Tanishq Mathew Abraham, Ph.D.

CEO of MedARC
Research Director at Stability AI

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Summary

I am the founder and CEO of MedARC. Founded in February 2023, MedARC aims to build a public community for developing state-of-the-art foundation models for medical AI research.

I recently graduated at 19 years old with a Ph.D. in Biomedical Engineering from the University of California, Davis. For the past 4 years, I was under the supervision of Dr. Richard Levenson at the UC Davis Department of Pathology and Laboratory Medicine. I was researching the application of deep learning (especially generative AI) to novel microscopy techniques for digital pathology. I have presented my work at several conferences (SPIE Photonics West, ICML workshop, BMES, etc.), published a book chapter, established various collaborations with labs around the world, and more. I have contributed to many open-source projects, including being on the founding team for DALL-E mini, being a frequent contributor to the fastai library, and lead developer of the UPIT library and DRLX library. I am also involved in various teaching initiatives, being a teaching assistant for Part 1 of the fast.ai course, and an instructor for the Part 2 of the fast.ai course.

I am currently a Research Director at Stability AI. At Stability AI, I focus on various generative and medical AI research directions, working with the variuos groups within Stability AI such as CarperAI, and I formerly served as their social media manager (Twitter). I have founded and lead a medical AI research organization called MedARC focused on training foundation models for medicine.

I have also been recognized as a child genius and a prodigy. I graduated high school at 10 years old with a 4.0 GPA. At 11 years old, I obtained 3 Associate Degrees also with a 4.0 GPA. At 14 years old, I graduated from UC Davis *summa cum laude* with a Bachelor's degree in Biomedical Engineering. For these reasons, I have been recognized on many international and national TV, radio and print news, TV and radio talk shows, reality TV shows and documentary shows, and have been a role model for young and old students around the world.

Education

University of California, Davis	Davis, CA, USA
Ph.D. degree in Biomedical Engineering	*Sept. 2018 - May 2023*
Advisor: Dr. Richard Levenson	*GPA 3.84*
University of California, Davis	Davis, CA, USA
B.S. degree in Biomedical Engineering	*Sept. 2016 - Jun. 2018*
summa cum laude	*GPA 3.94*
American River College	Sacramento, CA, USA
A.S. degrees in General Science, Mathematics & Physical Sciences, and Language Studies	*Jan. 2011 - May 2015*
Highest Honors	*GPA 4.0*

Academic Honors and Awards

[1] Top 50 Varkey Foundation/Chegg.org Global Student Prize Finalist, Sept. 2021
[2] Absolute Winner Award from Premio Internazionale Giuseppe Sciacca Foundation, Nov. 2018
[3] UC Davis University Honors Program Scholar. Sept. 2016-June 2018.
[4] UC Davis Biomedical Engineering Distinguished Innovation Award for "CardioVision: Non-Contact Heart Monitoring of Burn Patients" June 2018.

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[5] 18th UC Systemwide Bioengineering Symposium Diversity Travel Award, June 2017

[6] UC Davis Undergraduate Travel Award, April 2017

[7] Honorable Mention Award for "Whole-Body Mathematical Models of Synthetic Biosensing Liposomes" at West Coast Biological Sciences Undergraduate Research Conference, April 2017.

[8] UC Davis College of Engineering Dean's List Winter 2017 - Spring 2018 (5 quarters)

[9] UC Davis College of Agriculture and Environmental Sciences Dean's List Fall 2016 (1 quarter)

[10] UC Santa Cruz Regent Scholar Awardee (turned down to attend UC Davis), April 2016

[11] 2015 Phi Theta Kappa All-California Academic Team Award by Community College League

Scholarships

[1] Stability AI PhD Fellowship (fellowship for outstanding PhD students in AI research with open-source contributions, 2022-2023)

[2] 2018 UC Davis College of Engineering Dean's Distinguished Graduate Fellowship (2-year fellowship modeled after the NSF Graduate Research Fellowship Program)

[3] Robot Appreciation Society Scholarship (1-year scholarship awarded for both 2016 and 2017)

[4] Thomas E. Bruzzone Scholarship (UC Davis Undergraduate Scholarship 2017-2018)

[5] Richard C. and Joy Dorf Award (UC Davis Undergraduate Scholarship 2017-2018)

[6] Gail E. and Ruth M. Oliver Scholarship (UC Davis Undergraduate Scholarship 2016-2017)

[7] 2016 California Aggie Alumni Association Leadership Scholarship

Publications

[1] **Tanishq Mathew Abraham**, Paloma Casteleiro Costa, Caroline Filan, Zhe Guang, Zhaobin Zhang, Stewart Neill, Jeffrey J Olson, Richard Levenson, Francisco E Robles, "Label-and slide-free tissue histology using 3D epi-mode quantitative phase imaging and virtual H&E staining" *arXiv preprint* arXiv:2306.00548 [eess.IV] (2023).

