Elias Nehme

Curriculum Vitae, 17/06/2024
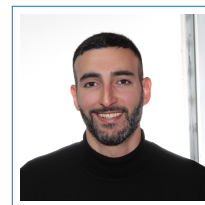
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Education

2018–2024 **Ph.D. Candidate in Electrical Engineering (Direct Track)**, *Technion - IIT*.
- *Thesis*: "Deep Computational Imaging: Optimal sensing, reconstruction, and uncertainty quantification".
- Supervised by Prof. Tomer Michaeli and Prof. Yoav Shechtman.

2011–2016 **B.Sc. in Biomedical Engineering**, *Technion - IIT*.

Professional Experience

2021–2022 **Verily (Google Life Sciences)**, *Haifa*.
Research Scientist Intern.

2017–2018 **Magentiq Eye**, *Haifa*.
Image Processing and Deep Learning Engineer.

2017–2018 **Inspiring Vision**, *Haifa*.
Software and Algorithm Developer.

2015–2016 **The Laboratory for Synthetic Biology and Bio-electronics**, *Haifa*.
Research Assistant.

2014–2015 **Hospitech Respiration & Rambam Medical Center**, *Haifa*.
Clinical Trials Assistant.

Teaching Experience

2017–2023 **Teaching Assistant**, *Technion*.
- Lab Writing: Undergraduate lab on "Diffusion Models", EE045107.
- T.A. in charge: "Statistical Methods in Image Processing", EE048954.
- T.A. in charge: "Algorithms and Applications in Computer Vision", EE046746.
- T.A. in charge: "Computational Optical Imaging", BME336547.
- T.A. in charge: "Analysis of Biological Signals", BME336208.
- Lab Instructor: Undergraduate lab on "Digital Systems", BME335002.

Fellowships, Awards, and Honors

2022-2023 **Jacobs-Qualcomm Fellowship in 3D Imaging and Reconstruction, Technion**.

2022 **Excellent Paper Award, MLIS-TCE Conference, Israel**.

2021 **VATAT Prize in Data Science, Machine Learning and Intelligent Systems, Technion**.

2020-2021 **Jacobs-Qualcomm Fellowship in 3D Imaging and Reconstruction, Technion**.

2019 **VATAT Prize in Data Science, Machine Learning and Intelligent Systems, Technion**.

2019 **Best Poster Award, Quantitative Bio-Imaging Conference, France**.

2018–2019 **Excellent TA Award, Biomedical Engineering, Technion**.

2018 **Lev-Margulis Memorial Prize, Israeli Society for Microscopy (ISM) Conference, Tel Aviv**.

2016 **Dean Excellence Award, Biomedical Engineering, Technion**.

Publications

Journal Publications

1. **N. Opatovski*, <u>E. Nehme</u>*, A. Parizat, O. Alalouf, and Y. Shechtman**, *"Depth-enhanced high throughput microscopy by compact PSF engineering"*, Nature Communications, 15(1), 4861 (2024).
   *N. Opatovski and E. Nehme contributed equally to this work.

2. **D. Xiao, R. Orange, N. Opatovski, A. Parizat, <u>E. Nehme</u>, O. Alalouf, and Y. Shechtman**, *"Large-FOV 3D localization microscopy by spatially variant point spread function generation"*, Science Advances, 10(10), eabc3656 (2024).

3. **O. Goldenberg, B. Ferdman, <u>E. Nehme</u>, Y.S. Ezra, and Y. Shechtman**, *"Learning Optimal Multicolor PSF Design for 3D Pairwise Distance Estimation"*, Intelligent Computing, 2022, 0004 (2022).

4. **T. Naor, Y. Nogin, <u>E. Nehme</u>, B. Ferdman, L.E. Weiss, O. Alalouf, and Y. Shechtman**, *"Quantifying cell-cycle-dependent chromatin dynamics during interphase by live 3D tracking"*, iScience, 25(5), 104197 (2022).

5. **A. Saguy, F. Jünger, A. Peleg, B. Ferdman, <u>E. Nehme</u>, A. Rohrbach, and Y. Shechtman**, *"DeepROCS: from speckle patterns to superior-resolved images by deep learning in rotating coherent scattering microscopy"*, Optics Express, 29(15), 23877-23887 (2021).

6. **A. Saguy, T.N. Baldering, L.E. Weiss, <u>E. Nehme</u>, C. Karathanasis, M.S. Dietz, M. Heilemann, and Y. Shechtman**, *"Automated Analysis of Fluorescence Kinetics in Single-Molecule Localization Microscopy Data Reveals Protein Stoichiometry"*, The Journal of Physical Chemistry B, 125 (22), 5716-5721 (2021).

