

# Maksim Kitsak

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PERSONAL Delft University of Technology *Voice:* +31.687.520.206  
DETAILS Quantum & Computer Engineering Department *E-mail:* m.a.kitsak@tudelft.nl  
EWI, Mekelweg 4, #09.280 *Webpage:*  
Delft, 2628 CD, The Netherlands <https://www.maksimkitsak.com/>

NATIONALITY United States of America

ETHNICITY Ukrainian

RESEARCH My interests lie at the intersection of *Biomedicine*, *Network Science*,  
INTERESTS and *Machine Learning*.

## HONORS & AWARDS

- I received an individual **NWO VICI award** in the amount of €1.5M for the project *Theory and inference of shortest and nearly shortest paths in large partially observed networks through learning their representations in non-Euclidean metric spaces*. The NWO VICI is the most prestigious talent-oriented funding program of the Dutch Research Council that is designed for senior researchers who have already demonstrated the ability to develop their own innovative lines of research and to act as coaches for young researchers.
- In 2018, I was invited by the DC Mayor's Office **Lab @ DC** to give a public talk based on the outcomes of my work *Resilience and Efficiency in Transportation Networks* published in *Science Advances*.
- My paper titled *Identification of Influential Spreaders in Complex Networks* is published in *Nature Physics* and featured on the journal **cover**. As of September 2025, this paper has 3,800+ citations, measured by Google Scholar.

## FUNDING

### Proposals under Review and In Preparation

- *The society of learning machines: understanding the principles of collective learning and knowledge sharing in decentralized machine learning*, **PI**, with Zaid Al-Ars (co-PI), TU Delft, €736,201, Dutch Research Council (NWO) (Status: Under Review).

### Current Awarded Grants

- *Theory and inference of shortest and nearly shortest paths in large partially observed networks through learning their representations in non-Euclidean metric spaces*, **PI**, TU Delft, €1.5M, Dutch Research Council (NWO) VICI (2025-2030).
- *NExTWORKx Phase 2: A collaboration between TU Delft and KPN on future telecommunication networks*, **co-PI**, together with P. Van Mieghem (PI), E. Smeitink (co-PI), R. Kooij (co-PI), L. Chen (co-PI), H. Wang (co-PI), and C. De Bacco (co-PI), TU Delft, €1M, Koninklijke PTT Nederland (KPN) (2025-2029).
- *TASTI: Tailored SynThetic Image generation (Consortium)*, **co-PI**, together with 15 co-PIs from Belgium, Canada, Netherlands, Spain, Sweden, and Turkey, TU Delft, €490,000, Xecs (2023-2025).
- *Mathematical Description and Inference of Complementarity Mechanisms in Complex Networks*, **PI**, TU Delft, €280,000, Dutch Research Council (NWO) (2022-2026).

## Past Awarded Grants

- *Summer Dutch Network Science Symposium*, **co-PI**, with H. Wang (co-PI, TU Delft) €6,000, Dutch Research Council (NWO) Scientific Meetings and Consultations Domain Science (2023).
- *On Privacy and Security of Dynamical Networks under Partial Topology Knowledge*, **co-PI**, with S. Pequito (co-PI, TU Delft) €5,000, Delft Safety and Security Institute (seed funding) (2021-2022).
- *Link Prediction and Community Inference in Networks using Latent Geometry*, **co-PI**, with D. Krioukov (PI, Northeastern University), \$300,000, Army Research Office, USA (2017-2020).
- *Latent Geometry of Random Simplicial Complexes*, **co-PI**, with D. Krioukov (PI, Northeastern University), and G. Lippner (co-PI, Northeastern University), \$390,000, Army Research Office, USA (2016-2019).
- *Latent Structure and Dynamics of Big Data*, **Key personnel**, with D. Krioukov (PI, Northeastern University), \$900,000, National Science Foundation, USA (2017-2021).

## EDUCATION

### **Boston University**, Boston, Massachusetts USA

Ph.D., Physics, May 2009

- Thesis Topic: Organization of Complex Networks
- Advisor: Professor H. Eugene Stanley
- Area of Study: Complex Networks, Statistical Physics

M.A., Physics, February 2005

- Area of Study: Quantum Field Theory, Elementary Particle Physics
- GPA: 3.94/4.00

### **Belarusian State University**, Minsk, Belarus

Specialist Diploma, Physics, June 2002

- With Honors in Physics
- Thesis Topic: Non-stationary 4 wave mixing in resonant media.
- Advisor: Professor Alexei. L. Tolstik
- Area of Study: Nonlinear Optics, Laser Physics and Spectroscopy
- GPA: 4.8/5.0

## CAREER

### **Delft University of Technology (TU Delft)**, Delft, The Netherlands. **Faculty of Electrical Engineering, Mathematics, & Computer Science** **Quantum & Computer Engineering Department,** **The Network Architectures & Services Group,**

*Associate Professor (UHD2, tenured)*

February, 2024 - Present

*Senior Assistant Professor (UD1, tenured)*

October, 2022 - January, 2024

*Assistant Professor (UD2, tenure-track)*

March, 2020 - September, 2022

### **Northeastern University, Network Science Institute**, Boston, Massachusetts USA.

*Associate Research Scientist*

August, 2014 - February, 2020

*Postdoctoral Scientist*

August, 2012 - July, 2014

**Dana-Farber Cancer Institute, Center for Cancer Systems Biology (CCSB),  
Harvard Medical School**, Boston, Massachusetts USA.

