Konstantinos **Nikolakakis**

(+1) 848-248-0973 | KostisNikolakakis@pm.me | knikolakakis.com | KonstantinosNikolakakis | K-Nikolakakis

Domain Knowledge & Expertise

Machine Learning, AI, Statistics, Generalization Error Analysis, Risk-Aware Decision Making, Multi-Armed Bandits, Optimization, Probabilistic Graphical Models, Learning from Graph-structured Data/Graph Recovery, Learning / Making Predictions from Noisy Data
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Python, PyTorch, Machine Learning System Design, Multi-Task Learning, Fine-Tuning, Foundation Models, Large Language Models, Efficient Pretraining of LLMs, Data Science, A/B Testing, Pattern Recognition, Probabilistic Modeling

Professional Experience

SES AI — ses.ai   *Woburn, Massachusetts*
MACHINE LEARNING SCIENTIST   *Sep 2024 - Present*

- Multi-Task Learning, Fine-Tuning, Foundation Models, Data Science, Graph Neural Networks
- Development of AI for molecular property predictions, generative AI, full-stack AI deployment on cloud, benchmarks and testing

Yale University   *New Haven, Connecticut*
POSTDOCTORAL ASSOCIATE, SCHOOL OF ENGINEERING & APPLIED SCIENCE, ELECTRICAL ENGINEERING   *Jul 2021 - Aug 2024*

- Research Domain: Machine learning, Algorithmic generalization error analysis and robustness in learning
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  Major Contributions:
- Developed novel statistical guarantees for accuracy in learning; Generalization error bounds for optimization algorithms including Stochastic Gradient Descent (SGD), variations of (S)GD, and Zeroth-Order learning (Derivative Free Optimization).
- Designed a novel robust federated learning algorithm under restricted user availability.
- Introduced (S)GD variants for minimizing time to accuracy for deep neural networks training; $3\times$ faster training for LLMs (GPT2), $4.3\times$ and $9\times$ faster training for ResNet-18 on CIFAR10 and ImageNet respectively
- Established novel statistical (sample complexity) guarantees for quantile-multi armed bandits with applications to A/B testing.
- Designed the first algorithm for quantile A/B testing under differential privacy.
- Proposed the first statistical analysis for learning graphs through structured data under the presence of noise.
- Established novel statistical guarantees for accurate prediction making and inference on noisy tree-structured data, with applications on recommender systems, epidemic and population dynamics.

  Detailed information of my research and major contributions appear in **Publications** below (and Google Scholar).

Michigan State University   *East Lansing , Michigan*
POSTDOCTORAL RESEARCHER, DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING   *May 2021 - Jun 2021*

- Core Project: Multi-agent decision making approaches with applications on supply chain optimization
- Inventory management; designing dynamic input-output PDE - ODE models for supply chain applications.

Education

Rutgers University, Electrical and Computer Engineering   *New Brunswick, New Jersey*
PH.D. IN ELECTRICAL AND COMPUTER ENGINEERING   *Feb 2016 - Apr 2021*

- Thesis: Learning Tree-Structured Models from Noisy Data
- Selected Courses: Error Control Coding, Information Theory, Measure Theory, Convex Optimization
- GPA: 3.9/4

Rutgers University, Computer Science   *New Brunswick, New Jersey*
PH.D. CANDIDATE IN COMPUTER SCIENCE   *Sep 2014 -Jan 2016*

- Major: Machine Learning and Pattern Recognition
- Selected Courses: Stochastic Dynamic Programming, Advanced Algorithms, Pattern Recognition, Numerical Analysis
- GPA: 3.8/4

University of Patras *Patras, Greece*

DIPLOMA OF ELECTRICAL AND COMPUTER ENGINEERING, BACHELOR'S AND MASTER'S DEGREE *Sep 2009 - Jun 2014*
- Major: Stochastic Signal Processing and Communications
- GPA: 8.3/10, top 4% in class of 2013-2014 (250 students, ECE Department)
- Programming Competition: 1st place (among 250 participants, class of 2013-2014)

