

# ARUNKUMAR KANNAN

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## ABOUT ME

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- [1] **Research:** My research is in the area of **Generative-AI**, **Multi-modal Foundation models (FM)** and **State-Space models**. Broadly, my doctoral work lies at the intersection of (3D/4D) functional imaging, deep learning, computer vision, image processing, and image analysis. Specifically, I am enthusiastic about leveraging structured state-space sequence models (**Mamba**) to learn long context spatio-temporal representations in medical imaging-based video sequences by incorporating prior-domain knowledge using **FMs** like **BioMedCLIP**.
- [2] **Skills:** State-space models, Transformer, Diffusion models, CLIP, Unsupervised/Self-supervised learning, Pytorch, Linux, CUDA, Python

## EDUCATION

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### The Johns Hopkins University, United States

*August 2022 - Present*

Ph.D., student

Department of Electrical and Computer Engineering

Thesis Advisor: [Prof. Brian Caffo](#), Department of Biostatistics

### University of British Columbia, Vancouver, Canada

*September 2019 - May 2022*

Master of Applied Science

School of Biomedical Engineering (CGPA: 4.00/4.33)

Thesis Advisor: Prof. Rafeef Garbi

### SSN College of Engineering, India

*July 2015 - April 2019*

Bachelor of Engineering

Department of Biomedical Engineering (CGPA: 9.04/10.00, *Rank: 2/948*)

Thesis Advisor: Prof. Geethanjali Balasubramanian

## RESEARCH INTERESTS

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

## INDUSTRY RESEARCH POSITIONS

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### AI Research Intern

*June 2025 - Present*

*Siemens Healthineers, Princeton, NJ*

Duties: Development of a Generative Model for the detection and analysis of lung cancer in CT volumetric data.

## PREPRINT

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- [A1] Pal, B<sup>1</sup>., **Kannan, A<sup>1</sup>.,** 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

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- [J1] **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

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- [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, B<sup>1</sup>., **Kannan, A**<sup>1</sup>., 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

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- [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

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- [B1] Lindquist, M., Smith, B., **Kannan, A.**, Zhao, A., Caffo, B. (2024). *Measuring the Functioning Human Brain* Annual Review of Statistics and Its Application (In Press).
- [B2] **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

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

### Graduate Teaching Assistant

June 2020 - April 2021

University of British Columbia

Department of Electrical and Computer Engineering

Courses: Digital Signal and Image Processing, Signals and Systems

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<sup>1</sup>denotes equal contribution

## AWARDS AND HONOURS

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- 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

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- 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

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- Reviewer, **MICCAI**, 2025  
Reviewer, **MICCAI GRAIL workshop**, 2024  
Reviewer, **MICCAI UNSURE workshop**, 2021  
Chair, **IEEE EMBS society**, SSNCE, 2018

## VOLUNTARY ACTIVITIES

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- Volunteer, **Maryland SPCA**, 2024