

EMAAD KHWAJA

Multimodal Generative AI Expert
San Francisco, CA

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Skills Summary

Technical: Python: pytorch, JAX, pandas, numpy; MySQL, R, Mathematica, Latex, Git, REST API

Scientific: Cell Culturing, Mouse Studies, Microscopy, Chemical Synthesis, Nanofabrication

Inter-Personal: Project Management, Collaborative Team Player, Presenting, Event Planning

Experience

Research Intern, Google

Mountain View, CA

CoreML Team, Multimodal Models Group

05/2023 – 08/2023

- Implemented architectural changes to the Imagen text-to-image model's U-Net to **improve image generation efficiency by at least 66%**
- Successfully accomplished project goals leading to publication (in preparation)

Health AI, Generalized Embeddings Group

06/2022 – 10/2022

- Implemented video vision transformer models in JAX on ultrasound imaging data to create foundation model to enable learning for downstream tasks
- Worked with program organizers to address gaps in intern onboarding and programming

Graduate Student Researcher, UC San Francisco

San Francisco, CA

Bo Huang Lab, Department of Pharmaceutical Chemistry

03/2020 – 05/2023

- Developed text-to-image models** to predict protein localization from amino acid sequences
- Developed convolutional neural networks with embedded real-world physical models to enhance visual quality via denoising of microscopy images
- Built a pipeline with biologists for fast and accurate image segmentation
- Redesigned lab website to improve outreach with prospective hires
- Created remote computational processing pipelines to enable work-from-home analysis

Optimization Analyst, Rockerbox

New York, NY

Media Sales Team

03/2018 – 08/2019

- Directed digital ad placements using big data for clients like Toyota, NFL, and Vanguard
- Effectively leveraged large-scale data to generate robust predictive models leading to **1-2x greater click through and purchase rates**
- Successfully **increased company margins by 23%** and drove \$3.1 million in revenue

Research Associate, Memorial Sloan Kettering Cancer Center

New York, NY

Jan Grimm Lab, Department of Radiochemistry

08/2016 – 08/2019

- Created scripts for group members to measure photons and efficacy of theranostic molecules
- Engineered protocol to synthesize highly structured nanoparticles for intraoperative imaging

Education

Ph.D. Bioengineering, UC Berkeley – UC San Francisco

Berkeley/San Francisco, CA

GPA: 4.00, Joint Bioengineering Graduate Program

08/2019 – 09/2023

- Graduate Certificate in Applied Data Science, UC Berkeley School of Information

M.S. Electrical Engineering & Computer Science, UC Berkeley

Berkeley, CA

GPA: 4.00

08/2022 – 05/2023

B.A. Biochemistry & Mathematics, Macaulay Honors College

New York, NY

Minor: Statistics

08/2013 – 08/2017

- Full Merit Scholarship, Graduated with Honors and Departmental Honors

Relevant Publications

Khwaja E, Song YS, Agarunov, A, Huang B. **CELL-E 2: Translating Proteins to Pictures and Back with a Bidirectional Text-to-Image Transformer**. NeurIPS 2023.

Khwaja E, Song YS, Huang B. **CELL-E: Biological Zero-Shot Text-to-Image Synthesis for Protein Localization Prediction**. Nature Res. Sq. 2023.06.02.2963881; doi:10.21203/rs.3.rs-2963881/v1

Wang Y, Pinkard H, **Khwaja E**, Zhou S, Waller L, Huang B. **Image denoising for fluorescence microscopy by self-supervised transfer learning**. Opt. Express 29, 41303-41312 (2021). doi:10.1364/OE.434191

Projects

Learning Genome Architecture Using MSA Transformers

Leveraging the multiple sequence alignment transformer architecture for genomic sequences to predict genomic operon clusters in various organisms

Physics-Based Image Denoising

Implemented a recurrent inference machine neural network model with equations dictating the statistical nature of noise in microscope images to quickly and effectively denoise images

Images of the Russian Empire: Colorizing the Prokudin-Gorskii Photo Collection

Automatically cropped and aligned high resolution 19th century black and white photos using image pyramids to produce colored recreations. Includes an edge detection algorithm from scratch.