*Visiting Postdoctoral Scientist*

August, 2012 - September, 2015

**Northeastern University**, Department of Mathematics, Boston, Massachusetts USA.

*Part-time Lecturer*

September, 2014 - December, 2014

**UC San Diego, Center for Applied Internet Data Analysis (CAIDA)**, La Jolla,  
California USA

*Postdoctoral Scientist*

August, 2009 - August, 2012

**Boston University, Center for Polymer Studies**, Boston, Massachusetts USA

*Research Assistant*

September, 2005 - July, 2009

**Fraunhofer Institute IISB**, Erlangen, Germany

*Intern*

April, 2003 - August, 2003

**Photeon Technologies GmbH**, Bregenz, Austria

*Intern*

July, 2002 - August, 2002

## SERVICE

**M.Sc. Electrical Engineering Coordinator**, TU Delft

Track: Wireless Communication and Sensing (WiCoS)

Responsibilities: Admissions, Student Support, Curriculum Maintenance

**Funding Agency Grant Reviewer and Panelist**

National Science Foundation (NSF, USA)

2016 - Present

Israel Science Foundation

2019 - Present

Binational Science Foundation (USA-Israel)

2020 - Present

Dutch Research Council (NWO, NL)

2023 - Present

Swiss Science Foundation (SNSF, CH)

2023 - Present

**Society co-chair**

Dutch Network Science Society (NetSciNL)

**Editorial Board Member**

Nature Scientific Reports

IEEE Transactions of Network Science and Engineering

**Membership in Professional Societies**

Institute of Electrical and Electronics Engineers (IEEE)

American Physical Society (APS)

Network Science Society (NetSci)

Dutch Network Science Society (NetSciNL)

**Consultant**

Consultant in Network and Data Sciences for the U.S. Army Corps of Engineers

### **Journal Reviewer**

Nature Machine Intelligence, Nature Communications, Nature Communications Physics, Nature Human Behaviour, Nature Scientific Reports, Physical Review X, Physical Review Letters, Physical Review E, Journal of Statistical Physics, Chaos, Europhysics Letters, New Journal of Physics, Physica A, Journal of Complex Networks, IEEE Transactions on Network Science and Engineering, Internet Mathematics, PLOS ONE, Computational Social Networks

### **Conference Organizer**

- Co-organizer (together with M. Á. Serrano, and M. Boguñá) of the Network Geometry satellite workshop at the NetSci2025 conference in Maastricht, the Netherlands, June, 2025
- Co-organizer (together with P. van der Hoorn, F. Henning, A. van Werde, V. Kumar B. R., and N. Litvak) of the 2024 Dutch Network Science Symposium in Eindhoven, the Netherlands, October, 2024
- Chair (together with H. Wang and P. van der Hoorn) of the Summer Dutch Network Science Symposium in Delft, the Netherlands, August, 2023
- School Chair for the NetSci 2022 (online), The Flagship Conference on Network Science (not) in Shanghai, China, July, 2022
- Focus Session on Network Theory at the March American Physical Society (APS) Meeting in Boston, USA, March, 2019
- Network Geometry and Topology Workshop (GeoTopoNets 2016), satellite to the NetSci 2016 conference in Seoul, Korea, June, 2016
- The Joint Network Seminar, Boston University and Northeastern University, MA, USA March, 2008 - May, 2009; September 2012 - 2014
- CAIDA/UCY Workshop on Network Geometry, (co-organizer) University of Cyprus, Cyprus, January 2011
- Information Theory and Applications Workshop (ITA) 2010, (co-organizer) UC San Diego, CA, USA, January - February, 2010
- UCSD Complex Network Seminar (DANCES), UC San Diego, CA, USA October, 2010 - 2012
- The Network Seminar, Boston University, MA, USA, March, 2007 - February, 2008

### **Program Committee Member**

- NetSci 2025, The Flagship Conference on Network Science in Maastricht, the Netherlands, June, 2025
- Complex Networks 2023, The 12<sup>th</sup> International Conference on Complex Networks and their Applications in Menton Riviera, France, November, 2023
- NetSci 2024, The Flagship Conference on Network Science in Quebec, QC, Canada, June, 2024
- NetSci 2023, The Flagship Conference on Network Science in Vienna, Austria, July, 2023
- Complex Networks 2022, The 11<sup>th</sup> International Conference on Complex Networks and their Applications in Palermo, Italy, November, 2022
- NetSci 2022, The Flagship Conference on Network Science in Shanghai, China, July, 2022
- Complex Networks 2021, The 10<sup>th</sup> International Conference on Complex Networks and their Applications in Madrid, Spain, December, 2021
- NetSci 2020, The Flagship Conference on Network Science in Rome, Italy, September, 2020
- NetSci 2019, The Flagship Conference on Network Science in Burlington, VT, USA, May, 2019
- Complex Networks 2018, The 7<sup>th</sup> International Workshop on Complex Networks and their Applications in Cambridge, UK, December, 2018

- CompleNet'18, International Conference on Complex Networks in Boston, MA, USA, March, 2018
- Macfang BCN 2017, Mapping Complexity Foundations and Applications of Network Geometry in Barcelona, Spain, November, 2017
- Complex Networks 2017, The 6<sup>th</sup> International Workshop on Complex Networks and their Applications in Lyon, France, November, 2017
- NetSci-X 2017, International School and Conference on Network Science, Tel Aviv, Israel, January, 2017
- Complex Networks 2016, The 5<sup>th</sup> International Workshop on Complex Networks and their Applications in Milan, Italy, November, 2016

## TEACHING

**(Dutch) University Teaching Qualification (UTQ)** September, 2022  
 The UTQ certificate is considered the demonstrable proof that one can teach courses at a university level in the Netherlands. The UTQ program includes four modules – DEVELOP, SUPERVISE, ASSESS, and TEACH – and is compulsory for all teaching staff members in Dutch universities.

