Ritvik **Vasan**

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Skills

General	Machine Learning, Deep Learning, Data Science, Statistical methods, Biophysics
Technical	Python, Numpy, Scipy, Pandas, R, PyTorch, Keras, Tensorflow, JAX, MATLAB, Java
Systems and Platforms	Git, AWS, Conda, Pip, PDM, Poetry, Docker, Distributed Computing

Summary

Machine learning scientist and software developer at the Allen Institute for Cell Science with 10 years of experience in computational biology. My research has featured in high-impact journals such as Nature and eLife. My expertise is in identifying and applying unique representation learning models to 3D imaging data to answer open questions posed by biologists, and providing these models as flexible and modular tools to be used by the community.

Education

University of California, San Diego
San Diego, CA

PhD in Mechanical Engineering (3.97/4.00) — *2017 - 2020*

M.S. in Mechanical Engineering (3.97/4.00) — *2015 - 2017*

BITS Pilani
Pilani, Rajasthan, India

B.S. in Mechanical Engineering (8.76/10.00) — *2011 - 2015*

Experience

Allen Institute for Cell Science
Seattle, WA

Scientist — *July 2020 - Present*

- Implemented spherical harmonics-based computational pipeline to analyse 200,000 3D images of human stem cells. Published in *Nature*
- Developed cytoDL - a flexible and modular python package for configurable 2D and 3D deep learning-based image to image transformations. Presented at *CytoData*
- Developed point cloud equivariant autoencoders for compact and interpretable representation learning of sparse 3D intracellular structures. Available on *bioRxiv*
- Developed data-driven method for graph-based inference of junctional forces from movies of ZO-1 tight junctions. Published in *Biophysical journal*.
- Led and presented work on projects in several national conferences and venues including *American Society for Cell Biology*, *Biophysical Society*, *CytoData*, *MIT*

Laboratory for computational and cellular mechanobiology, UCSD
San Diego, CA

PhD candidate — *Dec 2015 - 2020*

- Transitioned research from *bio-medical device prototyping* to *computational biophysics*.
- Published *6 peer reviewed papers in 3 years*, before most peers.
- Participated as *chair and platform speaker* in 3 international conferences including *Biophysical Society*.
- Awarded competitive *Frontiers of Innovation and Scholars Program (FISP)* fellowship and the *UCSD outstanding graduate student award* ($\sim$ 2 % acceptance rate).
- Created 1 open-source tool that has received press attention from websites like *phys.org, sciencedaily.com and jacobsschool.ucsd.edu*.
- Led collaborative teams of scientists across 4 universities.

Nano-bio imaging and devices lab, UCSD
San Diego, CA

Research assistant — *Sept - Dec 2015*

- Implemented preliminary protocols to develop *nano-bowls* for targeted drug delivery.
- Systematically analyzed for the presence of nano-bowls using a Scanning Electron Microscope (SEM).
- Briefed supervisors on my assessment of the capabilities of nano-bowl technology.

Applied physics and instrumentation lab, Indian Institute of Science
Bangalore, India

Research assistant — *July 2014 - Aug 2015*

- Designed a proof of concept of an *affordable* and *portable* cell-phone microscope for malaria diagnosis.
- Implemented machine learning algorithms for the detection of malaria parasite.
- Created a company *MuScope* and acquired seed funding worth 10000 USD.
- Selected as one of the *top innovation projects in India* for the Gandhian award by SRISTI.
- Publicized work through national newspapers and networks.

Mechanical engineering lab, Indian Institute of Science — *Bangalore, India*

Research assistant — *May - July 2014*

- Determined stiffness of MCF-7 breast cancer cells using cell aspiration techniques, atomic-force microscopy (AFM) and micro-grippers.

