

KRZYSZTOF CHOROMANSKI

research scientist at Google Brain Robotics
adjunct assistant professor at Columbia University
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EDUCATION

Columbia University, New York Ph.D. in Operations Research Mathematics Subject Classification: Combinatorics	<i>April 2013</i>
University of Warsaw, Warsaw, Poland M.D. in Mathematics M.D. in Computer Science	<i>May 2009</i>
Mieczyslaw Karłowicz Music School, Warsaw, Poland piano class	<i>September 2000 - May 2004</i>

PROFESSIONAL EXPERIENCE

Google Brain Robotics <i>research scientist</i>	October 2016 - Present <i>New York, NY</i>
· reinforcement learning and (guided) evolutionary search (ES) algorithms, policy gradient methods, sample-efficient blackbox optimization of high-dimensional functions, neural architecture search (NAS) algorithms for encoding RL policies, gradient and isospectral flows in ES · structured and compact neural network architectures for energy-efficient mobile robotics, machine learning for aerial robotics, anomaly detection in robotics · Transformers, Performers (efficient Transformers with linear attention modules)	
Columbia University, IEOR Department <i>adjunct assistant professor</i>	January 2016 - Present <i>New York, NY</i>
· instructorship of M.D. and Ph.D. classes on data mining and machine learning, supervising M.D. and Ph.D. students	
Google Research <i>research scientist</i>	September 2013 - October 2016 <i>New York, NY</i>
· structured transforms for dimensionality reduction, scalable random feature map based kernel methods, hashing and Monte Carlo algorithms, Quasi Monte Carlo methods · online/streaming density-based clustering of high-dimensional data, nearest neighbor search algorithms	

SELECTED INVITED TALKS

- Conference on Computer Vision and Pattern Recognition (CVPR) 2019, "The Unreasonable Effectiveness of ES: A Tale of Hadamard-Minitaurs, Toeplitz-Walkers and Wasserstein-Explorers", *June 16th 2019*
- IEOR-DRO Seminar at Columbia University, *April 2 2019*
- Google Research Conference, Mountain View, *2018*
- University Paris-Dauphine: Lamsade, Paris, France, *2017*
- Google Research Conference, Mountain View, *2017*

- University of Cambridge, University of Oxford, University College London (UCL), *November-December, 2016*
- University Paris-Dauphine: Lamsade, Paris, France, *2016*
- University Paris-Dauphine: Lamsade, Paris, France, *2015*
- City University of New York Graduate Center CS Colloquium, *March 27 2014*
- Computer Science Department at the UMass Amherst University, *February 20 2014*
- ICERM Semidefinite Programming and Graph Algorithms Workshop at Brown University, *February 14 2014*
- Department of Industrial Engineering and Operations (IEOR) Research at Columbia University, *February 11 2014*
- Google TechTalk at Google Research NYC, *December 12 2013*
- Charles University, Prague, Czech Republic (Prague Midsummer Combinatorial Workshop XIX), *July 29-August 2 2013*
- McGill University, Montreal, Canada, *January 21 2013*
- Charles University, Prague, Czech Republic, *December 11 2012*
- Yale University, Discrete Mathematics Seminar, *December 7 2012*
- Rutgers Discrete Mathematics Seminar, *October 2 2012*
- Google Tech Talk: "New classes of tournaments satisfying the Erdős-Hajnal conjecture", Mountain View, *August 1 2012*
- Erdős Memorial Lectures 2012, University of Memphis, *May 17-18 2012*
- Princeton University Discrete Seminar, *February 9 2012*
- Charles University Discrete Mathematics Seminar, Prague, Czech Republic, *December 20 2011*
- 2nd Bertinoro Workshop on Algorithms and Graphs, Bertinoro, Forli-Cesena, Italy, *December 11-16 2011*
- Memphis-Budapest Summer School in Combinatorics (an international study abroad program of the National Science Foundation) at Alfréd Rényi Institute, Budapest, Hungary, *August 7-20 2011*
- 15th International Conference on Random Structures and Algorithms, Atlanta, Emory University, *May 24-28 2011*
- Columbia University Discrete Mathematics Seminar, *2011*

