

Tel (IL): +972525103817 Machine/Deep Learning | Big Data | Robotics | Computer Vision
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Bio

I am a postdoctoral researcher at the Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts Institute of Technology (MIT), working with Prof. Daniela Rus. I am also a postdoctoral associate with the Harvard School of Engineering and Applied Sciences. Additionally, I am a machine learning researcher at Project CETI (Cetacean Translation Initiative) working closely with Prof. Antonio Torralba and Prof. Robert J. Wood. Previously, I received my Ph.D. from the Department of Computer Science at the University of Haifa, where I was supervised by Prof. Dan Feldman.

My main research interests are Deep/Machine Learning, Vision, Robotics, and Big Data. I am passionate about contributing to society by making Machine/Deep Learning algorithms more efficient and reliable to enhance their (daily) usage in different fields such as Computer Vision, Natural Language Processing, and Robotics. In my research, I aim at learning, impacting, and actually improving science, discovery, and life, thus, I search for real-world problems, design algorithms for solving them, prove their correctness, and finally demonstrate their (practical) applicability.

Education

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| Ph.D., Computer Science, University of Haifa, Israel
Thesis. MDL-BOOST: Constructing Efficient Machine/Deep Learning Systems via Data and Model Compression
Advisor: Prof. Dan Feldman | March 2020 - July 2022 |
| M.Sc., Computer Science, University of Haifa, Israel (Suma Cum Laude)
GPA 97.57 , Thesis grade 100 , Thesis defense grade 100
Thesis. Fast and Accurate Least-Mean-Squares Solvers (NeurIPS'19 Outstanding Paper Honorable Mention Award)
Advisor: Prof. Dan Feldman | October 2016 - September 2019 |
| B.Sc., Computer Science, University of Haifa, Israel | October 2012 - July 2016 |

Professional Experience

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| Machine Learning Researcher (Project CETI - Cetacean Translation Initiative)
Developing advanced machine learning and state-of-the-art robotics to understand the communication (language) of sperm whales. | 2023 - present |
| Postdoctoral Associate (SEAS, Harvard)
Working with Prof. Robert Wood's labs. | 2023 - present |
| Postdoctoral Researcher (CSAIL, MIT)
Hosted by Prof. Daniela Rus. | 2023 - present |
| Research Consultant (DataHeroes Ltd)
Suggesting provable data summarization techniques: from theory to practice. | 2023 |
| Lead Machine/Deep Learning Researcher (DataHeroes Ltd)
Efficiency in training deep learning models. | 2022 - 2023 |
| Graduate Research Assistant (University of Haifa) | 2018 - 2022 |

Research interests: Deep Learning, Machine Learning, Robotics, and Big Data.

- Autonomous toy-drones: suggested systems for running real-time deep learning tasks on weak micro-computers, such as the Raspberry Pi Zero v2 (whose price was \$15) attached to a toy-drone.
- Understanding and designing efficient neural network architectures.
- Researching compression methods for deep learning systems with and without fine-tuning.
- Developing a framework for boosting the performance of existing Least-Mean-Squares solvers, improving their widely used solvers from the famous sickit-learn python library.
- Suggesting coresets (provable data summarization) for a variety of machine learning problems, such as Dimensionality Reduction, Regression, Clustering, and more.
- Investigating novel provable sampling-based techniques for boosting motion (path) planning models of robots and space exploration algorithms.

Runway Project (Samsung Research Israel)

2018-2020

On-Device deep learning for speech recognition.

Chip Design - R&D Tools, Automations, and Methodology (Mellanox Technologies, Nvidia today)

2015 - 2019

- 2015-2016: Chip Design Student.
- 2017-2019: Chip Design Engineer.

Teaching Experience (University of Haifa)

- 2021-2022: Machine Learning course teaching assistant.
- 2021-2022: Deep Learning course teaching assistant.
- 2019-2020: Learning Big Data in the Cloud course teaching assistant.
- 2018-2019: Deep Learning course teaching assistant.
- 2018-2021: Robotics Lab Advisor.

