Igor Molybog

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Education

University Of California, Berkeley 2017 - 2022
M.S. + Ph.D. in Operations Research

- Minors in Mathematics and Computer Science
- Recipient of the IEOR PhD Fellowrship (Research Award, 2017)

Moscow Institute of Physics And Technology 2013 - 2017
B.S. in Applied Math, Computer Science and Physics

- Graduated summa cum laude, GPA 3.98

Work Experience

Meta AI Research 2022 - current
Research Scientist

- Ensured the resiliency to hardware errors of a language model training experiments distributed over thousands of GPU machines.
- Developed a theory of instabilities in large language models' training quality.
- Reduced the training compute and the inference latency of a large transformer-based model, increasing the capacity of the language model's context by order of magnitude.

University Of California, Berkeley 2017 - 2022
Graduate Student Researcher

- Conducted research in non-convex numerical optimization with a team of 5 graduate students and faculty
- Developed the first conditions for guaranteed convergence of local search methods in structured non-convex matrix sensing that can be applied to real-world cases in electrical grid analysis
- Developed an algorithm for provably secure analysis of electrical grid data, which is robust to cyberattacks
- Theoretically explained the interpolation phenomenon in a popular machine learning algorithm MAML
- Advisor: Prof. Javad Lavaei

Facebook AI Foundations Summer 2021
Machine Learning Engineering Intern

- Developed an on-device multilingual text classification model to enforce the integrity of ads in all of the Facebook applications around the world
- Achieved around 24% improvement in the target metrics over the in-production English-specific model retrained on a multilingual dataset
- For some policies, the proposed model leaves only $5-10\%$ gap in the precision compared to the on-server model for multilingual classification (which is 1000 times larger in size)

Google DeepMind Spring 2021
Research Scientist Intern

- Developed and tested a meta-learning approach for reinforcement learning agent modeling in a multiagent ad-hoc cooperative setting, solving tiny Bridge and tiny Hanabi games as milestones towards the Hanabi challenge

- Accelerated the proposed Meta-RL algorithm by a factor of 3 using offline reinforcement learning
- Advisor: Prof. Michael Bowling

Los Alamos National Lab Summer 2017
Visiting Researcher

- Developed and implemented an accelerated algorithm for the solution of a nonconvex optimization problem in complex-valued power systems data analysis (Matlab+Python)
- Advisor: Prof. Michael Chertkov

Skolkovo Institute for Science and Technology (Moscow) 2016-2017
Research Intern

- Implemented novel numerical optimization technique; adapted the code for applications in large-scale electrical grid control, obtaining 30% gain in speed compared to the out-of-the-box solution
- Advisor: Dr. Yury Maximov

Pasteur Institute (Paris) Summer 2016
Research Intern

- Implemented software (Java) and hardware (Arduino) solutions for a prototype of the technology of in-house hydrogel chip production for biomedical laboratories, reducing the design cycle from several weeks to several hours
- Advisor: Dr. Samy Gobaa

Recent publications

- H. Touvron, L. Martin *et al.* "Llama 2: Open Foundation and Fine-Tuned Chat Models," *ai.meta.com/research/publications/llama-2-open-foundation-and-fine-tuned-chat-models/.*

Conference Proceedings:

- *I. Molybog*, P. Albert, M. Chen et al. "A Theory on Adam Instability in Large-Scale Machine Learning," *arXiv:2304.09871*, submitted to NeurIPS 2023.
- Z.Ma, *I. Molybog*, S. Sojoudi and J. Lavaei "Over-parametrization via Lifting for Low-rank Matrix Sensing: Conversion of Spurious Solutions to Strict Saddle Points," *International Conference on Machine Learning*, 2023.

Journal papers:

- *I. Molybog*, R. Madani and J. Lavaei "Conic Optimization for Quadratic Regression Under Sparse Noise," *Journal of Machine Learning Research*, vol. 21, pp. 195–1, 2020.
- *I. Molybog*, S. Sojoudi and J. Lavaei "Role of Sparsity and Structure in the Optimization Landscape of Non-convex Matrix Sensing," *Mathematical Programming*, pp. 1–37, 2020.
- M. Jin, *I. Molybog*, R. Mohammadi-Ghazi and J. Lavaei "Scalable and Robust State Estimation from Abundant Data," *IEEE Transactions on Smart Grid*, vol. 11, no. 3, pp. 1880–1894, 2019.

Skills

- Rapid software/hardware prototyping: Python(Expert) / C/C++
- Distributed and parallel computing tools: Slurm / CUDA / NCCL / Apex / Triton
- Open-source development: pytorch(distributed) / fairscale / fairseq / metaseq / xformers
- Open-source tools: TensorFlow / Jax / pandas / scikit-learn

Leadership Experience

- Industry advisor of the faculty hiring committee at the Department of Electrical and Computer Engineering of the University of Hawai'i at Manoa 2023
- The chair of a section at the INFORMS Annual Meeting 2021
  Organised the section on Reaching Global Optimum in Non-Convex Optimization Problems
- Mentor on the First Steps in Research program at UC Berkeley 2021
- Co-founder of Align.ai 2019
  Founded an AI-as-a-service startup in commercial real estate space, grew the team to five people and took it through the UC-based Launch Accelerator
- Undergraduate Student-Mentor 2016 - 2017
  Supervised two cohorts of students, more than25 students each
- The president of the Russian Speaking Student Association at UC Berkeley 2019 - 2021
  Curated social, networking and learning events for approximately 100 senior and graduate students