OTHER TALKS

- International Conference on Machine Learning (ICML), Long Beach, California, *June 10-15 2019*
- Conference on Neural Information Processing Systems (NeurIPS), Montreal, Canada, *December 3-8 2018*, spotlight talk
- International Conference on Machine Learning (ICML), Stockholm, Sweden, *July 10-15 2018*
- International Conference on Machine Learning (ICML), New York, *June 19-24 2016*
- The 24th ACM International Conference on Information and Knowledge Management (CIKM), Melbourne, Australia, *October 19-23 2015*
- Algorithmic Learning Theory Conference, National University of Singapore, *October 6-9 2013*

- Neural Information Processing Systems Conference, Lake Tahoe, Nevada, *December 5-8 2013*, spotlight talk
- The Symposium on Principles of Database Systems (PODS), Scottsdale, Arizona, *2012*

SELECTED PAPERS

- *Rethinking Attention with Performers*, ICLR 2021 (oral, **top 40 papers**); Krzysztof Choromanski, Valerii Likhoshesterov, David Dohan, Xingyou Song, Andreea Gane, Tamas Sarlos, Peter Hawkins, Jared Davis, Afroz Mohiuddin, Lukasz Kaiser, David Belanger, Lucy Colwell, Adrian Weller
- *CWY Parametrization: a Solution for Parallelized Learning of Orthogonal and Stiefel Matrices*, AISTATS 2021; Valerii Likhoshesterov, Jared Davis, Krzysztof Choromanski, Adrian Weller
- *Ode to an ODE*, NeurIPS 2020; Krzysztof Choromanski, Jared Davis, Valerii Likhoshesterov, Xingyou Song, Jean-Jacques Slotine, Jacob Varley, Honglak Lee, Adrian Weller, Vikas Sindhwani
- *Demystifying Orthogonal Monte Carlo and Beyond*, NeurIPS 2020; Han Lin, Haoxian Chen, Krzysztof Choromanski, Tianyi Zhang, Clement Laroche
- *Effective Diversity in Population-Based Reinforcement Learning*, NeurIPS 2020 (spotlight); Jack Parker-Holder, Aldo Pacchiano, Krzysztof Choromanski, Stephen Roberts
- *Stochastic Flows and Geometric Optimization on the Orthogonal Group*, ICML 2020; Krzysztof Choromanski, David Cheikh, Jared Davis, Valerii Likhoshesterov, Achille Nazaret, Achraf Bahamou, Xingyou Song, Mrugank Akarte, Jack Parker-Holder, Jacob Bergquist, Yuan Gao, Aldo Pacchiano, Tamas Sarlos, Adrian Weller, Vikas Sindhwani
- *Learning to Score Behaviors for Guided Policy Optimization*, ICML 2020; Aldo Pacchiano, Jack Parker-Holder, Yunhao Tang, Anna Choromanska, Krzysztof Choromanski, Michael I. Jordan
- *Ready Policy One: World Building Through Active Learning*, ICML 2020; Philip Ball, Jack Parker-Holder, Aldo Pacchiano, Krzysztof Choromanski, Stephen Roberts
- *Robotic Table Tennis with Model-Free Reinforcement Learning*, IROS 2020; Wenbo Gao, Laura Graesser, Krzysztof Choromanski, Xingyou Song, Nevena Lazic, Pannag Sanketi, Vikas Sindhwani, Navdeep Jaitly
- *Rapidly Adaptable Legged Robots via Evolutionary Meta-Learning*, IROS 2020; Xingyou Song, Yuxiang Yang, Krzysztof Choromanski, Ken Caluwaerts, Wenbo Gao, Chelsea Finn, Jie Tan
- *ES-MAML: Simple Hessian-Free Meta Learning*, ICLR 2020; Xingyou Song, Wenbo Gao, Yuxiang Yang, Krzysztof Choromanski, Aldo Pacchiano, Yunhao Tang
- *Unsupervised Anomaly Detection for Self-flying Delivery Drones*, ICRA 2020: 186-192; Vikas Sindhwani, Hakim Sidahmed, Krzysztof Choromanski, Brandon Jones
- *Practical Nonisotropic Monte Carlo Sampling in High Dimensions via Determinantal Point Processes*, AISTATS 2020: 1363-1374; Krzysztof Choromanski, Aldo Pacchiano, Jack Parker-Holder, Yunhao Tang
- *Variance Reduction for Evolution Strategies via Structured Control Variates*, AISTATS 2020: 646-656; Yunhao Tang, Krzysztof Choromanski, Alp Kucukelbir
- *On the Erdős-Hajnal conjecture for six-vertex tournaments*, Eur. J. Comb. 75: 113-122 (2019); E. Berger, K. Choromanski, M. Chudnovsky
- *Orthogonal Estimation of Wasserstein Distances*, AISTATS 2019: 186-195; M. Rowland, J. Hron, Y. Tang, K. Choromanski, T. Sarlós, A. Weller