Invited Talks

- Efficient Machine Learning - Reading Group: “AutoCoreset: An Automatic Practical Coreset Construction Framework” (11.09.23).
- Department of the Air Force-MIT AI Accelerator: “Constructing Efficient Machine/Deep Learning Systems via Data and Model Compression” (23.06.23).
- Distributed Robotic Lab, CSAIL, MIT: “Efficient Deep Learning: From Theory to Practic” (21.03.23).
- University of Massachusetts Amherst: “Fast and Accurate Least-Mean-Squares Solvers” (07.3.23).
- DataHeroes Ltd: “Efficiency in Training and Deploying Machine Learning Models” (16.6.22).
- University of Haifa, Department of Computer Science, CS Colloquium: “Compressing Neural Networks: Towards Determining the Optimal Layer-wise Decomposition” (28.4.22).
- Lightricks, Israel: “Towards Efficient Neural Networks” (3.3.22).
- Neural Information Processing Systems 2021, Israel version: “Compressing Neural Networks: Towards Determining the Optimal Layer-wise Decomposition” (NeurIPS’21 24.11.21).

- Duke University, Department of Mathematics: “Fast and Accurate Least-Mean-Squares Solvers” (29.4.21).
- Harvard CMSA Seminar: “Fast and Accurate Least-Mean-Squares Solvers” (3.11.20).
- Knowledge Discovery and Data Mining Conference: “Tight Sensitivity Bounds For Smaller Coresets” (KDD 2020).
- Technion, pixel club: “Fast and Accurate Least-Mean-Squares Solvers” (21.1.20).
- Alibaba Group, Tel Aviv, Israel: “Coresets and Their Applications in Machine Learning” (6.1.20).
- Neural Information Processing Systems 2019 (oral presentation): “Fast and Accurate Least-Mean-Squares Solvers” (NeurIPS19, 11.12.19).
- Neural Information Processing Systems 2019, Israel version: “Fast and Accurate Least-Mean-Squares Solvers” (NeurIPS’19 28.11.19).
- University of Haifa, Robotics and Big Data (RBD) labs: “Streaming PCA” (7.11.19).

Awards

- Outstanding Reviewer Award, CVPR 2021.
- Honorable Mention for the Outstanding Paper Award, Neurips 2019 (the paper was part of my M.sc. thesis).
- M.Sc. - summa cum laude, advised by Prof. Dan Feldman, the Computer Science Department, Haifa University.
- Received the “Exceeded expectation” ranking twice, as a student and engineer at Mellanox technologies (Nvidia today).
- Received recognition for "highest level of professionalism and dedication" in 2017 at Mellanox technologies, chip design - design tools group.
- Won second place in the chip design Hackathon held at Mellanox technologies in 2018.

Academic Service: Program Committee (PC) Member/Reviewer

- IEEE International Conference on Robotics and Automation (ICRA) 2023.
- Conference on Neural Information Processing Systems (NeurIPS) 2022.
- The International Conference on Machine Learning (ICML) 2022.
- Machine Learning Journal (Springer) 2022.
- Conference on Neural Information Processing Systems (NeurIPS) 2021.
- Conference on Computer Vision and Pattern Recognition (CVPR) 2021.
- Association for the Advancement of Artificial Intelligence (AAAI) 2021.
- Association for the Advancement of Artificial Intelligence (AAAI) 2020.

Publications

- (1) Maalouf, A., Jadhav, N., Jatavallabhula, K. M., Chahine, M., Vogt, D. M., Wood, R. J., Torralba, A., & Rus, D. (2024). Follow anything: Open-set detection, tracking, and following in real-time. *IEEE Robotics and Automation Letters*
- (2) Wang, T.-H., Maalouf, A., Xiao, W., Ban, Y., Amini, A., Rosman, G., Karaman, S., & Rus, D. (2024). Drive anywhere: Generalizable end-to-end autonomous driving with multi-modal foundation models. *2024 International Conference on Robotics and Automation (ICRA)*
- (3) Maalouf, A., Tukan, M., Loo, N., Hasani, R., Lechner, M., & Rus, D. (2023). On the size and approximation error of distilled sets. *Proceedings of the 37th International Conference on Neural Information Processing Systems*
- (4) Maalouf, A., Tukan, M., Braverman, V., & Rus, D. (2023). Autocoreset: An automatic practical coreset construction framework. *International Conference on Machine Learning*

