

# NICHOLAS ROBERTS

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## EDUCATION

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### University of Wisconsin - Madison

August 2021 - Present

Ph.D. Computer Science, Mathematics minor

- Advisor: Frederic Sala

### Carnegie Mellon University

August 2019 - May 2021

M.S. Machine Learning

- Advisors: Ameet Talwalkar, Zachary C. Lipton

### University of California San Diego

September 2015 - March 2019

B.S. Computer Science, Mathematics minor

- Advisors: Sanjoy Dasgupta, Garrison W. Cottrell

- Magna Cum Laude with CSE department Highest Distinction honors

### Fresno City College

August 2013 - May 2015

## PUBLICATIONS

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\*equal contribution, +alphabetical

## WORK IN SUBMISSION

**Nicholas Roberts**, Xintong Li, Dyah Adila, Sonia Crompt, Tzu-Heng Huang, Jitian Zhao, Frederic Sala. (2023). *Geometry-Aware Adaptation for Pretrained Models*.

Mayee Chen, **Nicholas Roberts**, Kush Bhatia, Jue Wang, Ce Zhang, Frederic Sala, Christopher Ré. (2023). *Skill-it! A data-driven skills framework for understanding and training language models*.

## CONFERENCE PUBLICATIONS

Benedikt Boecking, **Nicholas Roberts**, Willie Neiswanger, Stefano Ermon, Frederic Sala, Artur Dubrawski. (2023). *Generative Modeling Helps Weak Supervision (and Vice Versa)*. International Conference on Learning Representations (ICLR), 2023.

**Nicholas Roberts\***, Xintong Li\*, Tzu-Heng Huang, Dyah Adila, Spencer Schoenberg, Cheng-Yu Liu, Lauren Pick, Haotian Ma, Aws Albarghouthi, Frederic Sala. (2022). *AutoWS-Bench-101: Benchmarking Automated Weak Supervision with 100 Labels*. Neural Information Processing Systems (NeurIPS) Datasets and Benchmarks Track, 2022.

Renbo Tu\*, **Nicholas Roberts\***, Mikhail Khodak, Junhong Shen, Frederic Sala, Ameet Talwalkar. (2022). *NAS-Bench-360: Benchmarking Neural Architecture Search on Diverse Tasks*. Neural Information Processing Systems (NeurIPS) Datasets and Benchmarks Track, 2022.

Harit Vishwakarma, **Nicholas Roberts**, Frederic Sala. (2022). *Lifting Weak Supervision To Structured Prediction*. Neural Information Processing Systems (NeurIPS), 2022.

Changho Shin, Winfred Li, Harit Vishwakarma, **Nicholas Roberts**, Frederic Sala. (2022). *Universalizing Weak Supervision*. International Conference on Learning Representations (ICLR), 2022.

**Nicholas Roberts\***, Mikhail Khodak\*, Tri Dao, Liam Li, Christopher Ré, Ameet Talwalkar. (2021). *Rethinking Neural Operations for Diverse Tasks*. Neural Information Processing Systems (NeurIPS), 2021.

Sanjoy Dasgupta, Akansha Dey, **Nicholas Roberts**, Sivan Sabato. (2018). *Learning from discriminative feature feedback*. Neural Information Processing Systems (NeurIPS), 2018.

## JOURNAL PUBLICATIONS

**Nicholas Roberts**<sup>\*</sup>, Samuel Guo<sup>\*</sup>, Cong Xu<sup>\*</sup>, Ameet Talwalkar, David Lander, Lvfang Tao, Linhang Cai, Shuaicheng Niu, Jianyu Heng, Hongyang Qin, Minwen Deng, Johannes Hog, Alexander Pfefferle, Sushil Ammanaghatta Shivakumar, Arjun Krishnakumar, Yubo Wang, Rhea Sukthanker, Frank Hutter, Euxhen Hasanaaj, Tien-Dung Le, Mikhail Khodak, Yuriy Nevmyvaka, Kashif Rasul, Frederic Sala, Anderson Schneider, Junhong Shen, Evan Sparks. (2023). *AutoML Decathlon: Diverse Tasks, Modern Methods, and Efficiency at Scale*. NeurIPS 2022 Competition Track, Proceedings of Machine Learning Research (PMLR).

Aarohi Srivastava<sup>+</sup>, ..., **Nicholas Roberts**<sup>+</sup> (276), ..., (442 authors). (2023). *Beyond the Imitation Game: Quantifying and Extrapolating the Capabilities of Language Models*. Transactions on Machine Learning Research (TMLR), 2023.

Kaustubh D. Dhole, ..., **Nicholas Roberts** (85), ..., (128 authors). (2023). *NL-Augmenter: A Framework for Task-Sensitive Natural Language Augmentation*. Northern European Journal of Language Technology (NEJLT), 2023.

Chen Zhang<sup>\*</sup>, Yerlan Idelbayev<sup>\*</sup>, **Nicholas Roberts**, Yiwen Tao, Yashwanth Nannapaneni, Brendan M. Duggan, Jie Min, Eugene C. Lin, Erik C. Gerwick, Garrison W. Cottrell, William H. Gerwick. (2017). *Small Molecule Accurate Recognition Technology (SMART) to Enhance Natural Products Research*. Scientific Reports.