### Tutor Faculty

- EE4C11 Systems Engineering TU Delft, Q1 2024

### Course Instructor

- EEX02 Communication Networks and Algorithms, TU Delft, Q3, 2024
- EE2T1 Telecommunication & Sensing, TU Delft, Q2, 2024  
 co-instructor with G. Janssen and O. Yarovoy,
- EE2T21 Telecommunications B, TU Delft, 2020 - 2023
- EE4C06 Networking, (guest lecturer) TU Delft, 2019, 2022
- PHYS 5115, Quantum Mechanics, Northeastern University, 2020.  
 co-taught with D. Krioukov
- PHYS2305, Thermodynamics and Statistical Mechanics, Northeastern University, 2017, 2018, 2019.  
 co-taught with D. Krioukov
- MATH1342, Calculus II for Sci. & Eng. Northeastern University, 2014.

### Teaching Assistant

- PY105, Introductory Physics Boston University, 2003 - 2006.
- PY106, Introductory Physics Boston University, 2003 - 2005.
- PY313, Elementary Modern Physics Boston University, 2004.
- PY355, Methods of Theoretical Physics Boston University, 2005.

## SUPERVISION

TU Delft policies require that each M.Sc. and Ph.D. student has two supervisors.

### Current Students:

- Roberto Gheda (Ph.D. student) Expected graduation: 2029, TU Delft
- Yongdin Tian (Ph.D. student) Expected graduation: 2027, TU Delft
- Elizaveta Evmenova (Ph.D. student) Expected graduation: 2026, TU Delft
- Zhihao Qiu (Ph.D. student) Expected graduation: 2025, TU Delft

### Alumni: Interns and Graduate Students

- Pinqi Guo (M.Sc.) Graduated: 2025.  
 TU Delft, *currently open to work.*
- Gabriel Budel, Ph.D. (co-supervised with P. Van Mieghem) Graduated: 2024,  
 TU Delft, *currently at the KPN telecommunications.*
- Ying Jin, M.Sc. (co-supervised with R. Kooij) Graduated: 2022,  
 TU Delft, *currently at the ABB Group.*
- Long MA, Ph.D. (co-supervised with P. Van Mieghem) Graduated: 2022,  
 TU Delft, *currently at Huawei, China.*

- Ivan Voitalov, Ph.D. (co-supervised with D. Krioukov)      Graduated: 2020, Northeastern University, *currently at Scipher Medicine.*
- William Cunningham, Ph.D. (co-supervised with D. Krioukov)      Graduated: 2018, Northeastern University *currently Head of Quantum Software at Agnostiq.*
- Susan Ghiassian, Ph.D. (co-supervised with A.-L. Barabási)      Graduated: 2015, Northeastern University, *currently Director of Data Science and Network Medicine at Scipher Medicine.*
- Chiara Orsini, intern (co-supervised with D. Krioukov)      Internship: 2012, UC San Diego *currently Senior Software Engineer at Amazon.*

#### Alumni: Postdoctoral Fellows

- Pim van der Hoorn (co-mentored with D. Krioukov)      Northeastern University *currently Assistant Professor at TU Eindhoven*
- Rodrigo Aldecoa (co-mentored with D. Krioukov)      Northeastern University *currently Co-Founder & CTO at iNuba.*
- Alexander Ganin (co-mentored with I. Linkov)      U.S. Army Corps of Engineers *currently at Concert AI.*

## RESEARCH

**Summary:** citations: 9,800+, *h*-index: 22, *i*-10 index: 31 (Google Scholar, Sep. 2025)

#### Representative Publications ( \* = corresponding author):

1. L. Ma, P. Van Mieghem, and M. Kitsak\*, *Reporting Delays: a Widely Neglected Impact Factor in COVID-19 Forecasts* PNAS Nexus, **3** (6), pgae204 (2024).  
**Significance:** Develops a statistical method to uncover and remove reporting delays from epidemic time series data.
2. M. Kitsak\*, A. Ganin, H. Cui, D. Eisenberg, A. Elmokashfi, D. Korkin, D. Alderson, and I. Linkov\*, *Finding Shortest and Nearly Shortest Paths in Large Substantially Incomplete Networks by Hyperbolic Mapping*, Nature Communications **14** 186 (2023).  
**Significance:** Discovers the geometric alignment of shortest paths and cellular pathways along geodesic curves in hyperbolic network embeddings, and offers a new approach to find paths in substantially incomplete networks.  
**PRESS:** Nature Review Physics, Techzle, EngineersOnline.nl, EMERCE, NewScientist, De Ingenieur, TU Delft.
3. M. Kitsak, A. Sharma, J. Menche, E. Guney, S. Ghiassian, and A.-L. Barabási\*, *Tissue Specificity of Human Disease Module*, Nature Scientific Reports **6** 35241 (2016).  
**Significance:** Explains tissue specificity of human diseases.
4. J. Menche, A. Sharma, M. Kitsak, S. Ghiassian, M. Vidal, J. Loscalzo, and A.-L. Barabási\*, *Uncovering Disease-Disease Relationships Through the Incomplete Interactome*, Science **347** 6224 (2015).  
**Significance:** Establishes the concept of the disease module.  
**PRESS:** MedicalXpress, Mathesia, Celiac.com, Northeastern University
5. M. Kitsak, L. K. Gallos, S. Havlin, and H. A. Makse\*, *Identification of Influential Spreaders in Complex Networks*, Nature Physics **6** 888 (2010).  
**Significance:** Paradigm shift from node-centric to network-centric approaches to epidemic spreading.  
**PRESS:** Technology Review, ScienceDaily, FastCompany, Science for SEO, We-media, NSF