Publications

- **K. Nikolakakis**, G. Chantzialexiou, D. Kalogerias, *"FEDSTR: Money-In AI-Out | A Decentralized Marketplace for Federated Learning and LLM Training on the NOSTR Protocol"*, Preprint
- **K. Nikolakakis**, A. Karbasi, D. Kalogerias, *"Select without Fear: Almost All Mini-Batch Schedules Generalize Optimally"*, SIAM SIMODS
- P. Theodoropoulos, **K. Nikolakakis**, D. Kalogerias, *"Federated Learning Under Restricted User Availability"*, IEEE International Conference on Acoustics, Speech and Signal Processing , (ICASSP 2024)
- P. Okanovic, R. Waleffe, V. Mageirakos, **K. Nikolakakis** et al., *"Repeated Random Sampling for Minimizing the Time-to-Accuracy of Learning"*, International Conference on Learning Representations , (ICLR 2024)
- **K. Nikolakakis**, F. Haddadpour, A. Karbasi, D. Kalogerias, *"Beyond Lipschitz: Sharp Generalization and Excess Risk Bounds for Full-Batch Gradient Descent"*, International Conference on Learning Representations , ICLR 2023
- **K. Nikolakakis**, F. Haddadpour, D. Kalogerias, A. Karbasi, *"Black-Box Generalization: Stability of Zeroth-Order Learning"*, Neural Information Processing Systems, (NeurIPS 2022)
- **K. Nikolakakis**, D. Kalogerias, A. Sarwate, *"Optimal Rates for Learning Hidden Tree Structures"*, ArXiv Preprint
- **K. Nikolakakis**, D. Kalogerias, O. Sheffet, A. Sarwate, *"Quantile Multi-Armed Bandits: Optimal Best-Arm Identification and a Differentially Private Scheme"*, IEEE Journal on Selected Areas in Information Theory, (JSAIT), May 2021
- **K. Nikolakakis**, D. Kalogerias, A. Sarwate, *"Predictive Learning on Hidden Tree-Structured Ising Models"*, Journal of Machine Learning Research (JMLR 2021), vol. 22, no 59, pp. 1-82, February 2021
- **K. Nikolakakis**, D. Kalogerias, A. Sarwate, *"Learning Tree Structures from Noisy Data"*, 22nd International Conference on Artificial Intelligence and Statistics (AISTATS 2019)

Invited Talks

- Annual Conference on Information Science and Systems (CISS), Princeton University, Princeton, New Jersey, 2020
- Conference on "Inference on Graphical Models", Columbia University, New York, 2019
- UC San Diego (Prof. Mikhail Belkin's group), *"Beyond Lipschitz: Sharp Generalization and Excess Risk Bounds for Full-Batch Gradient Descent"*

Awards

- "Anthony Massini Postdoctoral Fellowship": One year of support for postdoctoral studies, Yale University, 2022-2023
- "NeurIPS 2022 Scholar Award", Travel scholarship, NeurIPS 2022
- "Gerondelis Scholarship" by Gerondelis Foundation INC., Rutgers University, 2016-2017

Programming Skills

- Python, PyTorch, Scikit-learn, Matlab, C, C++, Unix

Teaching Experience

Rutgers University *New Brunswick, New Jersey*

DEPARTMENTS OF ELECTRICAL AND COMPUTER ENGINEERING & COMPUTER SCIENCE *Sep 2014 - Jan 2017*
- Probability Theory and Stochastic Processes (Spring 2016, Fall 2016, Fall 2017)
- Programming in C & Unix (Fall 2014, Spring 2015, Fall 2015)

Project Management Skills

- Goal setting and monitoring skills: Proposals for research funding (Anthony Massini Award), Course/Teaching Planning
- People management skills: Mentoring and guidance of Ph.D. students
- Teamwork: Collaboration with researchers from Yale and other institutions including ETH (Zurich), Princeton, Wisconsin-Madison
- Leading experience, initiatives and risk management; Commitment of resources, Identification of open research challenges

Languages

- English, Greek

Hobbies

- Martial Arts, Photography, Snowboarding