

# Mikhail Yurochkin

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## Education

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**Ph.D., Statistics** 2013 – 2018

*University of Michigan, Ann Arbor, MI, United States*

- Thesis: “Geometric Inference in Bayesian Hierarchical Models with Applications to Topic Modeling”
- Advisor: Professor XuanLong Nguyen

**Master of Arts, Statistics** 2013 – 2015

*University of Michigan, Ann Arbor, MI, United States*

**Bachelor's, Applied Mathematics and Physics** 2009 – 2013

*Moscow Institute of Physics and Technology, Moscow, Russia*

## Research Experience

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**Research Staff Member** June 2018 – Present

*IBM Research and MIT-IBM Watson AI Lab, Cambridge, MA, United States*

Machine Learning and Artificial Intelligence research.

- Leading research projects supporting IBM's platform for Large Language Models.
- Leading research teams on Algorithmic Fairness, Federated Learning, Out-of-Distribution Generalization, and Optimal Transport projects. Our work is regularly published in top-tier Machine Learning and Artificial Intelligence venues.
- Leading a team of engineers to create AI Fairness software and demonstrations.
- Leading interdisciplinary fairness research collaborations with human-computer interaction and healthcare groups.
- Mentoring graduate students and collaborating with academic research groups, including Yuekai Sun's group at the University of Michigan, Justin Solomon's Geometric Data Processing group at MIT, and Anette (Peko) Hosoi's group at MIT.
- Regularly representing IBM Research at conferences and workshops via invited talks and tutorial presentations.

**Research Associate** May 2018 – June 2018

*University of Michigan, Ann Arbor, MI, United States*

- Led two research projects in collaboration with senior PhD students and faculty resulting in two NeurIPS 2018 submissions.
- Studied driving behaviors using Bayesian modeling in collaboration with the Toyota Research Institute.

**Data science research intern** June 2017 – Aug 2017

*Adobe, San Jose, CA, United States*

- Proposed a method for jointly training a graph neural network and inferring the graph structure when the graph is unknown. Applied this method to forecasting number of visits to a major retailer's website across cities for improved marketing and sales.

**Consultant for Statistics, Computing, and Analytics Research** Sept 2016 – Dec 2017

*University of Michigan, Ann Arbor, MI, United States*

- Assisted faculty and graduate students in areas such as biology, dentistry, marketing, political science, public health, and computer science in identifying and implementing appropriate statistical methodology for their data and research problems.

**Science team intern** May 2016 – Aug 2016

*LogicBlox/Predictix, Atlanta, GA, United States*

- Proposed and implemented an explainable forecasting model based on Factorization Machines and Indian Buffet Process. Analyzed sales data from a major retailer using the proposed model and published a NeurIPS 2017 paper based on this work.

**Graduate Student Research Assistant** July 2014 – April 2018

*University of Michigan, Ann Arbor, MI, United States*

- Formulated topic modeling as a geometric problem and developed new algorithms significantly outperforming prior state-of-the-art in terms of estimation speed. These results were published at NeurIPS 2016 and 2017.
- Proposed Bayesian modeling approaches to identify insider attacks from SQL queries of a bank database.

## Teaching Experience

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**Guest Lecturer** on Fairness in ML @ University of Michigan, Introduction to ML Class

Nov 2022

**Graduate Student Instructor**

Sept 2013 – April 2016

*University of Michigan, Ann Arbor, MI, United States*

Taught labs, graded, held office hours:

- Topics in Biostatistics
- Applied Probability
- Introduction to Statistics
- Introduction to Probability