## Journal Articles: Network Medicine and Epidemic Spreading

1. L. Ma, P. Van Mieghem, and M. Kitsak<sup>\*</sup>, *Reporting Delays: a Widely Neglected Impact Factor in COVID-19 Forecasts*, PNAS Nexus, **3** (6), pgae204 (2024).
2. M. Kitsak<sup>\*</sup>, A. Ganin, H. Cui, D. Eisenberg, A. Elmokashfi, D. Korkin, D. Alderson, and I. Linkov<sup>\*</sup>, *Finding Shortest and Nearly Shortest Paths in Large Substantially Incomplete Networks by Hyperbolic Mapping*, Nature Communications **14** 186 (2023).  
**PRESS:** Nature Review Physics, Techzle, EngineersOnline.nl, EMERCE, NewScientist, De Ingenieur, TU Delft.
3. M. A. Achterberg, B. Prasse, L. Ma, S. Trajanovsky, M. Kitsak, and P. Van Mieghem<sup>\*</sup>, *Comparing the Accuracy of Several Network-based COVID-19 Prediction Algorithms*, International Journal of Forecasting **38** 2 489-504 (2022).
4. S. Vecherin, D. Chang, E. Wells, B. Trump, A. Meyer, J. Desmond, K. Dunn, M. Kitsak, and I. Linkov<sup>\*</sup>, *Assessment of the COVID-19 Infection Risk at a Workplace Through Stochastic Microexposure Modeling*, Nature Journal of Exposure Science & Environmental Epidemiology (2022).
5. L. Ma, M. Kitsak, and P. V. Mieghem<sup>\*</sup>, *Two-population SIR Model and Strategies to Reduce Mortality in Pandemics*, International Conference on Complex Networks and Their Applications, 265-276 (2021).
6. A. Sharma, M. Kitsak, M.H. Cho, A. Ameli, X. Zhou, Z. Jiang, J. D. Crapo, T. H. Beaty, J. Menche, P. S. Bakke, M. Santolini, and E. K. Silverman<sup>\*</sup>, *Integration of molecular interactome and targeted interaction analysis to identify a COPD disease network module*, Nature Scientific Reports **8** 1 14439 (2018).
7. M. Kitsak, A. Sharma, J. Menche, E. Guney, S. Ghiassian, and A.-L. Barabási<sup>\*</sup>, *Tissue Specificity of Human Disease Module*, Nature Scientific Reports **6** 35241 (2016).
8. J. Menche, A. Sharma, M. Kitsak, S. Ghiassian, M. Vidal, J. Loscalzo, and A.-L. Barabási<sup>\*</sup>, *Uncovering Disease-Disease Relationships Through the Incomplete Interactome*, Science **347** 6224 (2015).  
**PRESS:** MedicalXpress, Mathesia, Celiac.com, Northeastern University
9. A. Sharma, J. Menche, C. Huang, T. Ort, X. Zhou, M. Kitsak, N. Sahni, D. Thibault, L. Voung, F. Guo, N. Gulbahce, F. Baribaud, J. Tocker, R. Dobrin, E. Barnathan, H. Liu, R. A. Panettieri Jr. , S. Ghiassian, N. Gulbahce, R. A. Panettieri Jr., K. G. Tantisira, W. Qiu, B. A. Raby, E. K. Silverman, M. Vidal, S. T. Weiss, and A.-L. Barabási<sup>\*</sup>, *A disease module in the interactome explains disease heterogeneity, drug response and captures novel pathways and genes*, Human Molecular Genetics **24** 3005 (2014).
10. M. Kitsak, L. K. Gallos, S. Havlin, and H. A. Makse<sup>\*</sup>, *Identification of Influential Spreaders in Complex Networks*, Nature Physics **6** 888 (2010).  
**PRESS:** Technology Review, ScienceDaily, FastCompany, Science for SEO, We-media, NSF