[2] Paul S Scotti, Atmadeep Banerjee, Jimmie Goode, Stepan Shabalin, Alex Nguyen, Ethan Cohen, Aidan J Dempster, Nathalie Verlinde, Elad Yundler, David Weisberg, Kenneth A Norman, **Tanishq Mathew Abraham**, "Reconstructing the Mind's Eye: fMRI-to-Image with Contrastive Learning and Diffusion Priors" *NeurIPS 2023 (Spotlight)* arXiv:2305.18274 [cs.CV] (2023).

[3] Pierre Chambon, Christian Bluethgen, Jean-Benoit Delbrouck, Rogier Van der Sluijs, Małgorzata Połacin, Juan Manuel Zambrano Chaves, **Tanishq Mathew Abraham**, Shivanshu Purohit, Curtis P. Langlotz, Akshay Chaudhari, "RoentGen: Vision-Language Foundation Model for Chest X-ray Generation." *arXiv preprint* arXiv:2211.12737 [cs.CV] (2022).

[4] **Tanishq Mathew Abraham** and Tess Engel, Arshia Rangchi, Maxwell Fung, Maija Kiuru, Farzad Fereidouni, Richard Levenson, "FIBI (Fluorescence Imitating Brightfield Imaging) for rapid, slide-free dermatopathology," *Journal of Cutaneous Pathology* 49.12 (2022): 1060-1066.

[5] **Tanishq Abraham**, Michelle Mao, Cheemeng Tan, "Engineering approaches of smart, bio-inspired vesicles for biomedical applications," *Physical biology* 15.6 (2018): 061001.

Extended Abstracts

[1] **Tanishq Abraham**, Andrew Shaw, Daniel O'Connor, Austin Todd, Richard Levenson, "Slide-free MUSE Microscopy to H&E Histology Modality Conversion via Unpaired Image-to-Image Translation GAN Models," Computational Biology Workshop at International Conference on Machine Learning, July 2020. (peer-reviewed) Presentation, arXiv 2008.08579 [eess.IV].

Book Chapters

[B1] **Tanishq Abraham**, Austin Todd, Daniel A. Orringer, Richard Levenson. "Applications of artificial intelligence for image enhancement in pathology." In Artificial Intelligence and Deep Learning in Pathology, pp. 119-148. Elsevier, June 2020.

Poster Presentations

[P1] **Tanishq Mathew Abraham**, Richard Levenson. "A comparison of diffusion models and CycleGANs for virtual staining of slide-free microscopy images" Challenges of Deploying Generative AI Workshop at International Conference on Machine Learning, July 2023.

[P2] **Tanishq Abraham**, "UPIT: A fastai Package for Unpaired Image-to-Image Translation" April 2021. PyTorch Ecosystem Day.

[P3] **Tanishq Abraham**, Andrew Shaw, Daniel O'Connor, Austin Todd and Richard Levenson. "Slide-Free MUSE Microscopy to H&E Histology Modality Conversion with Deep Learning" October 2020. Biomedical Engineering Society Annual Meeting.

[P4] **Tanishq Abraham**, Andrew Shaw, Daniel O'Connor, Austin Todd and Richard Levenson. "Ex-vivo slide-free microscopy with H&E color-mapping via unpaired image-to-image translation" October 2020. 2nd International Symposium on Mathematical and Computational Oncology.

[P5] **Tanishq Abraham**, Cheemeng Tan. "Whole-Body Computational Design of Biomimetic Cells that Inhibit Circulating Tumor Cells" October 2018. Biomedical Engineering Society Annual Meeting.

[P6] **Tanishq Abraham**, Cheemeng Tan. "Whole-Body Mathematical Models of Synthetic Biosensing Liposomes" (with Rapid-fire) June 2017. 18th Annual UC Systemwide Bioengineering Symposium.

ORAL PRESENTATIONS

[O1] **Tanishq Abraham**, Paloma Casteleiro Costa, Caroline Filan, Francisco Robles, Richard Levenson. "Mode conversion of qOBM (quantitative oblique back-illumination microscopy) stain-free tissue images to emulate H&E histology via deep learning" Jan 2023. SPIE Photonics West.

[O2] **Tanishq Abraham**, Paloma Casteleiro Costa, Caroline Filan, Francisco Robles, Richard Levenson. "Virtual hematoxylin and eosin staining of qOBM microscopy with unsupervised deep learning" August 2022. 22nd Annual UC Systemwide Bioengineering Symposium.

[O3] **Tanishq Abraham**, Paloma Casteleiro Costa, Caroline Filan, Francisco Robles, Richard Levenson. "Mode-mapping qOBM microscopy to virtual hematoxylin and eosin (H&E) histology via deep learning" April 2022. SPIE Photonics Europe.

