

Wasiur Rahman Khuda Bukhsh

Mathematical Biosciences Institute
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Summary

Interested in applied probability theory, mathematical biology, data science. Provided service to the Ohio Department of Health as part of the OSU/IDI COVID-19 response modelling team.

Education

- 2014 – 2018 **Ph.D. (Dr. rer. nat.), summa cum laude (with distinction)**, *Department of Electrical Engineering and Information Technology, Technische Universität Darmstadt, Germany.*
Thesis: Model reductions for queueing and agent-based systems with applications in communication networks
Advisor: **Heinz Koepl**
- 2009 – 2011 **Master of Statistics (M.Stat.)**, *Indian Statistical Institute, Kolkata, India.*
- 2006 – 2009 **Bachelor of Science (B.Sc.) with Honours in Statistics**, *University of Calcutta, Kolkata, India.*

Professional Experience

- Jan 2020 – **President's Postdoctoral Scholar**, *Mathematical Biosciences Institute and the College of Public Health, The Ohio State University, Columbus, Ohio, USA.*
- Oct 2018 – **Postdoctoral Researcher**, *Mathematical Biosciences Institute, The Ohio State University, Columbus, Ohio, USA.*
- Dec 2019 *University, Columbus, Ohio, USA.*
- Jan 2014 – **Research Associate**, *Technische Universität Darmstadt, Darmstadt, Germany.*
- Sep 2018 *Department of Electrical Engineering and Information Technology*
- Jun 2011 – **Manager**, *ICICI Bank, Mumbai, India.*
- Dec 2013 *Advanced Analytics, Business Intelligence Unit (BIU)*

Publications

Peer-reviewed journal publications

- [1] **Wasiur R. KhudaBukhsh**, Boseung Choi, Eben Kenah, and Grzegorz Rempała. Survival Dynamical Systems for the Population-level Analysis of Epidemics. *Interface Focus*, 10(1), 2020.
- [2] **Wasiur R. KhudaBukhsh**, Arnab Auddy, Yann Disser, and Heinz Koepl. Approximate lumpability for markovian agent-based models using local symmetries. *Journal of Applied Probability*, 56, 9 2019.

- [3] **Wasiur R. KhudaBukhsh**, Sounak Kar, Bastian Alt, Amr Rizk, and Heinz Koepl. Generalized cost-based job scheduling in very large cluster systems. *IEEE Transactions on Parallel and Distributed Systems*, 31(11):2594–2604, 2020.
- [4] Boseung Choi, Sydney Busch, Dieudonné Kazadi, Benoit Ilunga, Emile Okitolonda, Yi Dai, Robert Lumpkin, Omar Saucedo, **Wasiur R. KhudaBukhsh**, Joseph Tien, Marcel Yotebieng, Eben Kenah, and Grzegorz A. Rempała. Modeling Outbreak Data: Analysis of a 2012 Ebola Virus Disease Epidemic in DRC. *BIOMATH*, 8(2), 2019.
- [5] **Wasiur R. KhudaBukhsh**, Amr Rizk, Sounak Kar, and Heinz Koepl. Provisioning and performance evaluation of parallel systems with output synchronization. *ACM Transactions on Modeling and Performance Evaluation of Computing Systems (TOMPECS)*, 4(1), 3 2019.
- [6] Hye-Won Kang*, **Wasiur R. KhudaBukhsh***, Heinz Koepl, and Grzegorz Rempała. Quasi-steady-state approximations derived from a stochastic enzyme kinetics. *Bulletin of Mathematical Biology*, 81(5):1303–1336, 2019. *joint first authors.
- [7] Bastian Alt, Markus Weckesser, Christian Becker, Matthias Hollick, Sounak Kar, Anja Klein, Robin Klose, Roland Kluge, Heinz Koepl, Boris Koldehofe, **Wasiur R. KhudaBukhsh**, Mahdi Mousavi, Martin Pfannemueller, Amr Rizk, Andy Schuerr, and Ralf Steinmetz. Transitions: A protocol-independent view of the future internet. *Proceedings of the IEEE*, 107(4):835–846, 4 2019.
- [8] **Wasiur R. KhudaBukhsh**, Julius Rückert, Julian Wulfheide, David Hausheer, and Heinz Koepl. SCHEDMIX: Heterogeneous strategy assignment in swarming-based live streaming. *Open Transactions on Communication Systems (OTCS)*, 2019. Accepted for publication.

