out of which 29 were full papers and 56 were short papers. While most papers received three reviews, the number of reviews varied between two and four. For the full papers, the review phase was followed by a rebuttal phase in which the authors could react to the reviews and provide clarifications. Next, the reviewers discussed the reviews and rebuttals with a metareviewer, and adjusted their final assessment when appropriate. The metareviewers summarized the reviews and discussion and provided a recommendation to the program chairs. One manuscript was accepted conditionally to undergo another round of editorial checks. In total, we accepted 13 full papers for this second volume. The short papers were in review at the time of compiling this full paper volume.

The accepted papers represent a wide range of topics in GIScience, including work on trajectory and movement analysis, computational geometry, semantics, GeoAI, and agent-based modeling.

The entire GIScience 2021 team would like to express their gratitude to all the authors, reviewers, workshop and tutorial organizers, and anybody else involved in organizing the conference. We are particularly grateful to the emergency reviewers for accepting the increased workload and to the broader GIScience community for providing support, advice, and for their understanding during these difficult times.

The GIScience 2020/21 Organizing Team



■ Conference Organization

General Chair

Piotr Jankowski, San Diego State University, USA & Adam Mickiewicz University, Poznań, Poland

Program Chairs

Krzysztof Janowicz, University of California, Santa Barbara, USA
Judith Versteegen, Wageningen University, The Netherlands

Local Organization Chair

Zbigniew Zwoliński, Adam Mickiewicz University, Poznań, Poland

Workshop and Tutorial Chairs

Grant McKenzie, McGill University, Canada
Marcin Winowski, Adam Mickiewicz University, Poznań, Poland

Sponsorship Chair

Bernd Resch, University of Salzburg, Austria

Publicity Chairs

Dara Seidl, Colorado Mountain College, USA
Alfred Stach, Adam Mickiewicz University, Poznań, Poland

Arrangements and Logistics

Joanna Gudowicz, Adam Mickiewicz University, Poznań, Poland
Robert Kruszyk, Adam Mickiewicz University, Poznań, Poland
Jarosław Jasiewicz, Adam Mickiewicz University, Poznań, Poland
Paweł Matulewski, Adam Mickiewicz University, Poznań, Poland
Małgorzata Mazurek, Adam Mickiewicz University, Poznań, Poland
Alicja Najwer, Adam Mickiewicz University, Poznań, Poland
Justyna Weltrowska, Adam Mickiewicz University, Poznań, Poland

Metadata Chairs

Blake Regalia, University of California, Santa Barbara, USA
Gengchen Mai, University of California, Santa Barbara, USA
Ling Cai, University of California, Santa Barbara, USA

Webmaster

Jakub Nowosad, Adam Mickiewicz University, Poznań, Poland



Program Committee


Name	University, Country
Benjamin Adams	University of Canterbury, New Zealand
Ola Ahlqvist	The Ohio State University, USA
Gennady Andrienko	Fraunhofer, Germany
Natalia Andrienko	Fraunhofer, Germany
Clio Andris	Georgia Tech, USA
Andrea Ballatore ^m	Birkbeck, University of London, UK
Kate Beard-Tisdale	University of Maine, USA
Itzhak Benenson	Tel Aviv University, Israel
Michela Bertolotto	University College Dublin, Ireland
Ling Bian	University at Buffalo, USA
Justine Blanford	University of Twente, The Netherlands
Thomas Blaschke	University of Salzburg, Austria
Boyan Brodaric	Geological Survey of Canada, Canada
Chris Brunson	National University of Ireland, Maynooth, Ireland
Ling Cai ^e	University of California, Santa Barbara, USA
Gilberto Camara	INPE, Brazil
Christophe Claramunt	Naval Academy Research Institute, France
Eliseo Clementini	University of L'Aquila, Italy
Tom Cova	University of Utah, USA
Clodoveu Davis	Universidade Federal de Minas Gerais, Brazil
Sytze de Bruin	Wageningen University, The Netherlands
Somayeh Dodge	University of California, Santa Barbara, USA
Suzana Dragicevic	Simon Fraser University, Canada
Matt Duckham	RMIT University, USA
Sara Irina Fabrikant	University of Zurich, Switzerland
Song Gao	University of Wisconsin-Madison, USA
Amy Griffin	RMIT University, Australia
Torsten Hahmann	University of Maine, USA
Jan-Henrik Haunert	Universität Bonn, Germany
Gerard Heuvelink	Wageningen University, The Netherlands
Stephen Hirtle	University of Pittsburgh, USA
Hartwig Hochmair	University of Florida, USA
Yingjie Hu ^m	University at Buffalo, USA
Bernhard Höfle	Heidelberg University, Germany
Marta Jankowska	University of California, San Diego, USA
Bin Jiang	University of Gävle, Sweden
Christopher Jones	Cardiff University, UK
Carsten Keßler	Aalborg University Copenhagen, Denmark
Peter Kiefer	ETH Zurich, Switzerland
Alexander Klippel	Wageningen University, The Netherlands
Jennifer Koch	University of Oklahoma, USA
Christian Kray	University of Münster, Germany
Shawn Laffan	The University of New South Wales, Australia
Tobia Lakes	Humboldt-Universität zu Berlin, Germany

