

Yatin Dandi

PH.D STUDENT · SCHOOL OF COMPUTER AND COMMUNICATION SCIENCES

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Education

École Polytechnique Fédérale de Lausanne

Lausanne, Switzerland

PH.D, COMPUTER SCIENCE

September, 2022 - Present

- **Advisors:** Prof. Lenka Zdeborová, Statistical Physics of Computation Laboratory (SPOC), and Prof. Florent Krzakala, Information, Learning and Physics Laboratory (IdePHICS).
- (scheduled) **Visiting student at the Massachusetts Institute of Technology (MIT)** under prof. David Gamarnik, December 2024-June 2025.
- (scheduled) **Program associate at the Simons Laufer Mathematical Sciences Institute (SLMath), Berkeley, Probability and Statistics of Discrete Structures**, January 2025-May 2025.

Indian Institute of Technology Kanpur

Kanpur, India

DUAL DEGREE (BTech-MTECH), COMPUTER SCIENCE AND ENGINEERING

July, 2017 - August 2022

- **Thesis title:** Tackling Heterogeneity in Collaborative Machine Learning, advisors: Prof. Martin Jaggi (EPFL) and Prof. Piyush Rai (IIT Kanpur).
- **Cumulative Performance Index (CPI) :** 9.6/10.0, Master's CPI: 10.0/10.0
- **Exchange and visiting student at Ecole polytechnique fédérale de Lausanne (EPFL)**

Honors & Awards

2024	EPFL Doc.Mobility grant , Grant awarded for conducting academic research at the Massachusetts Institute of Technology, USA.	Switzerland
2022	EDIC Fellowship, EPFL , Fellowship for the first year of doctoral studies.	Switzerland
2017	Aditya Birla Scholarship , Awarded to 15 students across all IITs	India
2018,2019	Academic Excellence Award, IIT Kanpur , Awarded (twice) for exceptional performance	India
2016	KVPY Scholarship, 2016 , Indian Institute of Science	India
2015	NTSE Scholarship , Government of India	India
2017	All India Rank 135 (out of 172024 students) , JEE Advanced 2017, second stage of admission process to IITs having 1.186 million applicants	India
2016	Selected for Indian National Physics and Chemistry Olympiads , HBCSE	Mumbai, India
2018	Selected to represent IIT Kanpur at a national-level event. , Microsoft code.fun.do hackathon	Hyderabad, India

Publications and Preprints

Asymptotics of feature learning in two-layer networks after one gradient-step

HUGO CUI, LUCA PESCE, YATIN DANDI, FLORENT KRZAKALA, YUE M. LU, LENKA ZDEBOROVÁ, BRUNO LOUREIRO

Spotlight, International Conference on Machine Learning, 2024, Arxiv: <https://arxiv.org/abs/2402.04980>

The Benefits of Reusing Batches for Gradient Descent in Two-Layer Networks: Breaking the Curse of Information and Leap Exponents

YATIN DANDI, EMANUELE TROIANI, LUCA ARNABOLDI, LUCA PESCE, LENKA ZDEBOROVÁ, FLORENT KRZAKALA

International Conference on Machine Learning, 2024, Arxiv: <https://arxiv.org/abs/2402.03220>

Online Learning and Information Exponents: The Importance of Batch size & Time/Complexity Tradeoffs

LUCA ARNABOLDI, YATIN DANDI, FLORENT KRZAKALA, BRUNO LOUREIRO, LUCA PESCE, LUDOVIC STEPHAN

International Conference on Machine Learning, 2024, Arxiv: <https://arxiv.org/abs/2406.02157>

Repetita iuvant: Data repetition allows sgd to learn high-dimensional multi-index functions

LUCA ARNABOLDI, YATIN DANDI, FLORENT KRZAKALA, LUCA PESCE, LUDOVIC STEPHAN

Preprint, Arxiv: <https://arxiv.org/abs/2405.15459>

Fundamental limits of weak learnability in high-dimensional multi-index models

EMANUELE TROIANI, YATIN DANDI, LEONARDO DEFILIPPIS, LENKA ZDEBOROVÁ, BRUNO LOUREIRO, FLORENT KRZAKALA

Preprint, Arxiv: <https://arxiv.org/abs/2405.15480>

Sampling with flows, diffusion and autoregressive neural networks: A spin-glass perspective

DAVIDE GHIO, YATIN DANDI, FLORENT KRZAKALA, AND LENKA ZDEBOROVÁ

Proceedings of the National Academy of Sciences, Vol. 121 | No. 27 July 2, 2024, NeurIPS 2023 Workshop on Diffusion Models, Arxiv:

<https://arxiv.org/abs/2308.14085>

How Two-Layer Neural Networks Learn, One (Giant) Step at a Time

YATIN DANDI, FLORENT KRZAKALA, BRUNO LOUREIRO, LUCA PESCE, LUDOVIC STEPHAN

Invited talk, NeurIPS 2023 Workshop: Mathematics of Modern Machine Learning (M3L), Arxiv: <https://arxiv.org/abs/2305.18270>

Universality laws for Gaussian mixtures in generalized linear models

YATIN DANDI*, LUDOVIC STEPHAN*, FLORENT KRZAKALA, BRUNO LOUREIRO, LENKA ZDEBOROVÁ (* DENOTES EQUAL

CONTRIBUTION)

Conference on Neural Information Processing Systems (Neurips), 2023, Arxiv: <https://arxiv.org/abs/2302.08933>

Maximally-stable Local Optima in Random Graphs and Spin Glasses: Phase Transitions and Universality