## Journal Articles: Machine Learning and Network Geometry

1. Y. Tian, Z. Al-Ars, M. Kitsak, and P. Hofstee\*, *Low-loss space in neural networks is continuous and fully connected*, (under review) (2025); arXiv:2505.02604
2. G. Budel and M. Kitsak\*, *Complementarity in Complex Networks*, (under review) (2025); arXiv:2003.06665
3. Y. Tian, Z. Al-Ars, M. Kitsak, and P. Hofstee\*, *Vanishing Variance Problem in Fully Decentralized Neural-Network Systems*, (under review) (2025); arXiv:2404.04616
4. G. Budel, M. Kitsak, R. Aldecoa, K. Zuev, and D. Krioukov\*, *Random Hyperbolic Graphs in  $d + 1$  Dimensions*, Physical Review E **109**, 054131 (2024).
5. I. Voitalov, P. van der Hoorn, M. Kitsak, F. Papadopoulos, and D. Krioukov\*, *Weighted Hypersoft Configuration Model*, Physical Review Research **2**(4) 043157 (2020).
6. M. Kitsak, I. Voitalov, and D. Krioukov\*, *Link Prediction with Hyperbolic Geometry*, Physical Review Research **2**(4) 043113 (2020).
7. M. Kitsak, F. Papadopolous, and D. Krioukov\*, *Latent Geometry of Bipartite Networks*, Phys. Rev. E **95** 032309 (2017).
8. M. Boguna, M. Kitsak, and D. Krioukov\*, *Cosmological Networks*, New Journal of Physics **16** 093031 (2014).
9. D. Krioukov, M. Kitsak, R.S. Sinkovits, D. Rideout, D. Meyer, and M. Boguñá\*, *Network Cosmology*, Nature Scientific Reports **2** 793 (2012).  
**PRESS:** UCSD, SDSC, Space, Time, The Register, CBS, Huffington Post, Huffington PostUK, PopularScience, LiveScience, Slashdot, RobotsNet, PhysOrg, ScienceDaily, TGDaily, DigitalJournal...
10. F. Papadopolous, M. Kitsak, M. Serrano, M. Boguñá, and D. Krioukov\* *Popularity Versus Similarity in Growing Networks*, Nature **489** 537 (2012).  
**PRESS:** UCSD, SDSC, Nature, Nature Physics, PhysOrg, ScienceDaily, AMS, Le Scienze
11. M. Kitsak, and D. Krioukov\*, *Hidden Variables in Bipartite Networks*, Phys. Rev. E **84** 026114 (2011).
12. D. Krioukov, F. Papadopolous, M. Kitsak, A. Vahdat, and M. Boguñá\*, *Hyperbolic Geometry of Complex Networks*, Phys. Rev. E **82** 036106 (2010).

## Journal Articles: Network Resilience and Robustness

1. S. Chung, D. Sardak, M. Kitsak, A. Jin, and I. Linkov\*, *Contested logistics: Resilience of strategic highways and railways*, Transportation Research Interdisciplinary Perspectives, **32** 101507 (2025).
2. S. Chung, M. Smith, A. Jin, L. Hogewood, M. Kitsak, J. Cegan, and I. Linkov\*, *Access to Emergency Services: A New York City Case Study*, Transportation Research Interdisciplinary Perspectives, **25** 101111 (2024).
3. I. Linkov\*, S. Galaitzi, B. Trump\*, E. Pinigina, K. Rand, E. Cline, and M. Kitsak\*, *Are Civilizations Destined to Collapse? Lessons From the Mediterranean Bronze Age*, Global Environmental Change **84**, 102792 (2024).

4. M. Kurth, W. Kozlowski, A. Ganin, A. Mersky, B. Leung, J. Dykes, M. Kitsak, and I. Linkov\*, *Lack of resilience in transportation networks: Economic implications*, Transportation Research Part D: Transport and Environment **86** 102419 (2020).
5. A. Ganin, A. Mersky, A. Jin, M. Kitsak, J. Keisler, and I. Linkov\*, *Resilience for Intelligent Transportation Systems (ITS)*, Transportation Research Part C **100** 318 (2019).
6. D. Eisenberg, M. Kitsak, A. Ganin, I. Linkov and D. Alderson\*, *Network Foundation for Command and Control (C2) Systems: Literature Review*, IEEE Access **6** 68782 (2018).
7. M. Kitsak, A. Ganin, D. Eisenberg, P. Krapivsky, D. Krioukov, and I. Linkov\*, *Stability of a Giant Connected Component in a Complex Network*, Phys. Rev. E **97** 012309 (2018).
8. A. Ganin, M. Kitsak, D. Marchese, J. M. Keisler, T. Seager, and I. Linkov\*, *Resilience and Efficiency in Transportation Networks*, Science Advances **3** 12 e1701079 (2017).  
**PRESS:** NU, National Public Radio, Australia Policy Online, WTOP, Laboratory Equipment, Tech Xplore, CITY LAB.
9. M. Kitsak, A. Elmokashfi, S. Havlin, and D. Krioukov\*, *Long-Range Correlations and Memory in the Dynamics of Internet Interdomain Routing*, PLOS ONE **10**(11) e0141481 (2015).

#### Journal Articles: Network Science and Percolation

1. G. Budel, Y. Jin, P. Van Mieghem, and M. Kitsak\*, *Topological Properties and Organizing Principles of Semantic Networks*, Nature Scientific Reports **13** 11728 (2023).
2. M. Kitsak, M. Riccaboni, S. Havlin, F. Pammolli and H. E. Stanley\*, *Structure of Business Firm Networks and Scale-Free Models*, Phys. Rev. E **81** 036117 (2010).
3. J. Shao, S. V. Buldyrev, R. Cohen, M. Kitsak, S. Havlin and H. E. Stanley\*, *Fractal Boundaries of Complex Networks*, Europhys. Lett. **84** 48004 (2008).
4. M. Kitsak, S. Havlin, G. Paul, M. Riccaboni, F. Pammolli, and H. E. Stanley\*, *Betweenness Centrality of Fractal and Non-Fractal Scale-Free Model Networks and Tests on Real Networks*, Phys. Rev. E **75** 056115 (2007).