Patrick Laube	Zurich University of Applied Sciences ZHAW, Switzerland
Michael Leitner	Louisiana State University, USA
Wenwen Li	Arizona State University, USA
Arika Ligmann-Zielinska	Michigan State University, USA
Gengchen Mai ^e	University of California, Santa Barbara, USA
Ed Manley ^m	University of Leeds, UK
Bruno Martins ^m	University of Lisbon, Portugal
Grant McKenzie ^m	McGill University, Canada
Mir Abolfazl Mostafavi	Laval University, Canada
Alan Murray	University of California, Santa Barbara, USA
Atsushi Nara ^m	San Diego State University, USA
David O'Sullivan	Victoria University of Wellington, New Zealand
Edzer Pebesma	University of Münster, Germany
Ross Purves	University of Zurich, Switzerland
Martin Raubal	ETH Zurich, Switzerland
Simon Scheider ^m	Utrecht University, The Netherlands
Oliver Schmitz	Utrecht University, The Netherlands
Johannes Scholz	Graz University of Technology, Austria
Johannes Schönig	University of Bremen, Germany
Dara Seidl ^m	Colorado Mountain College, USA
Raja Sengupta	McGill University, Canada
Shih-Lung Shaw	University of Tennessee, USA
Takeshi Shirabe	KTH Royal Institute of Technology, Sweden
Alex Singleton	University of Liverpool, UK
André Skupin	San Diego State University, USA
Seth Spielman	University of Colorado Boulder, USA
Kathleen Stewart	University of Maryland, USA
Martin Swobodzinski	Portland State University, USA
Jean-Claude Thill	University of North Carolina at Charlotte, USA
Sabine Timpf	University of Augsburg, Germany
Martin Tomko	University of Melbourne, Australia
Ming-Hsiang Tsou	San Diego State University, USA
Nico Van de Weghe	Ghent University, Belgium
Marc Van Kreveld	Utrecht University, The Netherlands
Judith Verstege	Wageningen University, The Netherlands
Monica Wachowicz	RMIT University, Canada
Shaowen Wang	University of Illinois at Urbana-Champaign, USA
Robert Weibel	University of Zurich, Switzerland
John Wilson	University of Southern California, USA
Stephan Winter	University of Melbourne, Australia
Ningchuan Xiao	The Ohio State University, USA
Eunhye Yoo	University at Buffalo, USA
Bailang Yu	East China Normal University, China
Sisi Zlatanova	University of New South Wales, Australia


^e: (additionally as) emergency reviewer, ^m: (additionally as) meta reviewer

■ List of Authors


Ankush Acharyya (10)
The Czech Academy of Sciences,
Institute of Computer Science,
Prague, Czech Republic

Negar Alinaghi  (5)
Geoinformation, TU Wien, Austria


Timon Behr (12)
University of Konstanz, Germany

Dominik Bucher  (4)
Institute of Cartography and Geoinformation,
ETH Zurich, Switzerland


Bram Custers  (7)
Eindhoven University of Technology,
The Netherlands


Anne Driemel  (6)
Hausdorff Center for Mathematics,
University of Bonn, Germany

Axel Forsch  (12)
University of Bonn, Germany


Ioannis Giannopoulos  (5, 9)
Geoinformation, TU Wien, Austria;
Institute of Advanced Research in Artificial
Intelligence (IARAI), Vienna, Austria


Antonia Golab (5)
Geoinformation, TU Wien, Austria

Carlos Granell  (2)
Institute of New Imaging Technologies,
Universitat Jaume I de Castellón, Spain


Jan-Henrik Haunert  (6, 12)
Institute of Geodesy and Geoinformation,
University of Bonn, Germany


