

ARUNKUMAR KANNAN

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ABOUT ME

- [1] **Research:** My research advances medical imaging analysis through the development of novel deep learning models, with a focus on:
- **Core Methodologies:** Generative AI, Multi-modal Foundation Models, and State-Space Models applied to 3D/4D functional imaging.
 - **Learning Representations:** Building robust foundational models to capture and learn long-context spatio-temporal patterns in medical video data.
 - **Data Synthesis:** Designing and implementing novel diffusion model frameworks to generate high-fidelity synthetic data, tackling the pervasive issue of data scarcity for rare conditions.
- [2] **Skills:** State-space models, Transformer, Diffusion models, CLIP, Masked Autoencoder, Pytorch, Linux, CUDA, Python

EDUCATION

The Johns Hopkins University, United States Ph.D., Candidate Department of Electrical and Computer Engineering <u>Thesis Advisor:</u> Prof. Brian Caffo, Department of Biostatistics <u>Thesis Committee:</u> Profs. Martin A. Lindquist, Rama Chellappa, Kyran Tsapkini, Ann S. Choe	<i>August 2022 - Present</i>
University of British Columbia, Vancouver, Canada Master of Applied Science School of Biomedical Engineering (CGPA: 4.00/4.33) <u>Thesis Advisor:</u> Prof. Rafeef Garbi	<i>September 2019 - May 2022</i>

SSN College of Engineering, India Bachelor of Engineering Department of Biomedical Engineering (CGPA: 9.04/10.00, <i>Rank: 2/948</i>) <u>Thesis Advisor:</u> Prof. Geethanjali Balasubramanian	<i>July 2015 - April 2019</i>
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RESEARCH INTERESTS

Video Understanding, State-space Models (Mamba), Diffusion Models for Medical Imaging, Neuroscience, ML Explainability

INDUSTRY RESEARCH POSITIONS

AI Research Intern <i>Siemens Healthineers, Princeton, NJ</i> <u>Mentor:</u> Dr. Yanbo Zhang; <u>Manager:</u> Dr. Sasa Grbic <u>Duties:</u> Developed a Novel Controllable Diffusion Model for the generation of synthetic lung nodules in CT volumetric data for rare lung lesion detection and characterization.	<i>June 2025 - Present</i>
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PREPRINT

- [A1] Pal, B¹., Kannan, A¹., Kathirvel, R. P., OToole, A. J., Chellappa, R. (2023). *Gaussian Harmony: Attaining Fairness in Diffusion-based Face Generation Models*. arXiv preprint arXiv:2312.14976.

JOURNAL ARTICLES

- [J1] Lindquist, M. A., Smith, B. B., **Kannan, A.**, Zhao, A., Caffo, B. (2025). *Measuring the Functioning Human Brain*. Annual Review of Statistics and Its Application, 12. [Impact factor 8.7; 2025]
- [J2] **Kannan, A.**, Hodgson, A., Mulpuri, K., Garbi, R. (2021). *Leveraging voxel-wise segmentation uncertainty to improve reliability in assessment of paediatric dysplasia of the hip*. International Journal of Computer Assisted Radiology and Surgery, 16(7), 1121-1129. [Impact factor 3.421; 2021]

PEER-REVIEWED CONFERENCE PROCEEDINGS

- [C1] **Kannan, A.**, Lindquist, M., Caffo, B., (2025). *BrainMT: A Hybrid Mamba-Transformer Architecture for Modeling Long-Range Dependencies in Functional MRI Data*. [MICCAI 2025 code](#).
- [C2] **Kannan, A.**, Caffo, B., Venkataraman, A., (2024). *GAMing the Brain: Investigating the Cross-modal Relationships between Functional Connectivity and Structural Features using Generalized Additive Models*. [MICCAI Machine Learning in Clinical Neuroimaging workshop 2024](#)
- [C3] Pal, B¹., **Kannan, A**¹., Kathirvel, R. P., OToole, A. J., Chellappa, R. (2024). *GAMMA-FACE: GAussian Mixture Models Amend Diffusion Models for Bias Mitigation in Face Images*. [ECCV 2024](#)
- [C4] Sushmitha, S., Tanushree Devi, B., Mahesh, V., Geethanjali, B., **Kannan, A.**, Pavithran, P. (2021). *Virtual Reality Therapy in Prolonging Attention Spans for ADHD*. In: Rizvanov, A.A., Singh, B.K., Ganasala, P. (eds) Advances in Biomedical Engineering and Technology. Lecture Notes in Bioengineering. Springer, Singapore.
- [C5] **Kannan, A.**, Hodgson, A., Mulpuri, K., Garbi, R. (2020). *Uncertainty Estimation for Assessment of 3D US Scan Adequacy and DDH Metric Reliability*. In Uncertainty for Safe Utilization of Machine Learning in Medical Imaging, and Graphs in Biomedical Image Analysis (pp. 97-105). Springer, Cham.
- [C6] Pavithran, P. G., **Kannan, A.**, Seshadri, N. G., Singh, B. K., Mahesh, V., Geethanjali, B. (2019, March). *Index of Theta/Alpha ratio to quantify visual-spatial attention in dyslexics using Electroencephalogram*. In 2019 5th International Conference on Advanced Computing and Communication Systems (ICACCS) (pp. 417-422). IEEE.

