Ilyas Fatkhullin

Address: Department of Computer Science, Andreasstrasse 5, 8050 Zürich, Switzerland
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Research interests: large-scale optimization, reinforcement learning, theoretical foundations of ML.

Education

ETH Zürich, Switzerland
Ph.D. in Computer Science, ETH AI Center Fellow 12/2021 – 08/2026
Advisor: Prof. Niao He (expected)
Dissertation Topic: Non-convex Stochastic Optimization and 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

Refereed Journal Papers

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

[2] **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.

[3] 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 (to appear), 2025 (preliminary version at CDC 2023).

[4] **I. Fatkhullin**, B. Polyak. *Optimizing Static Linear Feedback: Gradient Method.* SIAM Journal on Control and Optimization, 2021.
- **Cited over 100 times** (Google Scholar, September 2025).

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

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

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

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

[5] 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.

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

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

[8] 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, top 5% submissions.

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

[10] P. Richtárik, I. Sokolov, **I. Fatkhullin**. *EF21: A New, Simpler, Theoretically Better, and Practically Faster Error Feedback.* NeurIPS, 2021.
- Oral Presentation, top 1% submissions.
- **Cited over 200 times** (Google Scholar, September 2025).

Preprints / Under Review

[1] **I. Fatkhullin**, F. Hübler, G. Lan. *Can SGD Handle Heavy-Tailed Noise?* arXiv:2508.04860, 2025.

[*]Equal contribution.

Fellowships and Awards

Rising Star in AI Award, KAUST	02/2023
Spotlight Presentation Award at ICML (best 5% submissions)	07/2022
Oral Presentation Award at NeurIPS (best 1% submissions)	12/2021
ETH AI Center Doctoral Fellowship (< 1% acceptance rate)	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
Prizewinner of Russian National Student Olympiad in Physics (two consecutive years)	2018, 2019
Prizewinner of Russian National Olympiad in Physics among High School Students (11th place nationwide)	04/2015

Teaching

Lecturer, "Data Analysis and Machine Learning", Ashesi University, Ghana 05/2025
As 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 Zürich 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 Zürich Fall 2023, 2024
Guided paper discussions, advised on research topics, and graded final presentations.

Supervision and Mentoring

Supervised three Master's theses, one research internship, and two semester project (2022–2025), resulting in top-tier ML conference and journal publications. Alumni have progressed to Ph.D. programs at ETH Zürich, Caltech, and the Max Planck Institute.

Research Internships and Short-term Visits

Georgia Institute of Science and Technology, 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 with Prof. Ji Li 07–08/2018
Developed numerical solvers for physical simulations in materials science.

Professional Activities

Conference Reviewer: ICML 2022, 2024; AISTATS 2022; NeurIPS 2023,2024,2025; ICLR 2024.
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.

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"

Talks

I. Fatkhullin. *Can SGD Handle Heavy-Tailed Noise?* Georgia Tech, Atlanta, USA 08/2025

I. Fatkhullin. *Safe Error Feedback with Applications in Humanoid Robot Fleet Training.* ICSP 2025, Paris, France 08/2025

I. Fatkhullin. *Taming Nonconvex Stochastic Mirror Descent with General Bregman Divergence and Implications in Machine Learning.* ICCOPT 2025, Los Angeles, USA 07/2025

I. Fatkhullin. *Stochastic Optimization under Hidden Convexity.* EUROPT 2024, Lund, Sweden 07/2024

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

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

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

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

References

Prof. Niao He
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Prof. Peter Richtárik
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King Abdullah University of Science and Technology (KAUST), Saudi Arabia
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Prof. Guanghui (George) Lan
A. Russell Chandler III Chair and Professor, ISyE
Georgia Institute of Technology, USA
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Prof. Sebastian U. Stich
Tenured Faculty, CISPA Helmholtz Center for Information Security
Saarbrücken, Germany
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