Nadav Cohen*

Homepage: www.cohennadav.com   **E-mail:** cohennadav (at) tauex.tau.ac.il

Research Interests

Artificial Intelligence, Neural Networks, Learning Theory, Learning for Control, Tensor Analysis

Education

2012-2016: Ph.D. (direct track), School of Computer Science and Engineering, The Hebrew University of Jerusalem

– Advisor: Prof. Amnon Shashua

– Thesis: Analysis and Design of Convolutional Networks via Hierarchical Tensor Decompositions

– GPA: 99.4/100.0

2008-2012: B.Sc. Mathematics and B.Sc. Electrical Engineering, Technion — Israel Institute of Technology

– GPA: 98.3/100.0 (rank 1 of 1827 in Technion Class 2012)

– Member of the Technion Excellence Program for Distinguished Undergraduates

Academic Appointments

2019-present: Asst. Professor (Senior Lecturer), School of Computer Science, Tel Aviv University

2017-2019: Postdoctoral Fellow, School of Mathematics, Institute for Advanced Study (Princeton)

Industry Positions

2016-present: Co-Founder and Chief Scientist, Imubit Inc.

2010-2016: Chief Technology Officer, Cigol Digital Systems Ltd. (acquired by NVIDIA)

2004-2010: FPGA Engineer and Architect, aerospace and defense organizations

Honors and Awards

Apple Doctoral Fellowship to supervised student (2022)

Google Research Scholar Award (2021)

European Laboratory for Learning and Intelligent Systems (ELLIS) Scholarship (2020)

Google Gift for Machine Learning Research (2020)

Hans Wiener Prize for outstanding doctoral thesis (2018)

Zuckerman Postdoctoral Fellowship (2017)

Rothschild Postdoctoral Fellowship (2017)

Final Prize for Machine Learning Research (2017)

TheMarker (Israeli business newspaper) "40 under 40" list (2017)

Google Doctoral Fellowship in Machine Learning (2015)

The Hebrew University of Jerusalem Faculty of Science dean's honors list (2013)

Summa cum laude graduate of Technion B.Sc. Mathematics (2012)

Summa cum laude graduate of Technion B.Sc. Electrical Engineering (2012)

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* Updated on December 30, 2023

Maxim Bychkov Prize for outstanding achievements in B.Sc. Mathematics (2012)

Technion Excellence Program for Distinguished Undergraduates (2008-2012)

Technion president's honors list (2008-2012)

Technion Faculty of Mathematics Award for outstanding undergraduate achievements (2011)

Elias-Perlmutter Prize for outstanding achievements in B.Sc. Electrical Engineering (2011)

Award for outstanding R&D of aerospace system (2008)

Award for outstanding R&D of satellite system (2007)

Award for excellence in R&D (2006)

Publications

Conference Proceedings

[†] Yotam Alexander, Nimrod De La Vega, Noam Razin and Nadav Cohen. 'What Makes Data Suitable for a Locally Connected Neural Network? A Necessary and Sufficient Condition Based on Quantum Entanglement'. *Conference on Neural Information Processing Systems (NeurIPS) 2023, Spotlight Track (top 3%).*

[†] Noam Razin, Tom Verbin and Nadav Cohen. 'On the Ability of Graph Neural Networks to Model Interactions Between Vertices'. *Conference on Neural Information Processing Systems (NeurIPS) 2023.*

[†] Edo Cohen-Karlik, Itamar Menuhin-Gruman, Raja Giryes, Nadav Cohen and Amir Globerson. 'Learning Low Dimensional State Spaces with Overparameterized Recurrent Neural Nets'. *International Conference on Learning Representations (ICLR) 2023.*

[†] Noam Razin, Asaf Maman and Nadav Cohen. 'Implicit Regularization in Hierarchical Tensor Factorization and Deep Convolutional Neural Networks'. *International Conference on Machine Learning (ICML) 2022.*

Edo Cohen-Karlik, Avichai Ben David, Nadav Cohen and Amir Globerson. 'On the Implicit Bias of Gradient Descent for Temporal Extrapolation'. *Conference on Artificial Intelligence and Statistics (AISTATS) 2022.*

