Kumar Kshitij Patel | CV

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Research Goal: I want to further our understanding of optimization algorithms in practically relevant settings, i.e., with distributed computation and non-convexity. This has motivated me to study the *oracle complexity of optimization for Federated Learning*, specially in settings with data and systems heterogeneity. I also want to understand the game-theoretic considerations for collaboration protocols, and incorporate client personalization into these guarantees.

Education

- **Toyota Technological Institute at Chicago** — **Chicago, USA**
  Ph.D., Advisor: Prof. Nathan Srebro — *2019–Present*
  M.S. in Computer Science, Granted in 2021
- **École Polytechnique Fédérale de Lausanne** — **Lausanne, CH**
  Two Academic Exchange Semesters — *2017–2018*
- **Indian Institute of Technology Kanpur** — **Kanpur, IND**
  B.Tech., Computer Science and Engineering — *2015–2019*

Publications

- Bullins B.*, **Patel K. K.***, Shamir O.*, Srebro N.*, & Woodworth B.* (2021). A stochastic newton algorithm for distributed convex optimization. NeurIPS'21. *Alphabetical ordering [PDF]
- Woodworth B., **Patel K. K.**, & Srebro N. (2020). Minibatch vs local SGD for heterogeneous distributed learning. NeurIPS'20. [Talk][PDF]
- Woodworth B., **Patel K. K.**, Stich S.U., Dai Z., Bullins B., McMahan B., Shamir O. & Srebro N. (2020). Is local SGD better than minibatch SGD? ICML'20. [Talk] [PDF]
- Lin T., Stich S.U., **Patel K. K.**, & Jaggi M. (2019). Don't use large mini-batches, use local SGD. ICLR'20. [Talk][PDF]
- **Patel K. K.**, & Dieuleveut A. (2019). Communication trade-offs for synchronized distributed SGD with large step-size. NeurIPS'19. [PDF]
- Kapoor S., **Patel K. K.**, & Kar, P. (2018). Corruption-tolerant bandit learning. Machine Learning Journal, Springer. [Journal][PDF]

Work Experience

- **Applied Scientist Intern, Amazon AWS** — **Seattle, USA**
  Advisors: Dr. Srinivasan Sengamedu, Dr. Omer Tripp, Codeguru Team — *Jun 2020–Sept 2020*
  Worked on using deep language models: BERT and GPT-2, for detecting leakage of sensitive information in Java code, in symbiosis with program analysis tools. My project significantly advanced the adoption of deep learning to taint analysis in CodeGuru, and helped their customer facing application.
- **Research Intern, EPFL** — **Lausanne, CH**
  Advisor: Prof. Martin Jaggi, MLO Team — *Jun 2018–Dec 2018*
  Worked on two research projects: trying to understand the convergence of Local SGD, and establishing it as an alternative to traditional data-parallel training with large mini-batch SGD. Both works are published.

Awards and Achievements

- Recipient of **Honda Young Engineer and Scientist's (Y-E-S) Fellowship 2017**, awarded to only 14 undergraduates in India for their academic and research work.

- Recipient of **Academic Excellence Award 2015** at IIT Kanpur.
- **Represented India** as a part of the Youth Delegation to Nepal organized by the Government of India.
- **All India Rank 200** in JEE-Adv. 2015, and **99.9 %**-tile in JEE-Mains 2015 out of 1.3M students.

Service and Professional Activities

Reviewing

- For STOC'21, Springer Machine Learning Journal, ICML'21, NeurIPS'21, ICLR'22, AISTATS'22.

Organization

- Co-organizer of Machine Learning and Optimization reading group at TTIC.
- Co-organized the TTIC Student Workshop 2021.
- Co-started the TTIC/UChicago Student Theory Seminar.
- Teaching assistant and co-organizer for Research at TTIC Colloquium (Fall'20 -Winter'21).
- Volunteer for ICLR'20, and ICML'20.

Committees

- Student member of the Sexual Misconduct Policy Committee at TTIC (2021).

Participation

- Participant in the Mathematics of Deep Learning collaboration led by Simons Foundation, UC Berkeley; attending periodic presentations, summer reading group, and the annual meeting.
- Attended the Machine Learning Summer School 2020 organized by Max Plank Institute for Intelligent Systems, Tübingen, Germany.

Relevant Coursework and Skills

Machine Learning

- **Theory:** Convex Optimization, Statistical and Computational Learning Theory, Online Learning and Optimization, Bayesian Machine Learning, Information Theory and Coding.
- **Applications:** Topics in Machine Learning Systems, Introduction to Deep Learning, Computer Vision, Natural Language Processing.

Mathematics and Statistics

- Real Analysis (3-qtr sequence), Measure Theoretic Probability (2-qtr sequence), Matrix Computations, Time Series Analysis, Applied Stochastic Processes.

Computer Science

- Algorithms, Theory of Computation, Operating Systems, Database Design, Compiler Design.

Programming

- **Languages:** Python, C, R, LaTeX, HTML-CSS, C++, Matlab, SQlite, Assembly.
- **Packages:** PyTorch, Keras, Scikit, Gensim, NLTK, XGBoost, CVXPY.

Other Activities

- **Mentorship:** Peer Mentor to a first year PhD student at TTIC (2020), mentor to first-year computer science undergraduates for an introductory project on machine learning (2016), and a student guide to six students at the counselling service, at IIT Kanpur (2016).
- **Community Welfare:** Undergraduate head of *Raktarpan* (2016-17), an NGO that works in blood donation. Helped with drafting a plan for solar power generation at IIT Kanpur.
- **Debating and Writing:** Professional debater, participated at major Asian parliamentary debating leagues in India. Core team member for *Vox Populi*, IIT Kanpur's journalism society.