Peer-reviewed conference proceedings

- [9] **Wasiur R. KhudaBukhsh**, Bastian Alt, Sounak Kar, Amr Rizk, and Heinz Koepl. Collaborative uploading in heterogeneous networks: Optimal and adaptive strategies. In *IEEE International Conference on Computer Communications (INFOCOM)*, pages 1–9, 4 2018. < 20% acceptance rate. Best-in-Session Presentation Award.
- [10] **Wasiur R. KhudaBukhsh**, Amr Rizk, Alexander Frömmgen, and Heinz Koepl. Optimizing Stochastic Scheduling in Fork-Join Queueing Models: Bounds and Applications. In *IEEE International Conference on Computer Communications (INFOCOM)*, pages 1–9, 5 2017. ~ 20% acceptance rate.
- [11] Adrian Šošić, **Wasiur R. KhudaBukhsh**, A. M. Zourbir, and Heinz Koepl. Inverse reinforcement learning in swarm systems. In *AAMAS Workshop on Transfer in Reinforcement Learning*, May 2017. Available: <http://www.tirl.info/proceedings/2017/SosicEtal-Inverse.pdf>.
- [12] Adrian Šošić, **Wasiur R. KhudaBukhsh**, A. M. Zourbir, and Heinz Koepl. Inverse reinforcement learning in swarm systems. In *International Conference on Autonomous Agents & Multiagent Systems (AAMAS)*, page 14131421, 5 2017. ~ 26% acceptance rate, Best Paper Award Finalist.
- [13] **Wasiur R. KhudaBukhsh**, Julius Rückert, Julian Wulfheide, David Hausheer, and Heinz Koepl. Analysing and Leveraging Client Heterogeneity in Swarming-based Live Streaming. In *IFIP Networking Conference (IFIP Networking) and Workshops*, pages 386–394, 5 2016. ~ 26% acceptance rate.

- [14] Mahdi Mousavi, Hussein Al Shatri, **Wasiur R. KhudaBukhsh**, Heinz Koepl, and Anja Klein. Cross-Layer QoE-based Incentive Mechanism for Video Streaming in Multi-Hop Wireless Networks. In *IEEE 86th Vehicular Technology Conference (VTC)*, 9 2017.

Preprints/Submitted

- [15] **Wasiur R. KhudaBukhsh**, Casper Woroszylo, Grzegorz Rempała, and Heinz Koepl. A Functional Central Limit Theorem for Susceptible-Infected (SI) Process on Configuration Model Graphs. *Advances in Applied Probability*, 2020. Under revision. ArXiv preprint: <https://arxiv.org/abs/1703.06328>.
- [16] **Wasiur R. KhudaBukhsh***, Hye-Won Kang, Eben Kenah, and Grzegorz Rempała. Incorporating age and delay into models for biophysical systems. *Physical Biology*, 2020. Under review. (*Invited paper) arXiv preprint: <https://arxiv.org/abs/2007.00577>.

Manuscripts in progress

- [17] **Wasiur R. KhudaBukhsh***, Sat Kartar*, Eben Kenah, Grzegorz Rempała, and Joseph Tien. COVID-19 dynamics in an Ohio prison, 2020. *Joint first authors.
- [18] **Wasiur R. KhudaBukhsh**, Matthew Wascher, Mark Weir, Eben Kenah, Elisabeth Root, Joseph H. Tien, and Grzegorz Rempała. Projecting COVID-19 Cases and Subsequent Hospital Burden in Ohio, 2020.
- [19] **Wasiur R. KhudaBukhsh**, Boseung Choi, Eben Kenah, and Grzegorz Rempała. PDE and Stochastic PDE limits for biochemical reaction networks, 2020.
- [20] Zaynab Diallo, **Wasiur R. KhudaBukhsh**, and Eben Kenah. Semiparametric pairwise regression for infectious disease transmission with external sources of infection, 2020.
- [21] Caleb Deen Bastian, **Wasiur R. KhudaBukhsh**, Yuhuan Pan, Eben Kenah, and Grzegorz A. Rempała. Predicting the Size and Duration of COVID-19 Outbreaks under Minimal Assumptions, 2020.
- [22] Zaynab Diallo*, Yushuf Sharker*, **Wasiur R. KhudaBukhsh**, and Eben Kenah. Pairwise accelerated failure time models with external sources of infection and epidemiological studies of infectious disease transmission, 2020. *Joint first authors.

Thesis and technical notes

- [23] **Wasiur R. KhudaBukhsh**. *Model reductions for queueing and agent-based systems with applications in communication networks*. PhD thesis, Technische Universität, Darmstadt, 2018. Available at: <http://tuprints.ulb.tu-darmstadt.de/7588/>.
- [24] **Wasiur R. KhudaBukhsh**, Mark Sinzger, and Heinz Koepl. Bounds on the spectral radius of real-valued non-negative kernels on measurable spaces. Technical report, 2018. arXiv preprint: <https://arxiv.org/abs/1808.00258>.