[†] Omer Elkabetz and Nadav Cohen. 'Continuous vs. Discrete Optimization of Deep Neural Networks'. *Conference on Neural Information Processing Systems (NeurIPS) 2021, Spotlight Track (top 3%).*

[†] Noam Razin, Asaf Maman and Nadav Cohen. 'Implicit Regularization in Tensor Factorization'. *International Conference on Machine Learning (ICML) 2021.*

[†] Noam Razin and Nadav Cohen. 'Implicit Regularization in Deep Learning May Not Be Explainable by Norms'. *Conference on Neural Information Processing Systems (NeurIPS) 2020.*

[‡] Sanjeev Arora, Nadav Cohen, Wei Hu and Yuping Luo (alphabetical order). 'Implicit Regularization in Deep Matrix Factorization'. *Conference on Neural Information Processing Systems (NeurIPS) 2019, Spotlight Track (top 3%).*

[‡] Sanjeev Arora, Nadav Cohen, Noah Golowich and Wei Hu (alphabetical order). 'A Convergence Analysis of Gradient Descent for Deep Linear Neural Networks'. *International Conference on Learning Representations (ICLR) 2019.*

Assaf Shocher, Nadav Cohen and Michal Irani. '"Zero-Shot" Super-Resolution Using Deep Internal Learning'. *Conference on Computer Vision and Pattern Recognition (CVPR) 2018.*

[†] Supervised student paper

[‡] Primary authorship

‡ Sanjeev Arora, Nadav Cohen and Elad Hazan (alphabetical order). 'On the Optimization of Deep Networks: Implicit Acceleration by Overparameterization'. *International Conference on Machine Learning (ICML) 2018.*

‡ Nadav Cohen, Ronen Tamari and Amnon Shashua. 'Boosting Dilated Convolutional Networks with Mixed Tensor Decompositions'. *International Conference on Learning Representations (IC-LR) 2018, Oral Track (top 1%).*

Yoav Levine, David Yakira, Nadav Cohen and Amnon Shashua. 'Deep Learning and Quantum Entanglement: Fundamental Connections with Implications to Network Design'. *International Conference on Learning Representations (ICLR) 2018.*

‡ Nadav Cohen and Amnon Shashua. 'Inductive Bias of Deep Convolutional Networks through Pooling Geometry'. *International Conference on Learning Representations (ICLR) 2017.*

‡ Nadav Cohen and Amnon Shashua. 'Convolutional Rectifier Networks as Generalized Tensor Decompositions'. *International Conference on Machine Learning (ICML) 2016.*

‡ Nadav Cohen, Or Sharir and Amnon Shashua. 'On the Expressive Power of Deep Learning: A Tensor Analysis'. *Conference on Learning Theory (COLT) 2016.*

‡ Nadav Cohen, Or Sharir and Amnon Shashua. 'Deep SimNets'. *Conference on Computer Vision and Pattern Recognition (CVPR) 2016.*

Journals

Nadav Cohen, Govind Menon and Zsolt Veraszto. 'Deep Linear Networks for Matrix Completion — An Infinite Depth Limit'. *Society for Industrial and Applied Mathematics (SIAM) Journal on Applied Dynamical Systems, 2023.*

Yoav Levine, Or Sharir, Nadav Cohen and Amnon Shashua. 'Quantum Entanglement in Deep Learning Architectures'. *Physical Review Letters (PRL), 2019.*

Book Chapters

Yoav Levine, Or Sharir, Nadav Cohen and Amnon Shashua. 'Bridging Many-Body Quantum Physics and Deep Learning via Tensor Networks'. *'Mathematical Aspects of Deep Learning', Cambridge University Press, 2022.*

Yoav Levine, Noam Wies, Or Sharir, Nadav Cohen and Amnon Shashua. 'Tensors for Deep Learning Theory: Analyzing Deep Learning Architectures via Tensorization'. *'Tensors for Data Processing: Theory, Methods and Applications', Academic Press, 2022.*

Invited Papers, Workshops and Technical Reports

‡ Nadav Cohen, Or Sharir, Yoav Levine, Ronen Tamari, David Yakira and Amnon Shashua. 'Analysis and Design of Convolutional Networks via Hierarchical Tensor Decompositions'. *Intel Collaborative Research Institute Special Issue on Deep Learning Theory, 2017.*