Jan 2015 – April 2016

Sept 2014 – Dec 2014

Jan 2014 – April 2014

Sept 2013 – Dec 2013

## Publications

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- [1] T. Shnitzer, A. Ou, M. Silva, K. Soule, Y. Sun, J. Solomon, N. Thompson, and **M. Yurochkin**. Large Language Model Routing with Benchmark Datasets. *arXiv preprint arXiv:2309.15789*, 2023.
- [2] H. Wang, F. Polo, Y. Sun, S. Kundu, E. Xing, and **M. Yurochkin**. Fusing Models with Complementary Expertise. *arXiv preprint arXiv:2310.01542*, 2023.
- [3] L. Ngweta, S. Maity, A. Gittens, Y. Sun, and **M. Yurochkin**. Simple Disentanglement of Style and Content in Visual Representations. In *International Conference on Machine Learning (ICML)*, 2023.
- [4] K. Greenewald, A. Gu, **M. Yurochkin**, J. Solomon, and E. Chien. k-Mixup regularization for deep learning via optimal transport. *Transactions on Machine Learning Research (TMLR)*, 2023.
- [5] S. Maity, **M. Yurochkin**, M. Banerjee, and Y. Sun. Understanding new tasks through the lens of training data via exponential tilting. In *International Conference on Learning Representations (ICLR)*, 2023.
- [6] L. Li, N. Aigerman, V. Kim, J. Li, K. Greenewald, **M. Yurochkin**, and J. Solomon. Learning Proximal Operators to Discover Multiple Optima. In *International Conference on Learning Representations (ICLR)*, 2023.
- [7] L. Li, Q. Liu, A. Korba, **M. Yurochkin**, and J. Solomon. Sampling with Mollified Interaction Energy Descent. In *International Conference on Learning Representations (ICLR)*, 2023.
- [8] Z. Ashktorab, B. Hoover, M. Agarwal, C. Dugan, W. Geyer, H.B. Yang, and **M. Yurochkin**. Fairness Evaluation in Text Classification: Machine Learning Practitioner Perspectives of Individual and Group Fairness. In *CHI Conference on Human Factors in Computing Systems*, 2023.
- [9] S. Xue, Y. Sun, and **M. Yurochkin**. Calibrated Data-Dependent Constraints with Exact Satisfaction Guarantees. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2022. **Oral**.
- [10] D. Mukherjee, F. Petersen, **M. Yurochkin**, and Y. Sun. Domain Adaptation meets Individual Fairness. And they get along. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2022.
- [11] **M. Yurochkin** and Y. Sun. Communication-Efficient Model Fusion. In H. Ludwig and N. Baracaldo, editors, *Federated Learning: A Comprehensive Overview of Methods and Applications*, pages 145–176. Springer International Publishing, Cham, 2022.
- [12] M. Agarwal, **M. Yurochkin**, and Y. Sun. Personalization in Federated Learning. In H. Ludwig and N. Baracaldo, editors, *Federated Learning: A Comprehensive Overview of Methods and Applications*, pages 71–98. Springer International Publishing, Cham, 2022.
- [13] T. Shnitzer, **M. Yurochkin**, K. Greenewald, and J. Solomon. Log-Euclidean Signatures for Intrinsic Distances Between Unaligned Datasets. In *International Conference on Machine Learning (ICML)*, 2022.

