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, online environments, strategic agents, privacy considerations, and non-convexity. This motivates me to study the different aspects of Collaborative/Federated Learning.

Education

- **Toyota Technological Institute at Chicago** — **Chicago, USA**
  Ph.D., Expected: July, 2025, Advisors: Nathan Srebro, Lingxiao Wang — *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*

Work Experience

- **Research Intern, Sony AI** — **Tokyo, JP**
  Advisors: Dr. Nidham Gazagnadou, Dr. Lingjuan Lyu, PPML Team — *Jun 2023–Sept 2023*
  I worked on personalization in federated learning (FL) and provided new theoretical convergence guarantees for personalized local SGD, highlighting its advantages over the non-personalized variant. Our work also empirically shows when personalization is better than both pure local training and vanilla FL.
- **Applied Scientist Intern, Amazon AWS** — **Seattle, USA**
  Advisors: Dr. Srinivasan Sengamedu, Dr. Omer Tripp, Codeguru Team — *Jun 2020–Sept 2020*
  I 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.

Publications

- **Patel K. K.**, Gazagnadou N., Wang L., & Lyu L., Personalization Mitigates the Perils of Local SGD for Heterogeneous Distributed Learning. Under review, NeurIPS'24.
- Wang L., Zou D., **Patel K. K.**, Wu J., & Srebro N., Private Overparameterized Linear Regression without Suffering in High Dimensions. Under review, NeurIPS'24. [PDF]
- Yunis D., **Patel K. K.**, Wheeler S., Savarese P., Vardi G., Frankle J., Livescu K., Maire M., Walter M., Approaching Deep Learning through the Spectral Dynamics of Weights. Under review, NeurIPS'24.
- Han M.*, Shao H.*, **Patel K. K.*** & Wang L.*, On the effect of defection in federated learning and how to prevent it. Under review, JMLR. *Alphabetical ordering [PDF]
- **Patel K. K.**, Glasgow M., Zindari A., Wang L., Stich S., Cheng Z., Joshi N. & Srebro N., The Limits and Potentials of Local SGD for Distributed Heterogeneous Learning with Intermittent Communication. COLT'24. [PDF]
- Golrezaei N.*, Niazadeh R.*, **Patel K. K.*** & Susan F.*, Online combinatorial optimization with group fairness constraints. IJCAI'24. *Alphabetical ordering [PDF]
- Wang L., Zhou X., **Patel K. K.**, Tang L. & Saha A., Efficient Private Federated Non-Convex Optimization With Shuffled Model. Privacy Regulation and Protection in Machine Learning Workshop. ICLR'24. [PDF]
- **Patel K. K.***, Glasgow M.*, Wang L., Joshi N. & Srebro N., On the still unreasonable effectiveness of federated averaging for heterogeneous distributed learning. FL Workshop, ICML'23. **Best paper,**

honorable mention. *Equal Contribution [PDF]

- **Patel K. K.**, Wang L., Saha A. & Srebro N., Federated online and bandit convex optimization. ICML'23. OPT'22 Workshop, NeurIPS'22. [PDF]
- Yunis D., **Patel K. K.**, Savarese P., Vardi G., Livescu K. & Walter M., On convexity and linear mode connectivity. OPT'22 Workshop, NeurIPS'22. [PDF]
- **Patel K. K.**, Wang L., Woodworth B., Bullins B. & Srebro N., Towards optimal communication complexity in distributed non-convex optimization. NeurIPS'22 [Talk][PDF]
- Bullins B.*, **Patel K. K.***, Shamir O.*, Srebro N.* & Woodworth B.*, A stochastic newton algorithm for distributed convex optimization. NeurIPS'21. *Alphabetical ordering [PDF]
- Woodworth B., **Patel K. K.** & Srebro N., 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., Is local SGD better than minibatch SGD? ICML'20. [Talk] [PDF]
- Lin T., Stich S.U., **Patel K. K.** & Jaggi M., Don't use large mini-batches, use local SGD. ICLR'20. [Talk][PDF]
- **Patel K. K.** & Dieuleveut A., Communication trade-offs for synchronized distributed SGD with large step-size. NeurIPS'19. [PDF]
- Kapoor S., **Patel K. K.** & Kar, P., Corruption-tolerant bandit learning. Machine Learning Journal, Springer. [Journal][PDF]

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 Govt. of India.
- **All India Rank 200** in JEE-Adv. 2015, and **99.9 %**-tile in JEE-Mains 2015 out of 1.3M students.
- Among **top 1%** in national standard subject tests; qualified for **Indian National Chemistry Olympiad**.
- Received the **best talk award** at TTIC student workshop 2022 and the **best paper honorable mention** at the FL workshop at ICML'23.

Service and Professional Activities

Organization

- Co-proposer of NeurIPS'24 workshop: **Incentives for Data Sharing and Collaborative Learning**.
- Co-organizer of the **New Frontiers in Federated Learning** Workshop at TTIC (Summer'23). Our workshop had an excellent line up of speakers from industry and academia. The workshop resulted in several open problems, research directions, and new collaborations. [Workshop Link]
- Co-organizer of **Machine Learning and Optimization reading group** at TTIC, Winter'21-'22.
- Co-organized the **TTIC Student Workshop 2021**. [Workshop Link]
- Session chair for the session on **AI for drug-discovery** at ICML'22.
- Co-started the TTIC/UChicago Student Theory Seminar.
- Volunteer for IJCAI'24, NeurIPS'22, ICML'20,'22, and ICLR'20.

Teaching

- Co-presented the tutorial on Online Federated Learning at the 39^{th} **Conference on Uncertainty in Artificial Intelligence** (UAI'23). Our tutorial received a lot of interest from in-person and virtual participants, and provided a fresh perspective on sequential decision-making considerations in distributed environments. [UAI Tutorials]

- Teaching assistant for the Mathematical Toolkit course at TTIC (Spring'23).
- Teaching assistant for the Convex Optimization course at TTIC (Winter'22, and Winter'24).
- Teaching assistant and co-organizer for Research at TTIC Colloquium (Fall'20 - Winter'21).

Reviewing

- Journals: JMLR, TMLR, Springer Machine Learning Journal.
- Conferences: STOC'21, ICML'21,22,24 NeurIPS'21,22,23,24, ICLR'22,23,24, AISTATS'22,23,24. I have receieved several **top reviewer** awards and travel awards.
- Workshops: OPT'22,'23 @ NeurIPS'22,'23, FL workshop at NeurIPS'23, FL workshop at IJCAI'23.

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, reading groups, and meetings.
- 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:** Machine Learning Systems, Introduction to Deep Learning, Computer Vision, NLP.

Mathematics and Statistics

- Real Analysis (3-qtr sequence), Measure Theoretic Probability (2-qtr sequence), Numerical Linear Algebra, 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 a machine learning project (2016).
- Student guide to six students at the counseling 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.
- Senator at Students' Gymkhana and student nominee to the Department Undergraduate Committee.

Cultural Activities

- Four-year training in **Hindustani Sangeet** by *Gandharva Sangeet Mahavidyalaya, Mumbai*.
- Event co-ordinator for Junoon'16, the fusion rock band competition of Antaragni, IIT Kanpur.
- Professional debater, participated at major Asian parliamentary debating leagues in India.
- Core team member for *Vox Populi*, IIT Kanpur's journalism society.