#### Journal Articles: Nonlinear Optics

1. M. A. Kitsak and A. I. Kitsak\*, *Spatial Coherence of the Stokes Component of Stimulated Raman Scattering Excited in a Long Multimode Fibre*, Quantum Electronics **38**(7) 681 (2008).
2. M. A. Kitsak and A. I. Kitsak\*, *Cross Modulation Method of Transformation of the Spatial Coherence of Pulsed Laser Radiation in a Nonlinear Medium*, Quantum Electronics **38**(4) 365 (2008).
3. M. A. Kitsak and A. I. Kitsak\*, *Efficiency of Nonstationary Transformation of the Spatial Coherence of Pulsed Laser Radiation in a Multimode Optical Fibre upon Self-Phase Modulation*, Quantum Electronics **37**(8) 770 (2007).

4. A. I. Kitsak\* and M. A. Kitsak, *Transformation of the Spatial Coherence of Pulsed Laser Radiation Transmitted in the Nonlinear Regime through a Multimode Graded-index Fibre*, Quantum Electronics **36(1)** 27 (2006).
5. O. Ormachea, M.A. Kitsak and A.L. Tolstik\*, *Multiwave Mixing in Complex Molecular Media and Dynamic Modes of Light-Wave Transformation*, Nonlinear Phenom. Complex Syst. **6(3)** 762 (2003).
6. M.A. Kitsak\* *Nonstationary Four Wave Mixing in Resonant Media Under Conditions of Effective Parametrical Energy Transfer*, Journal of Optical Technology **69** 7-458 (2002).

### Proceedings

1. I. Häring, G. Sansavini, E. Bellini, N. Martyn, T. Kovalenko, M. Kitsak, G. Vogelbacher, K. Ross, U. Bergerhausen, K. Barker, and I. Linkov *Towards a Generic Resilience Management, Quantification and Development Process: General Definitions, Requirements, Methods, Techniques and Measures, and Case Studies*, chapter of *Resilience and Risk*. (I. Linkov, J. M. Palma-Oliveira [eds]) Springer, Dordrecht, 2017, pp 21-80.
2. M.A. Kitsak and A.I. Kitsak, *Studies of the Angular Frequency Spectrum of Raman Scattering Stokes Component Radiation Excited in an Extensive Multimode Waveguide*, Proc. SPIE **7008** 70081O (2008).
3. M.A. Kitsak and A.I. Kitsak, *The Efficiency of the Non-Stationary Process of Transformation of Spatial Coherence of Pulse Laser Radiation in a multimode Waveguide at the Phase Self-Modulation*, Proc. SPIE **7008** 70081N (2008).
4. M.A. Kitsak and A.I. Kitsak, *The Efficiency of Spatial Coherency Nonlinear Transformation of Pulse Laser Radiation in a Multimode Waveguide at Different Statistical Models of Incoming Radiation*, Proc. SPIE **6729** 67291Z (2007).
5. M.A. Kitsak and A.I. Kitsak, *The Analysis of Spatial Modes of the Raman Scattering Stokes Component Radiation Excited in an Extensive Multimode Waveguide*, Proc. SPIE **6729** 67291Y (2007).
6. A.I. Kitsak and M.A. Kitsak, *Transformation of Coherent and Angular Characteristics of Pulse Radiation at Self-Modulation in Non-Homogeneous Multimode Waveguides*, Proc. SPIE **6254** 625418 (2006).

### TALKS

#### Public Talks

- *Resilience and Efficiency in Transportation Networks*, public talk at DC Mayor's office, Washington, DC, March, 2018.

#### Invited Talks

- *Modeling and Inference of Complementarity Mechanisms in Networks and Implications for Collaboration Networks*, invited online seminar talk at the UIUC, Urbana-Champaign, IL, November, 2024.
- *Modeling and Inference of Complementarity Mechanisms in Networks*, colloquium talk at the UC Davis, Davis, CA, October, 2024.
- *Modeling and Inference of Complementarity Mechanisms in Networks*, invited seminar talk at the UC San Diego, San Diego, CA, October, 2024.
- *Complementarity in Complex Networks*, invited talk at the Network Geometry satellite of the NetSci 2024 conference, Quebec, QC, June, 2024.