- *KAMA-NNs: Low-dimensional Rotation Based Neural Networks*, AISTATS 2019: 236-245; K. Choromanski, A. Pacchiano, J. Pennington, Y. Tang
- *From Complexity to Simplicity: Adaptive ES-Active Subspaces for Blackbox Optimization*, NeurIPS 2019: 10299-10309; Krzysztof Choromanski, Aldo Pacchiano, Jack Parker-Holder, Yunhao Tang, Vikas Sindhwani
- *Unifying Orthogonal Monte Carlo Methods*; ICML 2019: 1203-1212; K. Choromanski, M. Rowland, W. Chen, A. Weller
- *Excluding Hooks and their Complements*, Electr. J. Comb. 25(3): P3.27 (2018); K. Choromanski, D. Falik, A. Liebenau, V. Patel, M. Pilipczuk
- *Excluding pairs of tournaments*, Journal of Graph Theory 89(3): 266-287 (2018); K. Choromanski
- *The Geometry of Random Features*, AISTATS 2018: 1-9; K. Choromanski, M. Rowland, T. Sarlós, V. Sindhwani, R. E. Turner, A. Weller
- *Initialization matters: Orthogonal Predictive State Recurrent Neural Networks*, ICLR 2018; K. Choromanski, C. Downey, B. Boots
- *Structured Evolution with Compact Architectures for Scalable Policy Optimization*, ICML 2018: 969-977; K. Choromanski, M. Rowland, V. Sindhwani, R. E. Turner, A. Weller
- *VisualBackProp: Efficient Visualization of CNNs for Autonomous Driving*, ICRA 2018: 1-8; M. Bojarski, A. Choromanska, K. Choromanski, B. Firner, L. J. Ackel, U. Muller, P. Yeres, K. Zieba
- *Optimizing Simulations with Noise-Tolerant Structured Exploration. ICRA 2018*, 2970-2977; K. Choromanski, A. Iscen, V. Sindhwani, J. Tan, E. Coumans
- *Geometrically Coupled Monte Carlo Sampling*, NeurIPS 2018 (spotlight): 195-205; M. Rowland, K. Choromanski, F. Chalus, A. Pacchiano, T. Sarlós, R. E. Turner, A. Weller
- *Adaptive anonymization of data using b-edge cover*, SC 2018: 59:1-59:11; A. Khan, K. Choromanski, A. Pothén, S. M. Ferdous, M. Halappanavar, A. Tumeo
- *Graph sketching-based Space-efficient Data Clustering*, SDM 2018: 10-18; A. Morvan, K. Choromanski, C. Gouy-Pailler, J. Atif
- *Learning-based Air Data System for Safe and Efficient Control of Fixed-wing Aerial Vehicles*, SSR 2018: 1-8; K. Choromanski, V. Sindhwani, B. Jones, D. Jourdan, M. Chociej, B. Boots
- *Structured adaptive and random spinners for fast machine learning computations*, AISTATS 2017: 1020-1029; M. Bojarski, A. Choromanska, K. Choromanski, F. Fagan, C. Gouy-Pailler, A. Morvan, N. Sakr, T. Sarlós, J. Atif
- *The Unreasonable Effectiveness of Structured Random Orthogonal Embeddings*, NIPS 2017: 219-228; K. Choromanski, M. Rowland, A. Weller
- *On Blackbox Backpropagation and Jacobian Sensing*, NIPS 2017: 6521-6529; K. Choromanski, V. Sindhwani
- *Differentially-private learning of low dimensional manifolds*, Theor. Comput. Sci. 620: 91-104 (2016); A. Choromanska, K. Choromanski, G. Jagannathan, C. Monteleoni
- *Quantization based Fast Inner Product Search*, AISTATS 2016: 482-490; R. Guo, S. Kumar, K. Choromanski, D. Simcha
- *Binary embeddings with structured hashed projections*, ICML 2016: 344-353; A. Choromanska, K. Choromanski, M. Bojarski, T. Jebara, S. Kumar, Y. LeCun