Herman Haverkort (6)
Institute of Computer Science,
University of Bonn, Germany


Barbara Hofer  (2)
Christian Doppler Laboratory GEOHUM and
Department of Geoinformatics – Z_GIS,
University of Salzburg, Austria

Ye Hong  (4)
Institute of Cartography and Geoinformation,
ETH Zurich, Switzerland


Ramesh K. Jallu (10)
The Czech Academy of Sciences,
Institute of Computer Science,
Prague, Czech Republic

Markus Kattenbeck  (5, 9)
Geoinformation, TU Wien, Austria


Markus Konkol  (2)
Faculty of Geo-Information Science and Earth
Observation (ITC), University of Twente,
Enschede, The Netherlands

Ourania Kounadi  (1)
Department of Geography and Regional
Research, University of Vienna, Austria


Isabella Kreller (11)
University of Regensburg, Germany


Sven Lautenbach  (3)
Heidelberg Institute for Geoinformation
Technology (HeiGIT) gGmbH at Heidelberg
University, Germany


Bernd Ludwig  (11)
University of Regensburg, Germany

Christina Ludwig  (3)
GIScience Research Group, Institute of
Geography, Heidelberg University, Germany

Maarten Löffler (10)
Department of Information and Computing
Sciences, Utrecht University, The Netherlands

Henry Martin  (4)
Institute of Cartography and Geoinformation,
ETH Zurich, Switzerland;
Institute of Advanced Research in Artificial
Intelligence (IARAI), Austria

Bartosz Mazurkiewicz  (9)
Geoinformation, TU Wien, Austria

David Medyckyj-Scott  (13)
Manaaki Whenua Landcare Research,
Auckland, New Zealand

Gert G.T. Meijer (10)
Academy of ICT and Creative Technologies,
NHL Stenden University of Applied Sciences,
The Netherlands

Wouter Meulemans  (7, 8)
Eindhoven University of Technology,
The Netherlands

11th International Conference on Geographic Information Science (GIScience 2021) – Part II.
Editors: Krzysztof Janowicz and Judith A. Verstegen



Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

- Fraser Morgan  (13)
Manaaki Whenua Landcare Research,
Auckland, New Zealand
- Daniel Nüst  (2)
Institute for Geoinformatics,
University of Münster, Germany
- Frank O. Ostermann  (2)
Faculty of Geo-Information Science and Earth
Observation (ITC), University of Twente,
Enschede, The Netherlands
- Fiona Polzin (1)
ITC-Faculty of Geoinformation and Earth
Observation, University of Twente, Enschede,
The Netherlands
- Martin Raubal  (4)
Institute of Cartography and Geoinformation,
ETH Zurich, Switzerland
- Andreas Reimer (8)
Eindhoven University of Technology,
The Netherlands
- Peter Rottmann (6)
Institute of Geodesy and Geoinformation,
University of Bonn, Germany
- Heiko Röglin (6)
Institute of Computer Science,
University of Bonn, Germany
- Maria Saumell (10)
The Czech Academy of Sciences, Institute of
Computer Science, Prague, Czech Republic;
Department of Theoretical Computer Science,
Faculty of Information Technology, Czech
Technical University in Prague, Czech Republic
- Eva-Marie Schömann (3)
GIScience Research Group, Institute of
Geography, Heidelberg University, Germany
- Jamie Scott  (13)
Massey University, Auckland, New Zealand
- Rodrigo I. Silveira (10)
Department of Mathematics,
Universitat Politècnica de Catalunya,
Barcelona, Spain
- Bettina Speckmann  (7, 8)
Eindhoven University of Technology,
The Netherlands
- Frank Staals (10)
Department of Information and Computing
Sciences, Utrecht University, The Netherlands
- Kristin Stock  (13)
Massey Geoinformatics Collaboratory,
Massey University, Auckland, New Zealand
- Sabine Storandt (12)
University of Konstanz, Germany
- Thomas C. van Dijk  (12)
University of Bochum, Germany
- Arthur van Goethem (8)
Eindhoven University of Technology,
The Netherlands
- Kevin Verbeek  (7)
Eindhoven University of Technology,
The Netherlands
- Brandon Whitehead  (13)
Manaaki Whenua Landcare Research,
Auckland, New Zealand
- Yanan Xin  (4)
Institute of Cartography and Geoinformation,
ETH Zurich, Switzerland
- Alexander Zipf  (3)
GIScience Research Group, Institute of
Geography, Heidelberg University, Germany;
HeiGIT gGmbH at Heidelberg University,
Germany