7. **<u>E. Nehme</u>*, B. Ferdman*, L.E. Weiss, T. Naor, D. Freedman, T. Michaeli, and Y. Shechtman**, *"Learning optimal wavefront shaping for multi-channel imaging"*, IEEE Transactions on Pattern Analysis and Machine Intelligence, 43(7), 2179-2192 (2021).
   *E. Nehme and B. Ferdman contributed equally to this work.

8. **R. Orange, <u>E. Nehme</u>, L.E. Weiss, B. Ferdman, O. Alalouf, and Y. Shechtman**, *"3D printable diffractive optical elements by liquid immersion"*, Nature Communications, 12(1), 1-6 (2021).

9. **L. von Chamier, R.F. Laine, J. Jukkala, C. Spahn, D. Krentzel, <u>E. Nehme</u>, M. Lerche, S. Hernández-Pérez, P.K. Mattila, E. Karinou, S. Holden, A.C. Solak, A. Krull, T. Buchholz, M.L. Jones, L.A. Royer, C. Leterrier, Y. Shechtman, F. Jug, M. Heilemann, G. Jacquemet, and R. Henriques**, *"Democratising deep learning for microscopy with ZeroCostDL4Mic"*, Nature Communications, 12(1), 1-18 (2021).

10. **R. Gordon-Soffer, L.E. Weiss, R. Eshel, B. Ferdman, <u>E. Nehme</u>, M. Bercovici, and Y. Shechtman**, *"Microscopic scan-free surface profiling over extended axial ranges by point-spread-function engineering"*, Science Advances, 6(44), eabc0332 (2020).

11. **B. Ferdman, <u>E. Nehme</u>, L.E. Weiss, R. Orange, O. Alalouf, and Y. Shechtman**, *"VIPR: Vectorial Implementation of Phase Retrieval for fast and accurate microscopic pixel-wise pupil estimation"*, Optics Express, 28(7), 10179-10198 (2020).

12. **<u>E. Nehme</u>, D. Freedman, R. Gordon, B. Ferdman, L.E. Weiss, O. Alalouf, R. Orange, T. Michaeli, and Y. Shechtman**, *"DeepSTORM3D: dense 3D localization microscopy and PSF design by deep learning"*, Nature Methods 17(7), 734-740 (2020).

13. **N. Granik, L.E. Weiss, <u>E. Nehme</u>, M. Levin, M. Chein, E. Perlson, Y. Roichman, and Y. Shechtman**, *"Single particle diffusion characterization by deep learning"*, Biophysical Journal 117, 185-192 (2019).

14. **<u>E. Nehme</u>, L.E. Weiss, T. Michaeli, and Y. Shechtman**, *"Deep-STORM: super-resolution single-molecule microscopy by deep learning"*, Optica 5, 458-464 (2018).
   - Research highlighted in Nature Methods: R. Strack, "Deep learning advances super-resolution imaging", Nature Methods 15, 403 (2018).

Peer-reviewed Conference Proceedings

1. **O. Yair, <u>E. Nehme</u>, and T. Michaeli**, *"Uncertainty visualization via low-dimensional posterior projections"*, To appear in Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), June 17-21, (2024).

2. **<u>E. Nehme</u>, O. Yair, and T. Michaeli**, *"Uncertainty quantification via neural posterior principal components"*, Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS), December 12-14, (2023).

3. **<u>E. Nehme</u>*, B. Ferdman*, L.E. Weiss, T. Naor, D. Freedman, T. Michaeli, and Y. Shechtman**, *"Learning optimal wavefront shaping for multi-channel imaging"*, IEEE International Conference on Computational Photography (ICCP), May 23-25, (2021).
   *Selected for a Special Issue of IEEE Transactions on Pattern Analysis and Machine Intelligence.

Preprints

1. **<u>E. Nehme</u>, R. Mulayoff, and T. Michaeli**, *"Hierarchical uncertainty exploration via feedforward posterior trees"*, arXiv, 10.48550/2405.15719, (2024).

2. **G. Volpe, C. Wählby, L. Tian, M. Hecht, A. Yakimovich, K. Monakhova, L. Waller, I.F. Sbalzarini, C.A. Metzler, M. Xie, K. Zhang, I.C.D. Lenton, H. Rubinsztein-Dunlop, D. Brunner, B. Bai, A. Ozcan, D. Midtvedt, H. Wang, N. Sladoje, J. Lindblad, J.T. Smith, M. Ochoa, M. Barroso, X. Intes, T. Qiu, L. Yu, S. You, Y. Liu, M.A. Ziatdinov, S.V. Kalinin, A. Sheridan, U. Manor, <u>E. Nehme</u>, O. Goldenberg, Y. Shechtman, H.K. Moberg, C. Langhammer, B. Špačková, S. Helgadottir, B. Midtvedt, A. Argun, T. Thalheim, F. Cichos, S. Bo, L. Hubatsch, J. Pineda, C. Manzo, H. Bachimanchi, E. Selander, A. Homs-Corbera, M. Fränzl, K. de Haan, Y. Rivenson, Z. Korczak, C.B. Adiels, M. Mijalkov, D. Veréb, Y. Chang, J.B. Pereira, D. Matuszewski, G. Kylberg, I. Sintorn, J.C. Caicedo, B.A. Cimini, M.A.L. Bell, B.M. Saraiva, G. Jacquemet, R. Henriques, W. Ouyang, T. Le, E. Gómez-de-Mariscal, D. Sage, A. Muñoz-Barrutia, E.J. Lindqvist, and J. Bergman**, *"Roadmap on deep learning for microscopy"*, arXiv, 10.48550/2303.03793, (2023).