Or Sharir, Ronen Tamari, Nadav Cohen and Amnon Shashua. 'Tensorial Mixture Models'. *Technical Report, 2016.*

‡ Nadav Cohen and Amnon Shashua. 'SimNets: A Generalization of Convolutional Networks'. *Conference on Neural Information Processing Systems (NeurIPS) 2014, Workshop on Deep Learning and Representation Learning.*

Patents

Granted

Abishek Mukund, Matthew Stephens and Nadav Cohen. 'Systems and Methods for Optimizing Refinery Coker Process'. *US Patent 11,494,651 (filed 2020, granted 2022).*

Nadav Cohen and Gilad Cohen. 'Controller Training Based on Historical Data'. *US Patent 11,200,489 (filed 2018, granted 2021).*

Pending

Ofer Salhov and Nadav Cohen. 'Control System With Optimization of Neural Network Predictor'. *US Patent Application 17/831,227 (filed 2022).*

Elhanan Ilani and Nadav Cohen. 'Predictive Control Systems and Methods With Offline Gains Learning and Online Control'. *US Patent Application 16/950,643 (filed 2021).*

Corrie Clark, Matthew Stephens, Janelle Jagnanan, Nadav Cohen and Gilad Cohen. 'Predictive Control Systems and Methods With Hydrocracker Conversion Optimization'. *US Patent Application 17/384,660 (filed 2021).*

Janelle Jagnanan, Joseph Von Edwins, Matthew Stephens, Kevin Clarke and Nadav Cohen. 'Predictive Control Systems and Methods With Fluid Catalytic Cracking Volume Gain Optimization'. *US Patent Application 17/308,474 (filed 2021).*

Advised Students

Current

Noam Razin, Ph.D. candidate (direct track), 2019-present

Yotam Alexander, Ph.D. candidate, 2021-present

Yuval Milo, M.Sc. candidate, 2022-present

Yonatan Slutzky, M.Sc. candidate, 2023-present

Benaya Koren, M.Sc. candidate, 2023-present

Alumni

Nimrod De La Vega, M.Sc., 2022-2023

Tom Verbin, M.Sc., 2022-2023

Itamar Menuchin, M.Sc., 2021-2022

Omer Elkabetz, M.Sc., 2020-2022

Asaf Maman, M.Sc., 2020-2022

Outreach

Advisory Board Member, Artificial Intelligence in Education Program, Israel Ministry of Education (2020-present)

Chairman, Industrial Affiliates Program, School of Computer Science, Tel Aviv University (2019-present)

Teaching

Teacher, Workshop in Deep Learning, School of Computer Science, Tel Aviv University (2021-present)

Lecturer, Foundations of Deep Learning, School of Computer Science, Tel Aviv University (2020-present)

Lecturer, Introduction to Machine Learning, School of Computer Science, Tel Aviv University (2020-present)

Teacher, Advanced Seminar in Machine Learning, School of Computer Science, Tel Aviv University (2019-present)

Joint lecturer, Advanced Practical Machine Learning, School of Computer Science and Engineering, The Hebrew University of Jerusalem (2016-2017)

Teacher, Advanced Seminar in Deep Learning, School of Computer Science and Engineering, The Hebrew University of Jerusalem (2015-2017)

Teaching assistant, Computer Vision, School of Computer Science and Engineering, The Hebrew University of Jerusalem (2013-2016)

Research Funding

TAU Center for Artificial Intelligence and Data Science High Impact Grant (2022-present)

Adelis Forever Foundation (2022)

Israel Council for Higher Education Data Science Center Research Grant (2021-present)

Israel Science Foundation Grant 1780/21 (2021-present)

Israel Science Foundation Grant 3243/21 (2021-present)

Google Research Scholar Award (2021)

Alibaba Research Grant (2021)

Google Gift for Machine Learning Research (2020)

Amnon and Anat Shashua (2020)

Yandex Initiative in Machine Learning (2019-present)

Len Blavatnik and the Blavatnik Family Foundation (2019-present)

Service

Action Editor

Transactions on Machine Learning Research (TMLR)

Area Chair

Conference on Neural Information Processing Systems (NeurIPS)

International Conference on Machine Learning (ICML)