## WORKSHOP PUBLICATIONS & PREPRINTS

**Nicholas Roberts**, Yingyu Liang, Frederic Sala. (2023). *Understanding Neural Architecture Search by its Architecture Parameters*. Midwest Machine Learning Symposium 2023.

Tzu-Heng Huang, Harit Vishwakarma, Catherine Cao, Spencer Schoenberg, **Nicholas Roberts**, Frederic Sala. (2023). *ScriptoriumWS: A Code Generation Assistant for Weak Supervision*. ICLR 2023 Deep Learning for Code Workshop.

Renbo Tu, **Nicholas Roberts**, Vishak Prasad, Sibasis Nayak, Paarth Jain, Frederic Sala, Ganesh Ramakrishnan, Ameet Talwalkar, Willie Neiswanger, Colin White. (2022). *AutoML for Climate Change: A Call to Action*. NeurIPS 2022 Tackling Climate Change with Machine Learning Workshop.

**Nicholas Roberts**, Davis Liang, Graham Neubig, Zachary C. Lipton. (2020). *Decoding and Diversity in Machine Translation*. NeurIPS 2020 Resistance AI Workshop.

Mikhail Khodak, Liam Li, **Nicholas Roberts**, Maria-Florina Balcan, Ameet Talwalkar. (2020). *A Simple Setting for Understanding Neural Architecture Search with Weight-Sharing*. ICML 2020 AutoML Workshop.

Mikhail Khodak<sup>\*</sup>, Liam Li<sup>\*</sup>, **Nicholas Roberts**, Maria-Florina Balcan, Ameet Talwalkar. (2020). *Weight-Sharing Beyond Neural Architecture Search: Efficient Feature Map Selection and Federated Hyperparameter Tuning*. MLSys 2020 On-Device Intelligence Workshop.

**Nicholas Roberts**, Dian A. Yap, Vinay U. Prabhu. (2019). *Deep Connectomics Networks: Neural Network Architectures Inspired by Neuronal Networks*. NeurIPS 2019 Real Neurons and Hidden Units Workshop.

**Nicholas Roberts**, Poornav S. Purushothama, Vishal T. Vasudevan, Siddarth Ravichandran, Chen Zhang, William H. Gerwick, Garrison W. Cottrell. (2019). *Using Deep Siamese Neural Networks to Speed up Natural Products Research*. NeurIPS 2019 workshop on Machine Learning and the Physical Sciences.

Dian A. Yap, **Nicholas Roberts**, Vinay U. Prabhu. (2019). *Grassmannian Packings in Neural Networks: Learning with Maximal Subspace Packings for Diversity and Anti-Sparsity*. NeurIPS 2019 Workshop on Bayesian Deep Learning.

**Nicholas Roberts**, Vinay U. Prabhu, Matthew McAteer. (2019). *Model Weight Theft With Just Noise Inputs: The Curious Case of the Petulant Attacker*. ICML 2019 Workshop on Security and Privacy of Machine Learning.

## PRESENTATIONS

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*Geometry-Aware Adaptation for Pretrained Models*

**Invited Talk** Microsoft Research, ML Foundations Seminar.

Host: Sébastien Bubeck.

Redmond, WA. August 2023.

*The AutoML Decathlon: Diverse Tasks, Modern Methods, and Efficiency at Scale*

**Invited Talk** AutoML Seminar.

Host: Aaron Klein.

Online. April 2023.

*AutoML Decathlon Hackathon*

**Invited Hackathon** AutoML Fall School.

Host: Frank Hutter.

Freiburg, Germany. October 2022.

*Rethinking AutoML for Diverse Tasks*

**Invited Talk** Physics  $\cap$  ML Seminar, University of Wisconsin - Madison.

Host: Gary Shiu

Madison, WI. March 2022.

*Searching for Convolutions and a More Ambitious NAS*

**Plenary Talk** AAAI 2021 Workshop on Learning Network Architecture During Training.

Online. February 2021.

*Model Weight Theft With Just Noise Inputs: The Curious Case of the Petulant Attacker*

**Spotlight Presentation** ICML 2019 Workshop on Security and Privacy of Machine Learning.

Long Beach, CA, USA. June 2019.

*Small Molecule Accurate Recognition Technology: A Digital Frontier to Reshape Natural Product Research*

**Spotlight Presentation** Applied Machine Learning Days 2018.

Lausanne, Switzerland. January 2018.

