Ilyas Fatkhullin

Address: Department of Computer Science, Andreasstrasse 5, 8050 Zurich, Switzerland
Website: fatkhullin.github.io Email: ilyas.fatkhullin@ai.ethz.ch, fatkhullin.ilyas@gmail.com

Education

ETH Zurich, Switzerland
Ph.D. in Computer Science, ETH AI Center Fellow 12/2021 – 06/2026
Advisor: Prof. Niao He (expected)
Research visit: ***Georgia Institute of Technology***, USA (with Prof. Guanghui Lan), 03–09/2025
Dissertation Topic: From Hidden Convexity to Stochastic Dynamics in Reinforcement Learning

Technical University of Munich, Germany
M.Sc. in Mathematics Grade: 1.1/1.0 09/2020 – 11/2021
Advisor: Prof. Peter Richtárik
Formal Reviewer: Prof. Michael Ulbrich
Thesis Topic: Error Compensation Method for Compressed Distributed Training

Moscow Institute of Physics and Technology, Russia
B.Sc. in Mathematics and Informatics Grade: 4.9/5.0 09/2016 – 08/2020
Advisor: Prof. Boris Polyak
Thesis Topic: Optimization Landscape of Linear Quadratic Regulator Problem with Output Feedback

Publications

The most up-to-date list of publications is available on my Google Scholar profile.

Refereed Journal Papers

[1] I. Fatkhullin, N. He, Y. Hu. *Stochastic Optimization under Hidden Convexity.* SIAM Journal on Optimization, 2025.

[2] J. Wu, A. Barakat, I. Fatkhullin, N. He. *Learning Zero-Sum Linear Quadratic Games with Improved Sample Complexity and Last-Iterate Convergence.* SIAM Journal on Control and Optimization, 2025 (preliminary version at CDC, 2023).

[3] I. Fatkhullin, I. Sokolov, E. Gorbunov, Z. Li, P. Richtárik. *EF21 with Bells & Whistles: Six Algorithmic Extensions of Modern Error Feedback.* Journal of Machine Learning Research, 2025.

[4] I. Fatkhullin, B. Polyak. *Optimizing Static Linear Feedback: Gradient Method.* SIAM Journal on Control and Optimization, 2021.
- *Cited over 100 times*.

[5] B. Polyak., I. Fatkhullin. *Use of Projective Coordinate Descent in the Fekete Problem.* Computational Mathematics and Mathematical Physics, 2020.

Refereed Conference Papers (ML)

[1] A. Sadiev, P. Richtárik, I. Fatkhullin. *Second-order Optimization under Heavy-Tailed Noise: Hessian Clipping and Sample Complexity Limits.* NeurIPS, 2025.

[2] F. Sun, I. Fatkhullin, N. He. *Natural Gradient VI: Guarantees for Non-Conjugate Models.* NeurIPS, 2025.

[3] R. Islamov, Y. As, I. Fatkhullin. *Safe-EF: Error Feedback for Nonsmooth Constrained Optimization.* ICML, 2025.

[4] F. Hübler*, I. Fatkhullin*, N. He. *From Gradient Clipping to Normalization for Heavy-Tailed SGD.* AISTATS, 2025. *Equal contribution.

[5] I. Fatkhullin, N. He. *Taming Nonconvex Stochastic Mirror Descent with General Bregman Divergence.* AISTATS, 2024.

[6] I. Fatkhullin, A. Tyurin, P. Richtárik. *Momentum Provably Improves Error Feedback!* NeurIPS, 2023.

[7] J. Yang, X. Li, I. Fatkhullin, N. He. *Two Sides of One Coin: the Limits of Untuned SGD and the Power of Adaptive Methods.* NeurIPS, 2023.

[8] A. Barakat, I. Fatkhullin, N. He. *Reinforcement Learning with General Utilities: Simpler Variance Reduction and Large State-Action Space.* ICML, 2023.

[9] I. Fatkhullin, A. Barakat, A. Kireeva, N. He. *Stochastic Policy Gradient Methods: Improved Sample Complexity for Fisher-non-degenerate Policies.* ICML, 2023.

[10] P. Richtárik, I. Sokolov, I. Fatkhullin, E. Gasanov, Z. Li, E. Gorbunov. *3PC: Three Point Compressors for Communication-Efficient Distributed Training and a Better Theory for Lazy Aggregation.* ICML, 2022.
- *Spotlight Presentation at ICML Main Track* (top 5% submissions).