Media Features

Google Sidelines Engineer Who Claims Its A.I. Is Sentient, The New York Times, 06/02/22

CCNY study breaks Förster resonant energy transfer (FRET) distance limit, EurekaAlert, 10/25/18
Research Newsletter, City University of New York, 02/18/17

Suffolk: Science Bowl Winners, Newsday, 03/22/13

Awards and Acknowledgements

Sigma Xi Membership

2022

Associate Member

The Scientific Research Honor Society is the international honor society of science and engineering.

Member

2022

The Erdős Institute

A multi-university collaboration focused on helping PhDs at every stage of their career.

National Science Foundation Graduate Research Fellowship

2019-2020

Honorable Mention

Highly prestigious recognition supporting students in their graduate research

American Chemical Society Award in Analytical Chemistry

2016

ACS – Division of Analytical Chemistry

Awarded for superior achievement in chemistry

Top 5 Finalist – CUNY Math Competition

2016

CUNY Institute for Software Design and Development

Ranked in the **top 5 out of 300 participants** in a series of challenging math problems

Volunteer Work and Extracurriculars

Charity Week Organizer

10/2017

Raised over **\$10,188.50 in one week** for refugees in Bangladesh and Yemen

Student Representative, Macaulay Honors College Council

10/2013 - 05/2016

Class of 2017

Represented 800 students and worked with faculty to hire two professors

Volunteer, Helping Hands for Relief and Development (Jordan)

08/2015

Distributed supplies and aid to refugees along the Syrian border

Teacher, Ronaki Ishik Primary School (Erbil, Iraq)

05/2014 - 06/2014

Created and taught English lessons to students. ages eight to thirteen

Additional Publications

Abad-Arredondo J, Garcia-Vidal FJ, Zhang Q, **Khwaja, E.** et al. **Fluorescence Triggered by Radioactive β -Decay in Optimized Hyperbolic Cavities.** Phys Rev Appl. 2020;14(2):24084. doi:10.1103/PhysRevApplied.14.024084

Rizvi W, Berisha N, Farley C, **Khwaja, E.** et al. **Distorted Phthalocyanines by Click Chemistry: Photoacoustic, Photothermal, and Surface-Enhanced Resonance Raman Studies.** Chem – A Eur J. 2019;25(64):14517-14521. doi:10.1002/chem.201903463

Deshmukh R, Biehs S-A, **Khwaja E,** Galfsky T, Agarwal GS, Menon VM. **Long-Range Resonant Energy Transfer Using Optical Topological Transitions in Metamaterials.** ACS Photonics. 2018;5(7):2737-2741. doi:10.1021/acsphotonics.8b00484

Rizvi W, **Khwaja E,** Siddiqui S, Bhupathiraju NVSDK, Drain CM. **Experimental Determination of Activation Energy of Nucleophilic Aromatic Substitution on Porphyrins.** J Chem Educ. 2018;95(1):164-168. doi:10.1021/acs.jchemed.6b00940

Shaffer TM, Harmsen S, **Khwaja E,** Kircher MF, Drain CM, Grimm J. **Stable Radiolabeling of Sulfur-Functionalized Silica Nanoparticles with Copper-64.** Nano Lett. 2016;16(9):5601-5604. doi:10.1021/acs.nanolett.6b02161

Additional Awards

Outstanding Student Leader

2017

CUNY Hunter College

Awarded for outstanding leadership in student clubs on campus

Goldberg/Revson Scholarship

2015 – 2017

Charles H. Revson Foundation

Fund awarded to students who have demonstrated academic excellence, commitment to the public good, and service to New York City

Raab Presidential Fellowship

2015

CUNY Hunter College Office of the President

Fund to support student experiences including non-paid research placements, research opportunities, and study abroad.

Wijnen Award - Excellence in Chemistry

2015

CUNY Hunter College Chemistry Department

Awarded for excellent academic research in chemistry

Horace W. Goldsmith Scholarship

2015

Horace W. Goldsmith Foundation