- [14] B.C. Kwon, U. Kartoun, S. Khurshid, **M. Yurochkin**, S. Maity, D. Brockman, A. Khera, P. Ellinor, S. Lubitz, and K. Ng. RMExplorer: A Visual Analytics Approach to Explore the Performance and the Fairness of Disease Risk Models on Population Subgroups. In *IEEE Visualization Conference (VIS) Short Papers*, 2022.
- [15] I. Baldini, D. Wei, K. Ramamurthy, **M. Yurochkin**, and M. Singh. Your fairness may vary: Pretrained language model fairness in toxic text classification. In *Findings of ACL*, 2022.
- [16] W. Stephenson, S. Ghosh, T. Nguyen, **M. Yurochkin**, S. Deshpande, and Broderick T. Measuring the sensitivity of Gaussian processes to kernel choice. In *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2022.
- [17] F. Petersen, D. Mukherjee, Y. Sun, and **M. Yurochkin**. Post-processing for Individual Fairness. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2021.
- [18] M. Agarwal, **M. Yurochkin**, and Y. Sun. On sensitivity of meta-learning to support data. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2021.
- [19] S. Maity, D. Mukherjee, **M. Yurochkin**, and Y. Sun. Does enforcing fairness mitigate biases caused by subpopulation shift? In *Advances in Neural Information Processing Systems (NeurIPS)*, 2021.
- [20] V. Huynh, N. Ho, N. Dam, X. Nguyen, **M. Yurochkin**, H. Bui, and D. Phung. On efficient multilevel Clustering via Wasserstein distances. *Journal of Machine Learning Research (JMLR)*, 2021.
- [21] D. Mukherjee, A. Guha, J. Solomon, Y. Sun, and **M. Yurochkin**. Outlier-Robust Optimal Transport. In *International Conference on Machine Learning (ICML)*, 2021.
- [22] S. Maity, S. Xue, **M. Yurochkin**, and Y. Sun. Statistical inference for individual fairness. In *International Conference on Learning Representations (ICLR)*, 2021.
- [23] A. Bower, H. Eftekhari, **M. Yurochkin**, and Y. Sun. Individually Fair Rankings. In *International Conference on Learning Representations (ICLR)*, 2021.
- [24] A. Vargo, F. Zhang, **M. Yurochkin**, and Y. Sun. Individually Fair Gradient Boosting. In *International Conference on Learning Representations (ICLR)*, 2021. **Spotlight**.
- [25] **M. Yurochkin** and Y. Sun. SenSel: Sensitive Set Invariance for Enforcing Individual Fairness. In *International Conference on Learning Representations (ICLR)*, 2021. **Oral**.
- [26] M. Weber, **M. Yurochkin**, S. Botros, and V. Markov. Black Loans Matter: Distributionally Robust Fairness for Fighting Subgroup Discrimination. *NeurIPS Fair AI in Finance Workshop*, 2020. **Spotlight Talk**.
- [27] L. Li, A. Genevay, **M. Yurochkin**, and J. Solomon. Continuous Regularized Wasserstein Barycenters. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2020.
- [28] S. Clatici\*, **M. Yurochkin\***, S. Ghosh, and J. Solomon. Model Fusion with Kullback–Leibler Divergence. In *International Conference on Machine Learning (ICML)*, 2020.
- [29] D. Mukherjee\*, **M. Yurochkin\***, M. Banerjee, and Y. Sun. Two Simple Ways to Learn Individual Fairness Metric from Data. In *International Conference on Machine Learning (ICML)*, 2020.
- [30] S. Xue, **M. Yurochkin**, and Y. Sun. Auditing ML models for individual bias and unfairness. In *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2020.
- [31] H. Wang, **M. Yurochkin**, Y. Sun, D. Papailiopoulos, and Y. Khazaeni. Federated Learning with Matched Averaging. In *International Conference on Learning Representations (ICLR)*, 2020. **Oral**.

- [32] **M. Yurochkin**, A. Bower, and Y. Sun. Training individually fair ML models with sensitive subspace robustness. In *International Conference on Learning Representations (ICLR)*, 2020. **Spotlight**.
- [33] **M. Yurochkin**, S. Clatici, E. Chien, F. Mirzazadeh, and J. Solomon. Hierarchical Optimal Transport for Document Representation. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2019.
- [34] **M. Yurochkin**, M. Agarwal, S. Ghosh, K. Greenewald, and N. Hoang. Statistical Model Aggregation via Parameter Matching. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2019.
- [35] P. Monteiller, S. Clatici, E. Chien, F. Mirzazadeh, J. Solomon, and **M. Yurochkin**. Alleviating Label Switching with Optimal Transport. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2019.
- [36] **M. Yurochkin**, Z. Fan, A. Guha, P. Koutris, and X. Nguyen. Scalable inference of topic evolution via models for latent geometric structures. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2019.
- [37] **M. Yurochkin\***, A. Guha\*, Y. Sun, and X. Nguyen. Dirichlet Simplex Nest and Geometric Inference. In *International Conference on Machine Learning (ICML)*, 2019. **Long Talk**.
- [38] **M. Yurochkin**, M. Agarwal, S. Ghosh, K. Greenewald, N. Hoang, and Y. Khazaeni. Bayesian Nonparametric Federated Learning of Neural Networks. In *International Conference on Machine Learning (ICML)*, 2019.
- [39] **M. Yurochkin**, S. Upadhyay, D. Bouneffouf, M. Agarwal, and Y. Khazaeni. Online Semi-Supervised Learning with Bandit Feedback. *ICLR Limited Labeled Data (LLD) Workshop*, 2019.
- [40] **Mikhail Yurochkin**. *Geometric Inference in Bayesian Hierarchical Models with Applications to Topic Modeling*. PhD thesis, University of Michigan, 2018.
- [41] **M. Yurochkin**, A. Guha, and X. Nguyen. Conic Scan-and-Cover algorithms for nonparametric topic modeling. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2017.
- [42] **M. Yurochkin**, X. Nguyen, and N. Vasiloglou. Multi-way Interacting Regression via Factorization Machines. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2017.
- [43] N. Ho, X. Nguyen, **M. Yurochkin**, H. Bui, V. Huynh, and D. Phung. Multilevel Clustering via Wasserstein Means. In *International Conference on Machine Learning (ICML)*, 2017.
- [44] **M. Yurochkin** and X. Nguyen. Geometric Dirichlet Means algorithm for topic inference. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2016.