- *Finding Shortest Paths in Substantially Incomplete Networks*, invited seminar talk at the Max-Planck Institute for Intelligent Systems, Tübingen, Germany, July, 2023.
- *Interdomain Internet Routing Paths: Resilience Perspective*, invited talk at the Risk and Resilience Festival, University of Twente, Enschede, the Netherlands, November, 2023.
- *Finding Shortest and Nearly Shortest Paths in Large Substantially Incomplete Networks*, invited talk at the CCEGNV workshop, Woods Hole, MA, USA, June, 2022.
- *Geometric Representations of Complementarity-Driven Networks*, invited seminar talk at Leiden University, Leiden, Netherlands, March, 2022.
- *Network Reconstruction with Hyperbolic Geometry*, invited seminar talk at Northwestern University, Evanston, IL, USA, April, 2021.
- *Geometric Representations of Complementarity-Driven Networks*, invited seminar talk at Northwestern University, Evanston, IL, USA, January, 2021.
- *Reconstruction of Shortest Paths with non-Euclidean Geometric Representations*, invited seminar talk at Worcester Polytechnic Institute, Worcester, MA, USA, February, 2020.
- *Latent Geometry Enables Hyperbolic and Geo-Hyperbolic Routing Schemes*, guest lecture at SimulaMet, Oslo, Norway, May, 2019.
- *Complex Systems through the Lens of Network Geometry*, colloquium talk at the University of Pittsburgh, Pittsburgh, PA, January, 2019.
- *Latent Geometry in Networked Systems: theory, inference and applications*, seminar at the University at Buffalo, Buffalo, NY, December, 2018.
- *Latent Geometry of Networked Systems: Theory, Inference and Applications*, talk at the Network Science Seminar talk at UC Davis, Davis, CA, February, 2018.
- *Latent Geometry of Networked Systems: Theory and Applications*, colloquium talk at Yeshiva University, New York, NY, February 2018.
- *Hyperbolic Geometry of Networked Systems*, seminar talk at the Queen Mary University of London, London, UK, December, 2017.
- *Hyperbolic Geometry of Protein-Protein Interaction Networks*, given at the NetMed17 workshop, Indianapolis, IN, June, 2017.
- *Latent Geometry in Networked Systems: from Interdomain Routing to Human Diseases*, colloquium talk given at the Rensselaer Polytechnic Institute, Troy, NY, February, 2017.
- *Geometry of Networked Systems*, colloquium talk given at the UC Merced, Merced, CA, April, 2016.
- *Latent Geometry in Technological, Social and Biological Systems*, colloquium talk given at the Indiana University, Bloomington, IN, March, 2015.
- *The Latent Geometry Formalism and its Applications to Social, Technological and Biological Systems*, colloquium talk given at the Northwestern University, Evanston, IL, January, 2014.
- *Network Geometry in 3+ Dimensions*, given at the Network Geometry Workshop, UC San Diego, La Jolla, CA, August, 2013.
- *Do Bipartite Network Have Metric Structure?*, given at the UC Human Complexity Seminar Series, UC San Diego, La Jolla, CA, May, 2011.
- *Identification of Influential Spreaders in Complex Networks*, given at the workshop on Bridging Psychology and Neurophysiology, University of North Texas, Denton, TX, March, 2011.
- *Epidemics in Social Networks*, colloquium talk given at the CSE, University of Nevada, Reno, NV, December, 2010.

#### Contributed Talks

- *Reporting Delays: A Widely Neglected Impact Factor in COVID-19 Forecasts*, lightning talk at the NetSci 2024 conference, Quebec, QC, June, 2024.
- *Are Civilizations Destined to Collapse? Lessons from the Late Mediterranean Bronze*

- Age*, given at the annual Society for Risk Analysis (SRA) meeting, Washington, DC, December, 2023.
- *Finding Shortest Paths in Substantially Incomplete Networks*, given at the NetSci 2023 conference, Vienna, Austria, July, 2023.
  - *Deducing Geometric Representations for Complementarity-Driven Networks*, given at the NetSci-X 2022 conference, (online), February, 2022.
  - *Link Prediction with Hyperbolic Geometry*, given at the NetSci 2019 conference, Burlington, VT, May, 2018.
  - *Latent Structure and Dynamics of Big Data*, given at the NSF PI meeting, Washington, DC, July, 2018.
  - *Stability of a Giant Connected Component in a Complex Network*, given at the CompleNet 2018 conference, Boston, MA, March, 2018.
  - *Predicting Protein Interactions with Latent Geometry*, given at the NetSci 2017 conference, Indianapolis, IN, June, 2017.
  - *Long-Range Correlations and Memory in the Dynamics of Internet Routing*, given at the NetSci 2016 conference, Seoul, June, 2016.
  - *Lorentz-Invariant Maximum Entropy Network Ensembles*, given at the CompleNet 2016 workshop, March, 2016.
  - *Resilience of Networked Systems Under Epidemic Spreading*, given at the World Congress on Risk 2015, Singapore, July, 2015.
  - *Operational Resilience and Critical Functionality in Networked Systems: Concepts, Design and Analysis*, given at the World Congress on Risk 2015, Singapore, July, 2015.
  - *Tissue Specificity of Human Disease*, given at the NetSci 2014 conference, Berkeley, CA, USA, June, 2014.
  - *Popularity vs Similarity in Growing Complex Networks*, given at the Network Frontier Workshop, Evanston, IL, USA, December, 2013.
  - *Network Geometry*, given at the NetSci 2013 conference, Technical University of Denmark, Copenhagen, Denmark, June, 2013.
  - *Geometry of Complex Networks*, given at the Center for Cancer Systems Biology Retreat conference, Rockport, MA, USA, September, 2012.
  - *Popularity vs Similarity in Growing Complex Networks*, given at the NetSci 2012 conference, Evanston, IL, USA, June, 2012.
  - *Do Bipartite networks have metric structure?*, given at the APS March Meeting, Boston, MA, February, 2012.
  - *Do bipartite networks have metric structure?*, given at the NetSci 2011 conference, Budapest, Hungary, June, 2011.
  - *Identification of Influential Spreaders in Complex Networks*, given at the Future Internet and Society: A Complex Systems Perspective conference, Maratea, Italy, October, 2010.
  - *Metric Structure of Bipartite Networks*, given at the CCNR, Northeastern University, MA, USA, May, 2010
  - *Identification of Influential Spreaders in Complex Networks*, given at the NetSci 2010 conference, Boston, MA, USA, May, 2010.
  - *Leadership in Business Firm Networks*, given at the 100th Statistical Mechanics Conference, Rutgers University, NJ, USA, December, 2008
  - *K-shell Structure of Complex Networks*, given at the Tenth Annual Greater Boston Area Statistical Mechanics Meeting, Waltham, MA, USA, October, 2008
  - *Organization of Complex Networks*, given at the NetSci 08 conference, Norwich, UK, June, 2008.
  - *K-shell Structure of Large-Scale Complex Networks*, given at the CCNR, Northeastern University, MA, USA, April, 2008.
  - *Transport properties of Fractal and Non-Fractal Scale-Free Networks*, given at the NetSci 07 conference, Queens, NY, USA, May, 2007.