[11] I. Fatkhullin*, J. Etesami*, N. He, N. Kiyavash. *Sharp Analysis of Stochastic Optimization under Global Kurdyka-Lojasiewicz Inequality.* NeurIPS, 2022. *Equal contribution.

[12] P. Richtárik, I. Sokolov, I. Fatkhullin. *EF21: A New, Simpler, Theoretically Better, and Practically Faster Error Feedback.* NeurIPS, 2021.
- *Oral Presentation at NeurIPS Main Track* (top 1% submissions).
- *Cited over 200 times*.

Preprints / Under Review

[1] I. Fatkhullin, F. Hübler, G. Lan. *Can SGD Handle Heavy-Tailed Noise?*, 2025. Under review in SIAM Journal on Optimization.
- NeurIPS Workshop "Optimization for Machine Learning".
- *Oral Presentation at NeurIPS OPT 2025 Workshop*. Preprint: arXiv:2508.04860.

[2] I. Fatkhullin, N. He, G. Lan, F. Wolf. *Global Solutions to Non-Convex Functional Constrained Problems with Hidden Convexity*, 2025. Under review in Mathematical Programming Series A.
- NeurIPS Workshop "Constrained Optimization for Machine Learning".
- *Oral Presentation at NeurIPS COML'25 Workshop.* Preprint: arXiv:2511.10626.

Fellowships and Awards

Oral Presentation Award from OPT 2025 Workshop at NeurIPS	11/2025
Oral Presentation Award from COML 2025 Workshop at NeurIPS	10/2025
TMLR Expert Reviewer	09/2025
Rising Star in AI Award, KAUST	02/2023
Spotlight Presentation Award at ICML	07/2022
Oral Presentation Award at NeurIPS	12/2021
ETH AI Center Doctoral Fellowship	02/2021
German Academic Exchange Service (DAAD) Scholarship for MSc in Germany	04/2020
PreDoc Program Fellowship in Mathematics, Technical University of Munich	03/2020

Teaching

Lecturer, "Data Analysis and Machine Learning", Ashesi University, Ghana 05/2025
Part of the Ashesi-ETH Master in Mechatronic Engineering program.
Designed and prepared a graduate-level course independently, including syllabus, lecture slides, assignments, and exam (3-week intensive module, concluding with a coding project and final exam).

Teaching Assistant, "Optimization for Data Science", ETH Zurich Spring 2023, 2024
Led weekly tutorials for 100+ students; co-designed and graded exams and homework assignments.

Instructor, Seminar "Advanced Topics in Machine Learning", ETH Zurich Fall 2023, 2024
Guided paper discussions, advised on research topics, and graded final presentations.

Supervision and Mentoring

Supervised several Master's theses, semester projects and research internships (2022–2025), resulting in top-tier ML conference and journal publications. Alumni have progressed to Ph.D. programs at ETH Zurich, Caltech, and the Max Planck Institute.

- Harish Rajagopal — Master's Thesis (2022); subsequently Software Developer at PQFORCE, Switzerland.
- Jiduan Wu — Master's Thesis (2023); subsequently Ph.D. student at the Max Planck ETH Center for Learning Systems, Germany.
- Florian Hübler — Research Assistant (2024); subsequently Ph.D. student at ETH Zurich.
- Florian Wolf — Master's Thesis (2025); subsequently Ph.D. student at Caltech, USA.
- Fangyuan Sun — Semester Project (2025); subsequently Master's Thesis at ETH Zurich.
- Lucas Whitfield — Semester Project (ongoing).
- Chung-En Tsai — Master's Thesis (ongoing).

Research Internships and Short-term Visits

Amazon, Luxembourg 10/2025-02/2026
Applied Scientist Intern in Forecasting & Optimization Team (ongoing)
Worked on large-scale capacity management problems of Amazon delivery network.

Georgia Institute of Science and Technology
H. Milton Stewart School of Industrial and Systems Engineering, Atlanta, USA 03–09/2025
with Prof. Guanghui (George) Lan
Studied properties of SGD under infinite variance.

King Abdullah University of Science and Technology, Saudi Arabia (remote) 03–09/2021
with Prof. Peter Richtárik
Worked on federated learning algorithms with momentum and quantization.