YATIN DANDI, DAVID GAMARNIK, LENKA ZDEBOROVÁ

Presented at the meeting on “Random Graphs: Combinatorics, Complex Networks and Disordered Systems” at the Oberwolfach Research

Institute for Mathematics in March. Arxiv: <https://arxiv.org/abs/2305.03591>

Data-heterogeneity-aware Mixing for Decentralized Learning

YATIN DANDI, ANASTASIA KOLOSKOVA, MARTIN JAGGI, SEBASTIAN STICH

NeurIPS 2022 Workshop: Optimization for Machine Learning, Arxiv: <https://arxiv.org/abs/2204.06477>

Implicit Gradient Alignment in Distributed and Federated Learning

YATIN DANDI*, LUIS BARBA*, MARTIN JAGGI (* DENOTES EQUAL CONTRIBUTION)

Proceedings of the AAAI Conference on Artificial Intelligence (Preliminary version also accepted at the FL-ICML Workshop, 2021), Arxiv:

<https://arxiv.org/abs/2106.13897>

Generalized Adversarially Learned Inference

YATIN DANDI, HOMANGA BHARADHWAJ, ABHISHEK KUMAR, PIYUSH RAI

Proceedings of the AAAI Conference on Artificial Intelligence (Preliminary version also accepted at the Neurips 2020 Workshop: Self-Supervised

Learning – Theory and Practice), Arxiv: <https://arxiv.org/abs/2006.08089>

Jointly Trained Image and Video Generation using Residual Vectors

YATIN DANDI, ANIKET DAS, SOUMYE SINGHAL, VINAY P. NAMBOODIRI, PIYUSH RAI

2020 Winter Conference on Applications of Computer Vision (WACV '20), Arxiv: <https://arxiv.org/abs/1912.07991>

Model-Agnostic Learning to Meta-Learn

ARNOUT DEVOS*, YATIN DANDI* (* DENOTES EQUAL CONTRIBUTION)

Proceedings of Machine Learning Research (PMLR) (Preliminary version accepted at the Pre-registration workshop, NeurIPS (2020)), Arxiv:

<https://arxiv.org/abs/2012.02684>

NeurInt-Learning Interpolation by Neural ODEs

AVINANDAN BOSE*, ANIKET DAS*, YATIN DANDI, PIYUSH RAI

Spotlight, The Symbiosis of Deep Learning and Differential Equations: DLDE Workshop, NeurIPS 2021. Arxiv:

<https://arxiv.org/abs/2111.04123>

Understanding Layer-wise Contributions in Deep Neural Networks through Spectral Analysis

YATIN DANDI, ARTHUR JACOT

Preprint, Arxiv: <https://arxiv.org/abs/2111.03972>

Internships

Optimization, Sampling, and Trajectory Inference algorithms

MILA

INTERNSHIP UNDER PROF. SIMON LACOSTE-JULIEN AND PROF. YOSHUA BENGIO

June 2022 - August 2022

- Proposed and analyzed a general theoretical framework for proving convergence rates of min-max optimization algorithms.
- Proved results related to the saddle-point Frank Wolfe algorithm.
- Worked on the analysis of sampling and trajectory Inference Algorithms motivated by applications in single-cell Biology.

- Implemented a state of the art algorithm for online collaborative filtering based on Fast Matrix Factorization for Online Recommendation with Implicit Feedback (He et al.) using Numpy and improved the model with sentiment and frequency dependent weighting schemes.
- Used Kafka for real-time data processing and simulated interactions using locust.
- Implemented a recommender system based on deep autoencoders and compared the results with other models using metrics such as hit ratio.
- Implemented a Bidirectional LSTM model using Keras for sentiment analysis of user comments.
- Trained the Latent Dirichlet allocation model on Wikipedia articles for automatic extraction of topics.

Seminars, Conferences, and Workshops

- Delivered a **talk** at the Leman-Th 2024 Workshop on Machine Learning & Neural Network Theory at EPFL, Switzerland, 2024
- Delivered a **talk** at the “Probability Theory Seminar” at EPFL, Switzerland, 2023.
- Delivered a **talk** at “Statistical Physics and Machine Learning Back Together Again”, Cargese, Corsica, France, 2023.
- Delivered a **talk** during the meeting “Random Graphs: Combinatorics, Complex Networks and Disordered Systems” at the Oberwolfach Research Institute for Mathematics in March, 2023.
- Presented a poster at “High Dimensional Statistics and Random Matrices” in Porquerolles, France, 2023.
- Presented a poster and participated in the Princeton Machine Learning Theory Summer School, Princeton University, USA, 2023.
- Presented a poster and participated in the Summer school on Statistical Physics and Machine learning at Ecole de Physique des Houches, France, 2022.
- Presented a poster at the Workshop on Spin Glasses, Les Diablerets, Switzerland, 2022.

Reviewing

Neurips (2024), ICML (2024), SIAM Journal on Mathematics of Data Science (2023), TMLR(2023), Neurips(2023), ICML(2023), ICLR(2023), AISTATS (2022)

Teaching and Supervision

- **Teaching Assistant:** Statistical physics for Optimization and Learning (EPFL), Statistical physics of computation (EPFL), Elements of statistics for data science (EPFL), Mathematics for Computer Science - 2, 3 (IITK), Introduction to Machine Learning (IITK)
- **Supervisor - Master’s thesis project:** Hardness of Learning through Gradient Descent in Convolutional Neural Networks, Mia Zosso, 2024