- (5) Jatavallabhula, K. M., Kuwajerwala, A., Gu, Q., Omama, M., Chen, T., Maalouf, A., Li, S., Iyer, G., Saryazdi, S., Keetha, N., Tewari, A., et al. (2023). Conceptfusion: Open-set multimodal 3d mapping. *Robotics: Science and Systems*
- (6) Maalouf, A., Gurfinkel, Y., Diker, B., Gal, O., Rus, D., & Feldman, D. (2023). Deep learning on home drone: Searching for the optimal architecture. *2023 International Conference on Robotics and Automation (ICRA)*
- (7) Tukan, M., Zhou, S., Maalouf, A., Rus, D., Braverman, V., & Feldman, D. (2023). Provable data subset selection for efficient neural network training. *International Conference on Machine Learning*
- (8) Maalouf, A., Eini, G., Mussay, B., Feldman, D., & Osadchy, M. (2022). A unified approach to coreset learning. *IEEE Transactions on Neural Networks and Learning Systems*
- (9) Maalouf, A., Jubran, I., & Feldman, D. (2022). Fast and accurate least-mean-squares solvers for high dimensional data. *IEEE Transactions on Pattern Analysis and Machine Intelligence*
- (10) Tukan, M., Muallem, L., & Maalouf, A. (2022). Pruning neural networks via coresets and convex geometry: Towards no assumptions. *Proceedings of the 36th International Conference on Neural Information Processing Systems*
- (11) Maalouf, A., Tukan, M., Price, E., Kane, D. G., & Feldman, D. (2022). Coresets for data discretization and sine wave fitting. *International Conference on Artificial Intelligence and Statistics*
- (12) Tukan, M., Maalouf, A., Feldman, D., & Poranne, R. (2022). Obstacle aware sampling for path planning. *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*
- (13) Liebenwein, L., Maalouf, A., Feldman, D., & Rus, D. (2021). Compressing neural networks: Towards determining the optimal layer-wise decomposition. *Proceedings of the 35th International Conference on Neural Information Processing Systems*
- (14) Tukan, M., Maalouf, A., Weksler, M., & Feldman, D. (2021). No fine-tuning, no cry: Robust svd for compressing deep networks. *Sensors*, 21(16), 5599
- (15) Maalouf, A., Lang, H., Rus, D., & Feldman, D. (2021). Deep learning meets projective clustering. *International Conference on Learning Representations*
- (16) Maalouf, A., Jubran, I., Tukan, M., & Feldman, D. (2021). Coresets for the average case error for finite query sets. *Sensors*, 21(19), 6689
- (17) Jubran, I., Maalouf, A., & Feldman, D. (2021). Overview of accurate coresets. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, e1429
- (18) Jubran, I., Maalouf, A., Kimmel, R., & Feldman, D. (2021). Provably approximated point cloud registration. *Proceedings of the IEEE/CVF International Conference on Computer Vision*, 13269–13278
- (19) Tukan, M., Maalouf, A., & Feldman, D. (2020). Coresets for near-convex functions. *Advances in Neural Information Processing Systems*, 33
- (20) Maalouf, A., Statman, A., & Feldman, D. (2020). Tight sensitivity bounds for smaller coresets. *Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*, 2051–2061
- (21) Jubran, I., Tukan, M., Maalouf, A., & Feldman, D. (2020). Sets clustering. *International Conference on Machine Learning*, 4994–5005
- (22) Maalouf, A., Jubran, I., & Feldman, D. (2019). Fast and accurate least-mean-squares solvers. *Proceedings of the 33rd International Conference on Neural Information Processing Systems*, 8307–8318

Papers Under Review

- (1) Tukan, M., Maalouf, A., & Osadchy, M. (2023). Dataset distillation meets provable subset selection. *arXiv preprint arXiv:2305.14113*
- (2) Feldman, D., Rosman, G., Volkov, M., Maalouf, A., & Rus, D. (2022). Coresets for k-segmentation of streaming data
- (3) Maalouf, A., Jubran, I., & Feldman, D. (2021). Introduction to coresets: Approximated mean

Skills & Interests

- Software:** In general I worked (and can work) with many programming languages such as Java, Java Script, C, C++, C#, Matlab, Csh, Bash, Tesh, Tcl, etc. But my favorite is Python and its libraries (Numpy, Scipy, Pandas, Sklearn, PyTorch, Tensor-Flow).
- Languages:** Arabic (native), Hebrew (fluent), English (fluent).
- Interests:** Travelling, sports (soccer, swimming, volleyball, hiking, biking, table tennis), nature, high adrenaline attractions (zip-line, bungee jump, rappelling, plane driving, etc).