Session Chair

Conference on Neural Information Processing Systems (NeurIPS)

International Conference on Machine Learning (ICML)

Organizer

Conference on the Mathematical Theory of Deep Neural Networks (DeepMath) 2020

Conference on Neural Information Processing Systems (NeurIPS) 2020, Workshop on Quantum Tensor Networks in Machine Learning

Reviewer

Conference on Neural Information Processing Systems (NeurIPS)

International Conference on Machine Learning (ICML)

Conference on Learning Theory (COLT)

Conference on Computer Vision and Pattern Recognition (CVPR)

International Conference on Learning Representations (ICLR)

Journal of Machine Learning Research (JMLR)

Springer Machine Learning

IEEE Transactions on Pattern Analysis and Machine Intelligence

SIAM Journal on Mathematics of Data Science

IEEE Transactions on Knowledge and Data Engineering

IEEE Journal on Selected Areas in Information Theory

Physical Review Letters (PRL)

Physical Review B (PRB)

Invited Conference and Workshop Talks

2023

Conference on Foundations of Computational Mathematics (FoCM) 2023, Workshop on Computational Harmonic Analysis and Data Science. Paris, France.

Oberwolfach Research Institute for Mathematics, Workshop on Nonlinear Approximation of High-Dimensional Functions in Scientific Computing. Oberwolfach, Germany.[§]

Institute for Computational and Experimental Research in Mathematics (ICERM), Workshop on Modern Applied and Computational Analysis. Providence, RI, USA.[§]

International Summit on Robotics and Artificial Intelligence. London, UK.[§]

Keynote. *Cyber Week, Workshop on AI and Cyber.* Tel Aviv, Israel.

AI Week. Tel Aviv, Israel.

Tel Aviv University Annual Summit for Ambassadors to Israel. Tel-Aviv, Israel.[||]

2022

International Conference on Machine Learning (ICML), Workshop on Continuous Time Perspectives in Machine Learning. Baltimore, MD, USA.

Schloss Dagstuhl – Leibniz Center for Informatics, Seminar on Tensor Computations: Applications and Optimization. Wadern, Germany.

Workshop on New Interactions Between Statistics and Optimization. Banff, Canada.

Workshop on Mathematics of Data Science. Bonn, Germany.

Meeting for Youth in High-Dimensions: Recent Progress in Machine Learning, High-Dimensional Statistics and Inference. Trieste, Italy.[§]

Workshop on Hammers and Nails: Machine Learning Meets Astro and Particle Physics. Rehovot, Israel.

AI Week. Virtual.

2021

Conference on Neural Information Processing Systems (NeurIPS) 2021, Workshop on Quantum Tensor Networks in Machine Learning. Virtual.

Conference on Algorithmic Learning Theory (ALT) 2021, Mentorship Workshop. Virtual.

Oberwolfach Research Institute for Mathematics, Workshop on Applied Harmonic Analysis and Data Science. Oberwolfach, Germany.

Workshop on Tensor Methods and their Applications in the Physical and Data Sciences. Virtual.

AI Week. Virtual.

2020

Conference on Neural Information Processing Systems (NeurIPS) 2020, Workshop on Quantum

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[§] Declined due to schedule conflict

[||] Canceled due to global disruption (e.g. COVID-19)

Tensor Networks in Machine Learning. Virtual.

Simons Institute for the Theory of Computing Workshop on Learning and Testing in High Dimensions. Virtual.

One World Seminar Series on the Mathematics of Machine Learning. Virtual.

Workshop on Theory of Deep Learning. Holetown, Barbados.

Tel Aviv University Annual Summit for Ambassadors to Israel. Tel-Aviv, Israel.[§]

Workshop on Mathematics of Data Science. Bonn, Germany.[‖]

Summer School and Workshop on the Foundations of Graph and Deep Learning. Baltimore, MD, USA.[§]

Keynote. *International Joint Conference on Artificial Intelligence (IJCAI), Workshop on Tensor Network Representations in Machine Learning.* Yokohama, Japan.[§]

Keynote. *Israel Machine Vision Conference (IMVC).* Tel-Aviv, Israel.

2019

Simons Institute for the Theory of Computing Workshop on Frontiers of Deep Learning. Berkeley, CA, USA.