Conferences

Talks

1. **Invited Talk**, *"Visualizing reconstruction uncertainty in imaging inverse problems"*, Hebrew University of Jerusalem Vision Seminar, Jerusalem, Israel, Jun 16, 2024.

2. **Invited Talk (Virtual)**, *"Visualizing reconstruction uncertainty in imaging inverse problems"*, AstraZeneca Center for Artificial Intelligence, Cambridge, UK, Jun 14, 2024.

3. **Invited Talk**, *"Quantifying and visualizing reconstruction uncertainty for imaging"*, Artificial Intelligence for Imaging, Sant Carles de la Rapita, Tarragona, Spain, May 26-Jun 01, 2024.

4. **Invited Talk**, *"Towards intelligent microscopes with deep learned optics"*, AI for Scientific Data Analysis, Chalmers University of Technology, Gothenburg, Sweden, May 31-Jun 01, 2023.

5. **Journal Club (Intern)**, *"Learning optimal wavefront shaping for multi-channel imaging"*, Verily Research, Haifa, Israel, February 16, 2022.

6. **Paper Talk**, *"Learning optimal wavefront shaping for multi-channel imaging"*, IEEE International Conference on Computational Photography 2021, Leonardo Hotel, Haifa, Israel, May 23-25, 2021.

7. **Plenary Award Lecture**, *"DeepSTORM3D: deep learning for dense 3D localization microscopy"*, Quantitative BioImaging 2020, Mathematical Institute at the University of Oxford, Oxford, UK, January 6-9, 2020.

8. **Invited Talk**, *"Deep learning for dense single molecule localization microscopy"*, MDML Meetup, Zebra Medical, Hertzeliya, Israel, September 23, 2019.

9. **Journal Club**, *"Deep-STORM: super-resolution single-molecule microscopy by deep learning"*, Prof. Gabriela Schlau-Cohen's group, Chemistry Department, Massachusetts Institute of Technology, Boston, Massachusetts, United States of America, August 31, 2018.

10. **Plenary Award Lecture**, *"Deep-STORM: super-resolution single-molecule microscopy by deep learning"*, Israeli Society for Microscopy 2018, Dan Panorama Hotel, Tel Aviv, Israel, June 20, 2018.

Poster Presentations

1. **<u>E. Nehme</u>, O. Yair, and T. Michaeli**, *"Uncertainty quantification via neural posterior principal components"*, Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS), New Orleans, Louisiana, United States of America, Dec 15, 2023.

2. **<u>E. Nehme</u>, L.E. Weiss, D. Freedman, T. Michaeli, and Y. Shechtman**, *"Deep learning for dense single-molecule localization microscopy"*, Learning for Computational Imaging Workshop in conjunction with ICCV 2019, Seoul, South Korea, Nov 2, 2019.

3. **<u>E. Nehme</u>, D. Freedman, T. Michaeli, and Y. Shechtman**, *"DeepSTORM3D: deep learning for dense 3D localization microscopy"*, Quantitative BioImaging 2019, Rennes, France, Jan 9-12, 2019.

4. **<u>E. Nehme</u>, L.E. Weiss, T. Michaeli, and Y. Shechtman**, *"DeepSTORM: super-resolution single-molecule microscopy by deep learning"*, NANO IL, International convention center, Jerusalem, Israel, Oct 9-11, 2018.

Patents

1. **Y. Shechtman, B. Ferdman, N. Opatovski, <u>E. Nehme</u> and R. Kedem**, *"Lens system for wavefront modulation"*, WO2022259243A1, (2022).

Extracurricular Activities and Academic Service

2019-2021 **Teachers Qualification Program**, *Israel's Ministry of Education & Biomedical Engineering, Technion-IIT*.
Basics of biological signal and image processing delivered to electronics high school teachers.

2018-Present **Reviewer**, *Optics Express, Biomedical Optics Express, Optica, Nature Scientific Reports, Patterns, CVPR, and NeurIPS*.

2015 **Students Semester Representative**, *Biomedical Engineering, Technion-IIT*.

2013–2014 **Nachshon Coordinator**, *The Center of Educational Technology (CET) & Perach*.
Supervising a group of 60 tutors, each one mentoring a group of 2-3 students from peripheral high schools for the 5-unit curriculum in mathematics.