- *Self-Similarity of Complex Networks*, given at Boston University, MA, USA, March, 2007.
- *Non-stationary 4-wave mixing in resonant media* given at the 2nd International Conference of Young Scientists and Specialists *Optics-2001*, St. Petersburg, Russian Federation, October, 2001.

## TECHNOLOGY TRANSFER

### Patents

- A.S. Rubanov, A.I. Kitsak, N.V. Karelin, M.A. Kitsak and V. M. Suchek, *The method of the spatial coherency transformation of the pulse laser radiation and its realization*, Belarus Patent Number **8325**, Issued 8/30/06, priority from 11/21/02.
- A.I. Kitsak, M.A. Kitsak, N.V.Karelin and V.M. Suchek, *The method of the spatial coherency reduction of the pulse laser radiation and the method of realization*, Belarus Patent Number **12107**, Issued 12/30/08, priority from 04/20/07.

### Knowledge Transfer: United States Army Corps of Engineers (USACE)

#### • Methodology for Transportation Resilience Evaluation

##### Public use cases and outreach:

- *Resilience and Efficiency in Transportation Networks*, **public talk** at DC Mayor's office, Washington, DC, March, 2018.
- S. Vecherin, D. Chang, E. Wells, B. Trump, A. Meyer, J. Desmond, K. Dunn, M. Kitsak, and I. Linkov\*, *Assessment of the COVID-19 Infection Risk at a Workplace Through Stochastic Microexposure Modeling*, Nature Journal of Exposure Science & Environmental Epidemiology (2022).
- M. Kurth, W. Kozlowski, A. Ganin, A. Mersky, B. Leung, J. Dykes, M. Kitsak, and I. Linkov\*, *Lack of resilience in transportation networks: Economic implications*, Transportation Research Part D: Transport and Environment **86** 102419 (2020).
- A. Ganin, A. Mersky, A. Jin, M. Kitsak, J. Keisler, and I. Linkov\*, *Resilience for Intelligent Transportation Systems (ITS)*, Transportation Research Part C **100** 318 (2019).
- A. Ganin, M. Kitsak, D. Marchese, J. M. Keisler, T. Seager, and I. Linkov\*, *Resilience and Efficiency in Transportation Networks*, Science Advances **3** 12 e1701079 (2017).

#### • Methodology for COVID-19 Workplace Microexposure Risk Evaluation

##### Public use cases and outreach:

- S. Vecherin, D. Chang, E. Wells, B. Trump, A. Meyer, J. Desmond, K. Dunn, M. Kitsak, and I. Linkov\*, *Assessment of the COVID-19 Infection Risk at a Workplace Through Stochastic Microexposure Modeling*, Nature Journal of Exposure Science & Environmental Epidemiology (2022).

#### • Methodology for COVID-19 Forecasting

##### Public use cases and outreach:

- **ERDC-SEIR forecast model**. Model developed by the Engineer Research and Development Center (ERDC) for the U.S. Centers for Disease Control and Prevention (CDC). The model has been used by the CDC for alongside 15 other models for COVID-19 forecasts of the first wave.

- **Methodology for Shortest Path Resilience**

Public use cases and outreach:

- M. Kitsak\*, A. Ganin, H. Cui, D. Eisenberg, A. Elmokashfi, D. Korkin, D. Alderson, and I. Linkov\*, *Finding Shortest and Nearly Shortest Paths in Large Substantially Incomplete Networks by Hyperbolic Mapping*, Nature Communications **14** 186 (2023).

## REFERENCES

- Professor H. Eugene Stanley (Ph.D. advisor),  
William Fairfield Warren Distinguished Professor, University Professor,  
Director of the Center for Polymer Studies,  
Boston University, Boston, Massachusetts USA  
*email:* hes@bu.edu; *voice:* +1.617.353.2617  
*reference request:* send.Stanley.4E0EEEEAA5D@interfolio.com
- Professor Shlomo Havlin (Ph.D. co-advisor),  
Distinguished Professor of Physics,  
Department of Physics,  
Bar-Ilan University, Ramat-Gan, Israel  
*email:* havlins@gmail.com; *voice:* +972.3.5318436
- Professor Albert-László Barabási (postdoctoral mentor),  
Distinguished Professor of Physics,  
Director of the Center for Complex Network Research,  
Northeastern University Boston, Massachusetts, USA  
*email:* barabasi@gmail.com; *voice:* 617.373.2355  
*reference request:* jmstanfill.ccnr@gmail.com
- Professor Dmitri Krioukov (postdoctoral mentor),  
Professor of Physics,  
Northeastern University Boston, Massachusetts, USA  
*email:* dima@neu.edu; *voice:* +1.617.373.2934
- Professor Dmitry Korkin (joint publications),  
Jurist Dean's Professor,  
Department of Computer Science,  
Worcester Polytechnic Institute, Worcester, Massachusetts, USA.  
*email:* dkorkin@wpi.edu; *voice:* +1.508.831.4916
- Prof. Zoltán Toroczkai (independent),  
Professor of Physics, Computer Science, and Engineering,  
Notre Dame University, Notre Dame, IN, USA  
*email:* toro@nd.edu; *voice:* +1.574.631.2618