Publications

(* denotes equal contribution)

2024	**Interpretable representation learning for 3D multi-piece intracellular structures using point clouds** **Vasan**, Ferrante, ..., Rafelski, Theriot, Viana	*bioRxiv*
2024	**Colony context and size-dependent compensation mechanisms give rise to variations in nuclear growth trajectories** Dixon, Frick, Leveille, **Vasan***, Garrison*, Lee*, Mogre*, Morris*, Nivedita*, ..., Rafelski	*bioRxiv*
2023	**Integrated intracellular organization and its variations in human iPS cells** Viana, **Vasan***, Chen*, Knijnenburg*, Yan*,..., Rafelski	*Nature*
2022	**Mechanistic insights into actin force generation during vesicle formation from cryo-electron tomography** Serwas, Akamatsu, Moayed, Vegesna, **Vasan**, ..., Drubin	*Developmental Cell*
2021	**Biomembranes undergo complex, non-axisymmetric deformations governed by Kirchhoff–Love kinematicsand revealed by a three-dimensional computational framework** Auddya, Zhang, Gulati,**Vasan**, ..., Rudraraju	*Proceedings of the Royal Society A*
2020	**Computational Modeling of Cell Membrane Mechanics from Sub-Cellular to Tissue Length Scales** **Vasan**	*University of California, San Diego*
2020	**Applications and challenges of machine learning to enable realistic cellular simulations** **Vasan**, Rowan, Lee, Johnson,Rangamani, Holst	*Frontiers in Physics*
2020	**Branched actin filament self-organization and force generation during clathrin-mediated endocytosis** Akamatsu, **Vasan**, Serwas, Ferrin, Rangamani, Drubin	*eLife*
2019	**A mechanical model reveals that non-axisymmetric buckling lowers the energy barrier associated with membrane neck constriction** **Vasan**, Rudraraju, Akamatsu, Drubin,Garikipati, Rangamani	*Soft Matter*
2019	**DLITE uses cell-cell interface movement to better infer cell-cell forces** **Vasan**, Maleckar, Williams, Rangamani	*Biophysical Journal*
2018	**The role of traction in membrane curvature generation** Alimohamadi*, **Vasan***, Hassinger, Stachowiak, Rangamani	*Molecular Biology of the Cell*
2018	**Intracellular membrane trafficking: modeling local movements in cells** **Vasan**, Akamatsu, Schoeneberg, Rangamani	*Springer*

Conferences

2024	**Talk** Biophysical Society meeting	*Philadelphia, PA*
2023	**Poster** American Society for Cell Biology meeting	*Boston, MA*
2023	**Talk** Broad institute, MIT	*Boston, MA*
2023	**Talk** Board of advisors meeting, Allen Institute	*Seattle, WA*
2022	**Poster** American Society for Cell Biology meeting	*Washington DC*
2021	**Poster** American Society for Cell Biology meeting	*Virtual*
2020	**Talk** American Society for Cell Biology meeting	*Virtual*
2019	**Chair** Cell mechanics, mechanosensing and motility, Biophysical Society meeting	*Baltimore, MD*
2019	**Platform speaker** Biophysical Society meeting	*Baltimore, MD*
2018	**Poster** American Society for Cell Biology meeting	*San Diego, CA*
2018	**Poster** Biophysical Society meeting	*San Diego, CA*
2017	**Platform speaker** FISP symposium	*San Diego, CA*
2017	**Poster** Biophysical Society meeting	*New Orleans, LA*

Awards

2017	**Outstanding graduate student** Mechanical and Aerospace Engineering	*UCSD*
2016	**Frontiers of Innovation and Scholars Program (FISP) fellowship**	*UCSD*
2014	**Social innovation grant**	*SRISTI*
2011	**Merit scholarship** $\sim$ 1 % acceptance	*BITS Pilani*
2011	**KVPY scholarship** $\sim$ 1 % acceptance	*Indian Institute of Science*
2011	**INSPIRE scholarship** $\sim$ 1 % acceptance	*CBSE*

Activities

- **Startup competitions**: Winner, 2019 IPHatch, Hong Kong. Pitched a business plan and technical details for a startup utilizing image processing IP made available through the competition.
- **Social innovation competitions**: Winner, 2014 SRISTI grant, India. Pitched a preliminary prototype of a cellphone microscope and received funding for executing a market-viable product.
- **Graduate mentor**: Directed 4 undergraduates and 1 junior graduate student on software engineering tasks and their research.
- **Teaching assistant**: Held discussion sessions and designed assignments for various biomechanics classes and a workshop on Git, Python and UNIX.
- **Outreach**: Designed and advised research projects for high school students through outreach programs like the Center for Talented Youth (CTY) and ENLACE program for cross-border friendships between Latin America and the United States.
- **Web development**: Created 2 research-lab websites and a website at *happyhoursinbangalore.appspot.com* to return happy hour information for every bar near a given location in Bangalore.

References

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