## Patents

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- K. Greenewald, L. Jung, J. Solomon, **M. Yurochkin**, and Y. Zeng. A method for outlier robust subgroup inference via clustering in the gradient space. Filed on April 29, 2023.
- **M. Yurochkin**, D. Mukherjee, M. Banerjee, Y. Sun, and S. Upadhyay. Learning Mahalanobis Distance Metrics from Data. Filed on June 11, 2021.
- S. Upadhyay, **M. Yurochkin**, D. Mukherjee, Y. Sun, A. Bower, H. Eftekhari, A. Vargo, and F. Zhang. Training Individually Fair Machine Learning Algorithms via Distributionally Robust Optimization. Filed on March 25, 2021.
- Y. Khazaeni, E. Daly, C. Muise, and **M. Yurochkin**. Artificial Intelligence for Learning Path Recommendations. Filed on December 31, 2020.
- K. Greenewald, **M. Yurochkin**, M. Agarwal, S. Ghosh, N. Hoang and Y. Khazaeni. A method for combining pre-trained neural networks into a memory and computation efficient global model. Filed on September 20, 2019.
- S. Upadhyay, **M. Yurochkin**, M. Agarwal, D. Bouneffouf and Y. Khazaeni. Method for Online Partially Rewarded Learning. Filed on August 28, 2019.

## Open-Source Software

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- inFairness, Python package for Individual Fairness: [github.com/IBM/inFairness](https://github.com/IBM/inFairness)
- Playground for comparing Group and Individual Fairness of toxic text detectors: temporarily behind VPN

## Talks

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Tutorials.....	
○ AI Fairness through Robustness @ AAAI	2023
○ Fairness of Machine Learning in Search Engines @ CIKM	2022
○ AI Fairness @ MIT-IBM THINK Industry Day	2022
Invited Talks.....	
○ Operationalizing Individual Fairness @ One World YoungStatS Webinar series	2023
○ AI Fairness & Language Models @ Northern Germany delegation visit to the MIT-IBM Lab	2023
○ Practical Individual Fairness @ TrustML Young Scientist Seminars	2022
○ Black Loans Matter: Fighting Bias for AI Fairness in Lending @ KDD Workshop on Machine Learning in Finance (Keynote)	2021
○ Model fusion via single-round FL @ Enterprise-Strength Federated Learning, ICML Expo	2021
○ Practical Individual Fairness algorithms @ Toronto Machine Learning Summit	2021
@ ODSC West	2021
@ Foundations of Algorithmic Fairness (FAF) workshop	2021
@ Research Talks for Enel	2021
@ IBM Research, Cambridge Lab All-hands	2021
○ Fusion of Heterogeneous Models in Federated Learning @ The 2nd Annual Federated & Distributed/ Decentralized Machine Learning Conference	2021
○ Federated Learning: Practice and Modern Algorithms @ ODSC Europe	2021
○ Invited panelist @ Federated Learning, AI and Data Security Summit, HUB Security event	2021
○ Fairness in mortgage lending @ Tech for Racial and Social Justice, UW-Madison Data Science Bazaar	2021
○ Individual Fairness through Robustness @ Algorithmic fairness with statistical guarantees, CMStatistics session	2020
@ Global Data Science Community meet-up, UniCredit event	2020
○ Fairness in AI @ What's Next in AI: AI we can trust, MIT-IBM conference	2020
○ Bayesian nonparametric fusion of heterogeneous models @ IBM Research Cambridge seminar series	2019
○ Geometric Inference in Bayesian Hierarchical Models with Applications to Topic Modeling @ MIT Geometric Data Processing Group seminar	2018
Contributed Presentations.....	
○ Data Science Research Forum (poster)	2017
○ Joint Statistical Meetings (speed session talk and poster)	2017
○ Michigan Student Symposium for Interdisciplinary Statistical Sciences (talk)	2017
○ Michigan Institute for Computational Discovery and Engineering Symposium (poster)	2016
○ Michigan Student Symposium for Interdisciplinary Statistical Sciences (poster)	2016