[O4] **Tanishq Abraham**, Andrew Shaw, Daniel O'Connor, Austin Todd, Richard Levenson. "Slide-Free MUSE Microscopy to H&E Histology Modality Conversion with Deep Learning" (Rapid-Fire) May 2020. UC Davis Biomedical Engineering Graduate Group Symposium.

[O5] **Tanishq Abraham**, Connor Dougherty, Michelle Mao, Ben Price, Sagar Shah (in alphabetical order). "CardioVision: Non-Contact Heart Monitoring of Burn Patients" June 2018. 19th UC Systemwide Bioengineering Symposium.

[O6] **Tanishq Abraham**, Connor Dougherty, Michelle Mao, Ben Price, Sagar Shah (in alphabetical order). "CardioVision: Non-Contact Heart Monitoring of Burn Patients" June 2018. UC Davis Pathology Grand Rounds.

[O7] **Tanishq Abraham**, Connor Dougherty, Michelle Mao, Ben Price, Sagar Shah (in alphabetical order). "CardioVision: Non-Contact Heart Monitoring of Burn Patients" June 2018. UC Davis Biomedical Engineering Senior Design Symposium.

[O8] **Tanishq Abraham**, Cheemeng Tan. "Whole-Body Mathematical Models of Synthetic Biosensing Liposomes: An Application for the Prevention of Metastasis" October 2017. Biomedical Engineering Society Annual Meeting.

[O9] **Tanishq Abraham**, Cheemeng Tan. "Whole-Body Mathematical Models of Synthetic Biosensing Liposomes" April 2017. West Coast Biological Sciences Undergraduate Research Conference.

[O10] **Tanishq Abraham**, Cheemeng Tan. "Whole-Body Mathematical Models of Synthetic Biosensing Liposomes" April 2017. UC Davis Undergraduate Research Conference.

TECHNICAL SKILLS

LABORATORY SKILLS:	PCR, gel electrophoresis, bacterial transformation, cell-free systems, artificial cell synthesis, microscopy, fluorescence microscopy, mathematical modeling of biological systems
COMPUTER SCIENCE SKILLS:	Deep learning (CNNs, GANs, Diffusion Models, Transformers, Large Language Models), Machine learning (Decision Trees, Random Forests, XGBoost, SVMs, Regression, etc.), Computer vision (Classification, segmentation, etc.)

Programming Proficiency

Languages:	Python, MATLAB, C++, LaTeX, HTML
Modeling and Analysis Software:	Solidworks, ImageJ, GIMP, QuPath
Libraries:	PyTorch, fastai, HuggingFace Transformers, Diffusers, Accelerate, Scikit-learn, OpenCV, NumPy, SciPy, Pandas

Other Training

Courses:	Machine Learning by Stanford University | Coursera
	Practical Deep Learning for Coders (Part 1) | fast.ai
	Deep Learning from the Foundations (Part 2) | fast.ai
Training:	UC Biomedical Engineering Entrepreneurship Academy | UC Davis

Teaching Experience

13.1 Instruction

Practical Deep Learning for Coders Part 2, 2022
fast.ai
Sept. 2022 - Feb. 2023
Preparing of Python notebooks and code for the class, recording lectures with other instructors and course contributors (led by Jeremy Howard), answering student questions, managing the course forum, and conducting research along the way.

13.2 Teaching Assistantship

Practical Deep Learning for Coders Part 1, 2022
fast.ai
April 2022 - July 2022
Answering student questions during and after lessons and managing the course forum.

BIM 1 - Introduction to Biomedical Engineering
University of California, Davis
Oct. 2020 - Dec. 2020
Lead two 3 hour-long virtual discussion sections, mentoring and grading about 60 freshman/sophomore students for their design project, gave lectures on the engineering design process and computer-aided design. Significantly contributed to the transition of the learning environment into a virtual setting due to the COVID-19 pandemic.

BIM 1 - Introduction to Biomedical Engineering
University of California, Davis
Oct. 2019 - Dec. 2019
Lead two 3 hour-long virtual discussion sections, mentoring about 50 freshman/sophomore students for two design projects, gave lectures on the engineering design process and computer-aided design. Mentored 11 teams for the design challenges. Out of the total 35 teams across all six discussion sections, one of the teams that I mentored won the course design challenge.

13.3 Undergraduates mentored

Students in the Levenson Lab:
Erika Moe, undergraduate at University of Oregon, interning from June 2021 to June 2022. She was researching nuclear segmentation for slide-free microscopy images.

Anna Weier, undergraduate at University of California, Davis, interned from Sept. 2020 to April 2021. She helped me run CycleGAN-based slide-free microscopy conversion experiments.