Awards and Funding

Awards

- 2019 Presidents Postdoctoral Scholars Program (PPSP) of the Ohio State University

2. Best-in-Session Presentation Award at the IEEE International Conference on Computer Communications (IEEE INFOCOM), Honolulu, Hawaii, USA, 2018.

Funding

1. The German Academic Exchange Service (DAAD) travel grant (Kongressreise) to participate in the Annual Meeting of the SMB in Sydney, Australia (~ 2000 EUR)

■ Presentations

Summary: 15 invited and 15 contributed/seminar talks. 5 poster presentations.

Invited talks

1. Special session at the Joint Mathematics Meetings (JMM), virtual, January 6-9, 2021 (upcoming)
2. Biostatistics seminar, the Ohio State University, Columbus, OH, USA, October 30, 2020 (upcoming)
3. Math-Bio seminar, Virginia Tech, virtual, September 23, 2020 (upcoming)
4. International Webinar Series on Artificial Intelligence and Machine Learning, virtual, September 18, 2020 (upcoming)
5. Workshop on Life on Planet Earth: Above and Below, MBI, OSU, August 11, 2020
6. International Webinar, Departments of Mathematics and Physics, Bidhan Chandra College, virtual, July 18, 2020
7. Special session of Data Science, Business Intelligence Unit, ICICI Bank, Mumbai, India, July 24, 2020
8. Special session at the Erdős Institute Python Bootcamp, May 2020 (jointly with Marissa Renardy)
9. Biostatistics Seminar, the Ohio State University, Columbus, OH, USA, February 28, 2020
10. Mathematical Modeling and Statistical Analysis of Infectious Disease Outbreaks, CIRM, Marseille, France, February 21, 2020
11. Mini-symposium speaker at the Annual Meeting of the SMB, Montreal, Canada, 2019
12. Mini-symposium speaker at the International Conference on Mathematical Methods and Models in Biosciences (BioMath), June 2019, Poland
13. BIRS-CMO workshop on "Scaling Limits of Dynamical Processes on Random Graphs", May 2019, Oaxaca, Mexico
14. Mini-symposium speaker at the Annual Meeting of the SMB and the JSMB, Sydney, Australia, 2018
15. Cloud Computing, Machine Learning And Networking Research (CLAN) Lab, Purdue University (May, 2017), Host : Vaneet Aggarwal

Contributed talks

1. Bernoulli-IMS One World Symposium 2020, virtual, August 25, 2020
2. Mini-symposium speaker at the Annual Meeting of the SMB, virtual, August 19, 2020
3. Joint Statistical Meetings 2020, virtual, August 2-6, 2020
4. Mini-symposium speaker at SIAM Conference on Mathematics of Data Science 2020 (virtual), June 2020
5. MBI Workshop on Mathematical and Computational Methods in Biology, May 6, 2020
6. International Indian Statistical Association Conference (IISA 2019), Mumbai, India, December 28, 2019
7. Latin American Congress of Probability and Mathematical Statistics (CLAPEM) XV, Merida-Yucatán, México, December, 2019
8. Mathematical Biosciences Institute (MBI) Seminar, Columbus, Ohio, USA, October, 2019
9. Joint Statistical Meetings (JSM) - American Statistical Association, Colorado, USA, 2019

10. Stochastic Processes and their Applications, Bernoulli Society, Northwestern University, July 2019, USA
11. International Conference on Mathematical Methods and Models in Biosciences (BioMath), June 2019, Poland
12. Mathematical Biosciences Institute (MBI) Seminar, Columbus, Ohio, USA, 2019
13. IEEE International Conference on Computer Communications (IEEE INFOCOM), Honolulu, Hawaii, USA, 2018
14. IEEE International Conference on Computer Communications (IEEE INFOCOM), Atlanta, GA, USA, 2017
15. IFIP Networking Conference and Workshops, Vienna, Austria, 2016

Poster presentations

1. Mathematical Models in Evolutionary Biology conference, CIRM, Marseilles, France, February 10-14 2020
2. Annual Meeting of the Infectious Disease Institute, The Ohio State University, September 2019, Columbus, OH, USA
3. Joint Statistical Meetings (JSM) - American Statistical Association, Colorado, USA, 2019
4. CMCF Algorithms and Methods for Single Cell Genomics, University of California, Irvine, June 2019, USA
5. BIRS-CMO workshop on "Scaling Limits of Dynamical Processes on Random Graphs", May 2019, Oaxaca, Mexico