- From Industrial Statistics to Data Science (poster) 2015

## Awards

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- Outstanding Technical Achievement Award for contributions to Federated Learning Security and Privacy (IBM internal) 2023
- Outstanding (O-level) Accomplishment (IBM internal) 2022
- IBM Creator: Courageous Leader (IBM internal) 2022
- Outstanding Technical Achievement Award (IBM internal) 2021
- EB1 Green Card (outstanding professor or researcher) 2021
- Research (A-level) Accomplishment (IBM internal) 2020
- Faces of IBM: AI Pioneer (IBM internal) 2020
- Outstanding Demonstration - Honorable Mention award NeurIPS 2020
- Reviewer award NeurIPS 2018, 2019
- Rackham Conference Travel Grant 2016, 2017
- Abramov scholarship (awarded to less than 5% students at MIPT) 2010

## Mentorship

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- Anthony Ou, MIT Master's of Engineering (MEng) student 2023-Present
- Break Through Tech AI (BTAI) @ MIT, Project Advisor for two student teams 2023-Present
- Michael Feffer, IBM Research Tech for Justice summer PhD student intern 2023
- Hao Bang (Kevin) Yang, MIT Master's of Engineering (MEng) student 2022-2023
- Break Through Tech AI (BTAI) @ MIT, Project Advisor for a group of six students 2022
- Yuchen Zeng, MIT-IBM summer PhD student intern 2022
- Subha Maity, IBM Research Tech for Justice summer PhD student intern 2022
- Lilian Ngweta, IBM Research summer PhD student extern 2022, 2023
- Todd Zhou, Research Science Institute (RSI) high school student 2022
- Luann Jung, MIT Master's of Engineering (MEng) student (with J. Solomon) 2021-2022
- Yining Chen, MIT-IBM summer PhD student intern 2021
- Haingoharijao Faniriniaina Ramandiamanana, African Master's in Machine Intelligence (AMMI) student (with J. Solomon and D. Palmer) 2020
- Debarghya Mukherjee, MIT-IBM summer PhD student intern 2020
- Hongyi Wang, IBM Research summer PhD student intern 2019

## Professional Activities

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### Organization and Service.....

- Practical Bayesian Methods for Big Data and Big Models workshop (co-organizer) @ MIT-IBM AI week 2019
- Optimal Transport seminar (with Y. Mroueh) @ IBM Research AI seminar series 2019

### Reviewer.....

- Neural Information Processing Systems (NeurIPS) 2016-2022
- Transactions on Pattern Analysis and Machine Intelligence (TPAMI) 2022
- International Conference on Learning Representations (ICLR) 2018-2021
- International Conference on Machine Learning (ICML) 2017-2019
- Bayesian Analysis (BA) 2019
- Journal of Machine Learning Research (JMLR) 2019
- Journal of Computational and Graphical Statistics (JCGS) 2016

## Media coverage

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- Interview for Expansion, one of the top media outlets in Mexico (in Spanish) 2023
- “AWANI Tonight: Creating a fairer AI”, Malaysian news (1.75M subscribers) 2023
- “Debugging foundation models for bias”, IBM Research 2022
- “New research helps make AI fairer in decision-making”, IBM Research 2021
- “Finding a good read among billions of choices”, MIT News 2019
- “Optimal Transport for Label Switching: Using Geometry to Solve Problems in AI”, IBM Research 2019

## Additional information

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- Personal webpage: [moonfolk.github.io](https://moonfolk.github.io)
- LinkedIn: [www.linkedin.com/in/mikhail-yurochkin-a45659114](https://www.linkedin.com/in/mikhail-yurochkin-a45659114)
- GitHub: [github.com/moonfolk](https://github.com/moonfolk)
- Google Scholar: [scholar.google.com/citations?user=QjBF9sUAAAAJ](https://scholar.google.com/citations?user=QjBF9sUAAAAJ)