Senior Design Teams:
UC Davis Computer Science Senior Design Team, Jan. to June 2020 - The project was on creating a full pipeline

(from training to inference) for the conversion of MUSE images to H&E images. The students met regularly with me, presented their work to us for evaluation, as well as presented relevant papers during our weekly journal club.

John Hopkins University Biomedical Engineering Senior Design Team, Feb. to April 2020. Their project focused on applying MUSE for surgical margin assessment during Mohs surgery. I helped them with preliminary MUSE-to-H&E translation experiments.

PROFESSIONAL MEMBERSHIPS

BIOMEDICAL ENGINEERING SOCIETY	2016-2021
SPIE	2021 - present
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS	2021 - present

HONOR SOCIETY MEMBERSHIPS

PHI THETA KAPPA	2012-2015
TAU BETA PI	2018
PHI KAPPA PHI	2018
PHI BETA KAPPA	2018

SERVICE

16.1 Positions

[1] UC Davis Biomedical Engineering Student Association, Program Advising Chair, June 2021-June 2023
[2] UC Davis Biomedical Engineering Student Association Graduate Student Association Representative, June 2021-June 2022
[3] UC Davis Synthetic Biology Club, Public Relations Officer, 2016-2017
[4] Phi Theta Kappa American River College chapter, Vice President of Communications, 2014-2015
[5] American River College Physics and Astronomy Club, Co-founder and Vice President, 2012-2014

16.2 Peer Review: Journals

[1] Journal of Pathology Informatics, 2020

16.3 Peer Review: Books

[1] Approaching (Almost) Any Machine Learning Problem by Abhishek Thakur, July 2020

OPEN-SOURCE CONTRIBUTIONS

DRLX (A library for distributed training of diffusion models via reinforcement learning)	July 2023 - present
DALL·E mini (replication efforts of OpenAI's text-to-image generation models)	July 2021
UPIT (developed & maintained by me, unpaired image translation algorithms)	Aug. 2020 - present
fastai (A training framework built on top of PyTorch)	June 2019 - present

INVITED TALKS, PODCASTS, PANELS

[1] Invited guest, The Cognitive Revolution, June 2023, Part 1 Link, Part 2 Link.
[2] Invited panelist, Industry Panel, Stanford AIMI Symposium, June 2023, Link.
[3] Invited guest, Their Life and Work podcast, Feb. 2023, Link.
[4] Invited guest, UC Davis Face to Face Podcast, Aug. 2022, Link.
[5] "What are CycleGANs? (a novel deep learning tool in pathology)",
Abhishek Thakur's YouTube channel. Aug. 2020. Link.
[6] Invited speaker, Deepalaya High School Special Event, Mumbai India, Dec. 2019
[7] Invited speaker, Guest Lecture Series, VJTI Technovanza 2019, Mumbai, India, Dec. 2019
[8] "Reaching the impossible - A child's perspective", TEDxYouth@Folsom, Sacramento, CA, Aug. 2016
[9] Invited speaker, Sharjah International Children's Book Festival, Sharjah, UAE, April 2016

[10] Invited speaker, "Youth Think Tank", 7 Days of Genius, 92Y, New York City, CA, March 2014

[11] "College life begins at 7", TEDxSacramento, Sacramento CA, June 2013

[12] Panelist for SXSW 2013 Interactive Conference, Austin, TX, March 2013

Social Media and Other Communities

I am active on Twitter, mainly participating in discussions and sharing resources related to machine learning and STEM. I have amassed over 40k followers on Twitter (including luminaries in the field of machine learning like Jeremy Howard, Andrej Karpathy, Jack Clark, and more), with many people finding my content useful. Check out my account here. Additionally, I have a blog related to machine learning topics. Check it out over here.

I am also active in several online machine learning communities. I am a moderator for the fast.ai forums and one of the top 5 members of the community. Additionally, I am a moderator of the "The Machine Learning Community" Discord server with over three thousand members. Finally, I am a staff member for both CarperAI and EleutherAI. In EleutherAI, I run a highly popular diffusion model reading group.

I am also active on Kaggle, where I have received 2 silver medals and 2 bronze medals in machine learning competitions, as well as achieving Notebooks Grandmaster and Discussions Master rank. Some of the content and resources I shared have been widely used throughout the machine learning community. One of my code examples/notebooks on Kaggle was used heavily by winners of a Kaggle competition. One dataset I released on Kaggle has been used in several papers, even a Nature Machine Intelligence paper.

Extracurricular Activites

[1] UC Davis University Chorus - Winter 2019

[2] TV appearances: The Doctors Show, The Queen Latifah Show, Conan, CNN, MSNBC, Huffington Post Live, Child Genius, etc. - 2012-present

[3] San Francisco Boy Chorus (performed at 8 concerts, National Anthem for San Francisco Giants and Oakland As) - Sept. 2011 - June 2014