## AWARDS

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<b>ML and Systems Rising Stars award</b> <i>MLCommons</i>	2023
<b>NeurIPS Scholar Award</b> <i>Neural Information Processing Systems (NeurIPS)</i>	2022
<b>Prove AI Fellowship</b> <i>Prove AI Labs</i>	2021
<b>First-Year CS Departmental Scholarship</b> <i>University of Wisconsin - Madison</i>	2021
<b>NeurIPS “Travel” Award</b> <i>Neural Information Processing Systems (NeurIPS)</i>	2020
<b>UnifyID AI Fellowship</b> <i>UnifyID AI Labs</i>	2019
<b>Outstanding Undergraduate Researcher Award (honorable mention)</b> <i>Computing Research Association (CRA)</i>	2019
<b>NeurIPS Travel Award</b> <i>Neural Information Processing Systems (NeurIPS)</i>	2018
<b>Best Spotlight Presentation Award</b> <i>Applied Machine Learning Days (AMLDD)</i>	2018

## EXPERIENCE

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**University of Wisconsin - Madison** August 2021 -  
*Research Assistant (Sprocket Lab w/Frederic Sala)*

· Ph.D. research on Weak Supervision and Automated Machine Learning advised by Frederic Sala

- Microsoft Research** June 2023 - September 2023  
*Research Intern*
- Developed activation function search techniques for large-scale LLM pretraining
  - Developed learning curve extrapolation techniques to ablate architectural choices in transformers
- Carnegie Mellon University** May 2020 - August 2020, May 2021 - August 2021  
*Research Assistant (SAGE Lab w/Ameet Talwalkar)*
- Explored two directions for expanding NAS search spaces: large scale edge learning and operation learning
  - Gave monthly research presentations to J.P. Morgan researchers
- Amazon AWS AI** June 2019 - August 2019  
*Applied Scientist Intern*
- Identified areas for improvement in existing ASR systems when recognizing rare or zero shot entities
  - Researched and developed methods for hypothesis rescoring in ASR systems using neural language modeling
- UnifyID** February 2019 - June 2019  
*AI Fellow + Machine Learner Intern*
- Developed a novel model extraction attack against deep learning models for computer vision using just noise inputs
  - Researched ways to apply network neuroscience findings to deep learning
- Intuit** June 2018 - September 2018  
*Software Engineering Intern*
- Researched and implemented a novel controllable text generation model as a service within Intuit
  - Identified dynamic topic models as a promising direction for analyzing customer support tickets over time
- Altum** January 2018 - May 2018  
*Applied Scientist Intern*
- Developed language model to extract NLP features from text data for cryptocurrency trading
  - Implemented SoTA unsupervised sentiment analysis models for classifying streaming online forum data
- UCSD CSE Department** September 2017 - March 2018  
*Data Science Tutor*
- Tutored DSC 10 Introduction to Data Science, under Professor Janine Tiefenbruck
  - Tutored DSC 20 Principles of Data Science, under Professor Marina Langlois
- Teradata** June 2017 - September 2017  
*Software Engineering Intern*
- Improved training methodology and architecture of deep learning time series model used internally
  - Developed open source Spark-Teradata connector forked from Databricks connector for AWS Redshift
- Skqrl** June 2016 - December 2016  
*Software Engineering Intern*
- Developed web scraping tool to compile product data
  - Designed and implemented search pipeline and database using Python, Django, and MySQL
- ModSpot** January 2016 - March 2016  
*Software Engineering Intern*
- Implemented new user account, edit profile, and login designs in Objective-C for iOS application
  - Refactored analytics code for gathering statistics on app usage
- The Comeback Community** June 2015 - September 2015  
*Volunteer Full Stack Developer*
- Developed website for educational nonprofit using Google Cloud Platform
- Fresno City College** January 2015 - May 2015  
*Tutor*

- Tutored calculus, linear algebra, data structures, discrete mathematics, and Android app development

**Fresno County Sheriff's Office**  
*IT Intern*

May 2013 - August 2013

- Replaced malfunctioning hardware in employee PCs

## LEADERSHIP, ACTIVITIES, AND EXTRACURRICULAR

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<b>Wisconsin:</b>	AutoML Conference 2023 NeurIPS 2022 High School Outreach Lead competition organizer: AutoML Cup 2023 AutoML Decathlon competition @ NeurIPS 2022 AutoML Decathlon Hackathon @ Wisconsin AutoML Decathlon Hackathon @ the AutoML Fall School 2022 Reviewer: NeurIPS 2022, 2023 NeurIPS Datasets and Benchmarks Track 2021, 2022, 2023 ICML 2022, 2023 ICML 2023 Efficient Systems for Foundation Models Workshop AISTATS 2023 AutoML 2023 AutoML 2023 Workshop Track TMLR Scratch Club Wisconsin Hoofer Sailing Club	Competition Chair Group Leader
<b>CMU:</b>	MSML Student Committee 2019-2021 MSML Admissions Committee 2020-2021	Teacher Member Event Organizer Committee Member
<b>UCSD:</b>	Tau Beta Pi Engineering Honor Society Triton Engineering Student Council Data Science Student Society	House Leader Data Analyst Workshop Coordinator
<b>FCC:</b>	Google Developer Group Fresno City College Science and Engineering Club	President/Founder Treasurer

## TECHNOLOGIES AND SKILLS

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<b>Competent:</b>	Python, PyTorch, AWS, TensorFlow, Java, Scala, C/C++, Unix, Docker
<b>Familiar:</b>	SQL, Kaldi ASR, Google Cloud Platform, Matlab/Octave, JavaScript