# Arunkumar Kannan

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## Education

**Master of Applied Science** Fall 2019 – Present
School of Biomedical Engineering
University of British Columbia, Vancouver, Canada
Advisor: Prof. Rafeef Garbi

**Bachelor of Engineering** Fall 2015 – Spring 2019
Department of Biomedical Engineering; CGPA: 9.04/10
SSN College of Engineering (SSNCE), Anna University, India
Advisor: Assoc. Prof. Geethanjali Balasubramanian

## Experience

**Graduate Research Assistant** Sept 2019 – Present
Biomedical Signal and Image Processing Laboratory, UBC
Advisor: Prof. Rafeef Garbi, Department of Electrical and Computer Engineering

- Working on the development of AI-based techniques for automating the diagnosis and management of developmental dysplasia of the hip (DDH), specifically proposing a diagnostic framework that provides uncertainty estimate of the deep-learning based system to assist the end-user i.e., clinician in developing confidence over the predicted DDH metrics.

**Graduate Teaching Assistant** Sept 2020 – Apr 2021
University of British Columbia, Vancouver, Canada
Department of Electrical and Computer Engineering

- ELEC 421: Digital Signal and Image Processing - Fall 2020
- ELEC 221: Signals and Systems - Spring 2021

**Summer Research Intern** May 2019 – July 2019
Healthcare Technology Innovation Centre, IIT Madras, India
Advisor: Malay Shah

- Developed an automated cuff-based blood pressure measurement device using LabVIEW interface.
- Investigated quality control specifications required for an in-house developed medical device named *iQuant* - a point of care diagnostic instrument that reads quantitative test kits and provides numerical measurements including blood sugar, cholesterol level etc.

**Undergraduate Research Assistant** July 2018 – Apr 2019
SSN College of Engineering, Anna University, India
Advisor: Prof. Geethanjali Balasubramanian

- Investigated the dissemblance that prevails in cognitive processing, specifically visuospatial attention and phonological processing, of dyslexic children using electroencephalogram (EEG).
- Calculated the weightage of various Brodmann cortical areas of the brain using relative power, coherence and phase delay of different frequency bands in EEG and visualized the interdependance of the same using derived correlation matrix.

**Research Assistant** Nov 2017 – Dec 2017
National Institute of Technology, Raipur, India
Advisor: Prof. R. Periyasamy

- Developed a real-time hardware circuit to record the electroencephalogram signal of the brain and performed spectral analysis on the recorded signal using LabVIEW interface.

## Publications

- Kannan, A., Hodgson, A., Mulpuri, K. et al. Leveraging voxel-wise segmentation uncertainty to improve reliability in assessment of paediatric dysplasia of the hip . Int J CARS (2021). https://doi.org/10.1007/s11548-021-02389-y
- Sushmitha, S., B. Tanushree Devi, V. Mahesh, B. Geethanjali, K. Arun Kumar, and P. G. Pavithran. "Virtual Reality Therapy in Prolonging Attention Spans for ADHD." In Advances in Biomedical Engineering and Technology, pp. 391-400. Springer, Singapore, 2021.
- Kannan, A. and Hodgson, A. and Mulpuri, K. and Garbi, R., Uncertainty Estimation for Assessment of 3D US Scan Adequacy and DDH Metric Reliability. MICCAI Workshop on Uncertainty for Safe Utilization of Machine Learning in Medical Imaging (UNSURE). Held online (due to COVID-19 pandemic), pp. 97–105, Oct 2020.
- Kannan, A., Pavithran, P.G. and Bagyaraj, S., 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, 2020
- Pavithran, P. G., K. Arunkumar, NP Guhan Seshadri, Bikesh Kumar Singh, V. Mahesh, and B. Geethanjali. "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, 2019.

## Academic Projects

**Exploration of an Uncertainty Measure in CNNs used for Hip Dysplasia Diagnosis** Jan 2020 – Apr 2020

- Proposed an uncertainty metric called DDH metric variance to quantify the model uncertainty associated with the 3D U-Net that automatically segments ilium, acetabulum and femoral head in a 3D ultrasound scan of neonatal hip.
- Implemented Monte-Carlo dropout sampling, a Bayesian-based approach, to quantify the model uncertainty of the deep neural network.

**Real-time ECG Visualization and Interpretation using LabVIEW** Jan 2018 – May 2018

- Developed a real-time hardware circuit to measure the electrocardiogram signal of the heart using three way lead system with proper grounding.
- Furthermore, visualized the recorded signal in portable devices like mobile phone using the telemetry system in LabVIEW to send the data to a physician located elsewhere for further diagnosis.

## Relevant courses

- **Graduate courses:** Machine Learning and Data Mining, Fundamentals of Visual Computing, Advanced Machine Learning Tools for Engineers.
- **Undergraduate courses:**
  - **Mathematics and Computer science courses:** Linear Algebra and Multivariate Calculus, Ordinary Differential Equation and Complex Variable Theory, Transforms and Partial Differential Equations, Probability and Random Processes, Fundamentals of Computer Programming, Object Oriented Programming and Data Structures, Analog and Digital Communication, Computer Networks.
  - **Core courses:** Signals and Systems, Control Systems, Microprocessor and Microcontroller, Principles of Digital Signal Processing, Pattern Recognition and Neural Networks, Digital Image Processing.

## Technical Skills

**Languages**: Python, C/C++, Julia, MATLAB
**Developer Tools**: Git, VS Code, PyCharm
**Software Packages**: Pytorch, Tensorflow, LaTeX, LabVIEW, SPSS, Origin
**Environments**: Microsoft Windows, Linux

## Awards and Honors

**2019** Awarded **UBC International Tuition Award** consecutively for two academic years: 2019-20 and 2020-21.
**2019** Awarded **Graduate Research Assistantship** from Prof. Rafeef Garbi to carry out the applied science master's research at UBC.
**2019** Awarded **Medal of Honor** from SSNCE for having secured the second rank among 948 candidates who graduated in biomedical engineering program based on performance in all the University examinations held during 2015-19.
**2018** Received **Undergraduate Merit Scholarship** from SSNCE for three years under the category of exemplary and outstanding for the academic excellence carried out in the university examinations held during 2015-19.
**2018** Selected amongst 12 out of 200 teams all over India to participate in the Grand Finale of **Smart India Hackathon** under medical devices theme organized by the Ministry of India.
**2017** Received **Undergraduate Research Grant**(INR 25,000) from SSNCE to design and develop a command prompt assist device for locked-in syndrome patients.