- *Recycling Randomness with Structure for Sublinear time Kernel Expansions*, ICML 2016: 2502-2510; K. Choromanski, V. Sindhvani
- *Orthogonal Random Features*, NIPS 2016: 1975-1983; F. X. Yu, A. T. Suresh, K. Choromanski, D. N. Holtmann-Rice, S. Kumar
- *Forcing large transitive subtournaments*, J. Comb. Theory, Ser. B 112: 1-17 (2015); E. Berger, K. Choromanski, M. Chudnovsky
- *EH-suprema of tournaments with no nontrivial homogeneous sets*, J. Comb. Theory, Ser. B 114: 97-123 (2015); K. Choromanski
- *An Optimal Online Algorithm For Retrieving Heavily Perturbed Statistical Databases In The Low-Dimensional Querying Model*, CIKM 2015: 1381-1390; K. Choromanski, A. Rostamizadeh, U. Syed
- *Tournaments with near-linear transitive subsets*, J. Comb. Theory, Ser. B 109: 228-249 (2014); K. Choromanski, M. Chudnovsky, P. D. Seymour
- *Tournaments and colouring*, J. Comb. Theory, Ser. B 103(1): 1-20 (2013); E. Berger, K. Choromanski, M. Chudnovsky, J. Fox, M. Loebl, A. Scott, P. D. Seymour, S. Thomassé
- *Upper Bounds for Erdős-Hajnal Coefficients of Tournaments*, Journal of Graph Theory 74(1): 122-132 (2013); K. Choromanski
- *Differentially-Private Learning of Low Dimensional Manifolds*, ALT 2013: 249-263; A. Choromanska, K. Choromanski, G. Jagannathan, C. Monteleoni
- *Adaptive Anonymity via b-Matching*, NIPS 2013: 3192-3200; K. Choromanski, T. Jebara, K. Tang
- *Scale-free graph with preferential attachment and evolving internal vertex structure*, Journal of Statistical Physics 151 (6), 1175-1183 (2013); K. Choromanski, M. Matuszak, J. Miekisz
- *The power of the Dinur-Nissim algorithm: breaking privacy of statistical and graph databases*, PODS 2012: 65-76; K. Choromanski, T. Malkin

HONORS & AWARDS

- second prize for the best student paper ("Analysis of the random graph evolution with complex vertex structure on the example of Complex Preferential Attachment Scheme Model") from the theory of probability and applications of mathematics by Polish Mathematical Society, 2008
- Polish Minister of Science Scholarship for Achievements in Science, 2006-2007
- bronze medal at the 35th International Physics Olympiad in Pohang, South Korea, 2004
- gold medal at Polish Physics Olympiad, 2004
- silver medal at Polish Mathematical Olympiad, 2004
- winner of Physics Competition organized by Warsaw University of Technology, 2004
- gold medal at Team AUSTROPOL Mathematical Competition, Graz, Austria, 2003
- bronze medal at Polish Mathematical Olympiad, 2003
- Polish Prime Minister Scholarship for Achievements in Science, 2002-2004

TEACHING

Data Mining, Data Mining for Engineers, Advanced Topics in IEOR: Big Data & Machine Learning, Machine Learning and High-Dimensional Data

REVIEWING BOARDS

Journal of Combinatorial Theory Series B, Journal of Graph Theory, Journal of Discrete Mathematics, Conference on Neural Information Processing Systems (NIPS), International Conference on Machine Learning (ICML), Conference on Artificial Intelligence and Statistics (AISTATS), Symposium on Foundations of Computer Science (FOCS), ACM-SIAM Symposium on Discrete Algorithms (SODA)

TECHNICAL SKILLS

Programming Languages

Python, C, C++, C#, Java, Prolog, OCaml

Databases

MySQL, PostgreSQL, Microsoft SQL