Teaching Experience

1. STAT 4201: Introduction to Mathematical Statistics
Department of Statistics, The Ohio State University, USA
Role: Instructor
Terms: Fall semester 2019 (> 120 students)
2. PUBHBIO7193: Individual studies in Biostatistics (Advanced stochastic epidemiology)
Division of Biostatistics, The Ohio State University, USA
Role: Instructor (jointly with Eben Kenah)
Terms: Summer semester 2019
3. Computational Methods for Systems and Synthetic Biology (CMSSB)
Department of Electrical Engineering and Information Technology, Technische Universität Darmstadt, Germany
Role: Teaching Assistant
Terms: Summer semester 2016, Summer semester 2017

Student Supervision and Mentoring

Summary: (Co-) Supervised a total of 12 undergrad (B.Sc.) and 6 M.Sc. students.

M.Sc. Students

1. Robert Lumpkin, 2019, Master degree project (jointly with Prof. Greg Rempala), Department of Mathematics, The Ohio State University, USA (*resulted in the publication [4]*)
2. Arnab Auddy, 2017, Summer internship, Technische Universität Darmstadt, Germany (*resulted in the publication [2]*)
3. Markus Schanz, 2017, Master thesis (jointly with Christian Koch), Technische Universität Darmstadt, Germany

4. Hameer Abbasi, 2017, Master thesis (jointly with Bastian Alt), Technische Universität Darmstadt, Germany
5. Ranjani Krishnan, 2018, Master thesis (jointly with Denny Stohr), Technische Universität Darmstadt, Germany
6. Sayantan Kumar, 2018, Summer internship, Technische Universität Darmstadt, Germany (*manuscript to be submitted for publication*)

Outreach and Service

COVID-19 Modelling Response

1. Provided service to the Ohio Department of Health and Ohio Hospital Association as part of the OSU/IDI COVID-19 response modelling team. Provided daily predictions of COVID-19 cases and resultant hospital burden in the state of Ohio, USA.

Organizing conferences

1. Invited session at the IMS Asia Pacific Rim Meeting, Melbourne, Australia, 2022 (pending acceptance. Jointly with Gursharn Kaur)
2. Invited session at the Annual Meeting of the ENAR, 2021 (jointly with Marissa Renardy)
3. Mini-symposium at the Annual Meeting of the Society for Mathematical Biology, 2020 (jointly with Hye-Won Kang)
4. Mini-symposium at the SIAM Conference on Mathematics of Data Science (MDS20), Cincinnati, OH, USA, June 11, 2020 (jointly with Veronica Ciaconel)
5. Contributed Session at the Latin American Congress of Probability and Mathematical Statistics (CLAPEM) XV, Merida-Yucatán, México, December, 2019 (jointly with Hye-Won Kang)
6. Session at the 2019 International Indian Statistical Association Conference (IISA 2019), Mumbai, India, December 2019 (jointly with Arindam Fadikar)

Tutorials

1. "How to write scientific papers" for MBI REU students, 2019
2. "Introduction to epidemic modelling" for SAMMS REU students, 2019
3. "Modeling the COVID-19 pandemic" for the Erdős Institute bootcamp, May 2020

Mentoring REUs

1. MBI REUs, Summer 2019
2. Ohio 5 SURE students at the College of Public Health, OSU, 2019

Reviewer

1. Stochastic Processes and their Applications
2. Bulletin of Mathematical Biology
3. Journal of Chemical Physics
4. Journal of Mathematics in Industry
5. Journal of Scientific Research
6. IEEE Multi-Conference on Systems and Control, Sydney, Australia, 2015
7. Journal of Mathematical Biology
8. IEEE Transactions on Automatic Control
9. IEEE Transactions on Networking
10. IEEE Transactions on Control of Network Systems
11. Journal of Mathematics in Industry
12. PLOS One

13. American Control Conference (ACC)

Other Services

1. Judge for the OSU Mathematical Contest for Modeling, 2018, 2019
2. Judge for OPA travel awards, the Ohio State University, 2019

Professional Memberships

1. Society for Industrial and Applied Mathematics (SIAM)
2. Bernoulli Society for Mathematical Statistics and Probability
3. The Society for Mathematical Biology (SMB)
4. American Statistical Association (ASA)
5. American Association for the Advancement of Science (AAAS)

Computer Skills

Programming Languages C, R, Python, SQL, Julia

Software Matlab, SAS, Microsoft Office, \LaTeX

Languages

English Professional Proficiency

Bengali Mother Tongue

Hindi Working Knowledge

German Intermediate (B1 level)

References

Available upon request.