École Polytechnique Fédérale de Lausanne, Switzerland (remote) 06–10/2020
with Prof. Sebastian Stich and Prof. Martin Jaggi
Studied accelerated methods for convex optimization.

German Electron Synchrotron (DESY), Hamburg; with Prof. Judith Katzy 07–09/2019
Applied adversarial learning methods to the detection of events in high-energy physics.

Helmholtz-Zentrum Berlin, Germany; with Prof. Ji Li 07–08/2018
Developed numerical solvers for physical simulations in materials science.

Professional Activities

Journal Reviewer: Mathematical Programming; Operations Research; SIAM Journal on Optimization; SIAM Journal on Control and Optimization; Journal of Machine Learning Research; IEEE Transactions on Automatic Control; Transactions on Machine Learning Research.

Conference Reviewer: ICML (2022-2024); AISTATS 2022; NeurIPS (2023-2025); ICLR 2024.

Session Organizer at INFORMS Optimization Society Conference 07/2024
Location: Rice University, Houston, USA
Cluster and Session Title: "Optimization in Data Science"; "Recent Advances in Min-Max Optimization"

Session Organizer at International Conference on Continuous Optimization 07/2025
Location: University of Southern California, Los Angeles, USA
Cluster and Session Title: "Optimization for Data Science"; "Adaptive Methods in Optimization"

Session Organizer at INFORMS Optimization Society Conference 03/2026
Location: Atlanta, USA
Session Title: "Methods for Multi-stage Decision Making"

Session Organizer at SIAM Optimization Conference 06/2026
Location: Edinburgh, United Kingdom
Session Title: "Optimization under Data-driven Constraints"

Selected Talks

I. Fatkhullin. *Natural Gradient VI: Guarantees for Non-conjugate Models.* 11/2025
SlidesLive NeurIPS 2025, San Diego, USA

I. Fatkhullin. *Can SGD Handle Heavy-Tailed Noise?* 08/2025
H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, USA

I. Fatkhullin. *Safe Error Feedback with Applications in Humanoid Robot Fleet Training.* 08/2025
International Conference on Stochastic Programming (ICSP 2025), Paris, France

I. Fatkhullin. *Taming Nonconvex Stochastic Mirror Descent with General Bregman Divergence and Implications in Machine Learning.* 07/2025
International Conference on Continuous Optimization (ICCOPT 2025), Los Angeles, USA

I. Fatkhullin. *Heavy-Tailed Gradients in AI Models.* 12/2024
ETH AI Center Seminar, Zurich, Switzerland

I. Fatkhullin. *Stochastic Optimization under Hidden Convexity.* 07/2024
European Conference on Advances in Continuous Optimization (EUROPT 2024) , Lund, Sweden

I. Fatkhullin. *Momentum Provably Improves Error Feedback!* 12/2023
SlidesLive NeurIPS 2023, New Orleans, USA

I. Fatkhullin. *Stochastic Policy Gradient Methods: Improved Sample Complexity for Fisher-non-degenerate Policies.* 07/2023
SlidesLive ICML 2023, Honolulu, USA

I. Fatkhullin. *Policy Gradient Methods in Reinforcement Learning.* 02/2023
Rising Star in AI Symposium, KAUST, Saudi Arabia

I. Fatkhullin. *Stochastic Optimization under Kurdyka-Lojasiewicz Condition.* 10/2022
Institute of Machine Learning (IML) Seminar, Zurich, Switzerland

I. Fatkhullin. *Stochastic Optimization under Kurdyka-Lojasiewicz Condition.* 06/2022
ETH AI Center Doctoral Seminar, Zurich, Switzerland

I. Fatkhullin. *Practical Algorithmic Extensions of Modern Error Feedback.* 10/2021
Federated Learning One World (FLOW) Seminar

References

Prof. Niao He
Associate Professor, Department of Computer Science
ETH Zurich, Switzerland
Email: niao.he@inf.ethz.ch

Prof. Peter Richtárik
Professor of Computer Science
King Abdullah University of Science and Technology (KAUST), Saudi Arabia
Email: peter.richtarik@kaust.edu.sa

Prof. Guanghui (George) Lan
A. Russell Chandler III Chair and Professor, ISyE
Georgia Institute of Technology, Atlanta, USA
Email: george.lan@isye.gatech.edu