Workshop on Theoretical Physics for Machine Learning. Aspen, CO, USA.[§]

Society for Industrial and Applied Mathematics (SIAM) Conference on Computational Science and Engineering (CSE), Minisymposium on Low-Rank Tensor Methods and Deep Learning. Spokane, WA, USA.[§]

Institute of Electrical and Electronics Engineers (IEEE) International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP). Guadeloupe, West Indies.[§]

Institute for Computational and Experimental Research in Mathematics (ICERM), Workshop on Theory and Practice in Machine Learning and Computer Vision. Providence, RI, USA.

Workshop on Mathematics of Deep Learning. Berlin, Germany.[§]

International Congress on Industrial and Applied Mathematics (ICIAM), Minisymposium on Theoretical Foundations of Deep Learning. Valencia, Spain.[§]

International Conference on Sampling Theory and Applications (SAMPTA), Special Session on Deep Learning. Bordeaux, France.[§]

International Conference on Approximation Theory (AT), Minisymposium on Neural Network Approximation. Nashville, TN, USA.[§]

Workshop on Theory of Deep Learning. Istanbul, Turkey.[§]

AI and Big Data Day. Lviv, Ukraine.[§]

Institute of Science and Technology (IST) Austria, Workshop on the Theory of Deep Learning. Vienna, Austria.[§]

African Institute for Mathematical Sciences (AIMS), Spring School on Mathematics of Data Science. Cape Town, South Africa.[§]

Workshop on AI and Tensor Factorization for Physical, Chemical, and Biological Systems. Santa Fe, NM, USA.[§]

Keynote. *Israel Machine Vision Conference (IMVC).* Tel-Aviv, Israel.[§]

Workshop on Hammers and Nails: Machine Learning Meets Astro and Particle Physics. Rehovot, Israel.[§]

Interdisciplinary Workshop on Quantum Computing. Jerusalem, Israel.[§]

Workshop on Quantum Computing and Quantum Chemistry: Theory, Platforms, and Practical Applications. Tel Aviv, Israel.

Israel's Homeland Security (iHLS) Conference on Quantum Technologies for Security. Rishon LeZion, Israel.

AI Week. Tel Aviv, Israel.

2018

Symposium on the Mathematical Theory of Deep Neural Networks. Princeton, NJ, USA.

Oberwolfach Research Institute for Mathematics, Workshop on Applied Harmonic Analysis and Data Processing. Oberwolfach, Germany.

Workshop on Physics and Machine Learning. New York City, NY, USA.

Institute of Electrical and Electronics Engineers (IEEE) Conference on Decision and Control (CDC), Workshop on the Intersections of Machine Learning and Parameter Estimation in Control. Miami Beach, FL, USA.[§]

Workshop on Machine Learning and Physics. Beijing, China.[§]

Deep Learning Summer Course. Hsinchu City, Taiwan.[§]

Summer School on Machine Learning. Yerevan, Armenia.[§]

Keynote. *Israel Machine Vision Conference (IMVC).* Tel-Aviv, Israel.[§]

2017

Conference on Computer Vision and Pattern Recognition (CVPR), Workshop on Tensor Methods in Computer Vision. Honolulu, HI, USA.

International Conference on Computer Vision (ICCV), Workshop on Matrix and Tensor Factorization Methods in Computer Vision. Venice, Italy.[§]

Workshop on Mathematics of Deep Learning. Berlin, Germany.

Workshop on Physics and Machine Learning. New York City, NY, USA.

Association for the Advancement of Artificial Intelligence (AAAI) Spring Symposium Series, Science of Intelligence: Computational Principles of Natural and Artificial Intelligence. Palo Alto, CA, USA.

Conference on Applied Inverse Problems (AIP), Minisymposium on Deep Neural Networks: Theory and Application. Hangzhou, China.

GAMM Annual Meeting, Minisymposium on Nonlinear Approximations for High-Dimen-sional Problems. Weimar, Germany.

Workshop on Hammers and Nails: Machine Learning and High Energy Physics. Rehovot, Israel.[§]

2016

Conference on Neural Information Processing Systems (NeurIPS), Workshop on Learning with Tensors: Why Now and How. Barcelona, Spain.