DISSERTATIONS

- [D1] **Kannan, A.** *Uncertainty-based assessment of hip joint segmentation and 3D ultrasound scan adequacy in paediatric dysplasia measurement using deep learning*. Master of Applied Science Thesis. University of British Columbia, Vancouver, Canada, 2022.

BOOK CHAPTERS AND VOLUMES

- [B1] **Kannan, A.**, Pavithran, P. G., Bagyaraj, S. (2020). *Design and development of command prompt assist device for locked in syndrome patients*. In Smart Healthcare for Disease Diagnosis and Prevention (pp. 7-13). Academic Press.

ACADEMIC AND RESEARCH POSITIONS

- Graduate Teaching Assistant** August 2023 - Present
Johns Hopkins University
Department of Electrical and Computer Engineering
Courses: ECE 651: Random Signal Analysis, ECE 623: Medical Image Analysis, ECE 637: Foundations of Reinforcement Learning
- Graduate Research Assistant** September 2019 - February 2022
University of British Columbia
Supervisor: Prof. Rafeef Garbi
Projects: Uncertainty Estimation for Assessment of 3D US Scan Adequacy and DDH Metric Reliability, Leveraging voxel-wise segmentation uncertainty to improve reliability in assessment of paediatric dysplasia of the hip, Model

¹denotes equal contribution

Calibration Using Deep Ensembles for Enhanced Reliability of Paediatric Hip Dysplasia Assessment from 3D Ultrasound.

Graduate Teaching Assistant

University of British Columbia

Department of Electrical and Computer Engineering

Courses: Digital Signal and Image Processing, Signals and Systems

June 2020 - April 2021

AWARDS AND HONOURS

Johns Hopkins ECE Departmental Fellowship

2022-2023

Graduate Research Assistanship

2019-2022

Awarded by Prof. Rafeef Garbi to carry out master's thesis research in BiSICL lab at UBC.

International Tuition Award

2019-2021

UBC award incoming graduate students to recognize their outstanding academic achievement during the course of their undergraduate studies.

Dean's Medal of Honor

2019

Awarded by SSNCE for securing 2nd rank among 948 candidates in the biomedical engineering program for the best academic performance in the university examinations held during 2015-19.

Undergraduate Merit Scholarship

2016-2019

Awarded by SSNCE for three years under the category of exemplary and outstanding for the best academic performance in the university examinations held during 2015-19.

Smart India Hackathon Finalist

2018

Selected amongst 12 out of 200 teams all over India to participate in the finale of Smart India Hackathon under medical devices theme organized by the Ministry of India.

CONFERENCE, WORKSHOP & POSTER PRESENTATIONS

2025 BrainMT: A Hybrid Mamba-Transformer Architecture for Modeling Long-Range Dependencies in Functional MRI Data.

International Conference on Medical Image Computing and Computer-Assisted Interventions, Daejeon, South Korea

2024 GAMing the Brain: Investigating the Cross-Modal Relationships between Functional Connectivity and Structural Features using Generalized Additive Models

Statistical Methods in Imaging Conference, Indiana University, Indianapolis, IN

International Workshop on Machine Learning in Clinical Neuroimaging, Marrakech, Morocco

2021 Leveraging Voxel-wise Segmentation Uncertainty to Improve Reliability in Assessment of Paediatric Dysplasia of the Hip

Information Processing in Computer-Assisted Interventions, Munich, Germany (*Virtual*)

2020 Uncertainty Estimation for Assessment of 3D US Scan Adequacy and DDH Metric Reliability

MICCAI UNSURE workshop, Lima, Peru (*Virtual*)

PROFESSIONAL ACTIVITIES

Reviewer, MICCAI, 2025

Reviewer, MICCAI GRAIL workshop, 2025

Reviewer, MICCAI GRAIL workshop, 2024

Reviewer, MICCAI UNSURE workshop, 2021

Chair, IEEE EMBS society, SSNCE, 2018

VOLUNTARY ACTIVITIES

Volunteer, Maryland SPCA, 2024