Don Kurian Dennis

t-dodenn@microsoft.com | donkdennis@gmail.com
Webpage : www.dkdennis.xyz
Github : www.github.com/metastableB

Research Fellow, Machine Learning & Optimization Group
Microsoft Research India
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri

Research Interests

Primary: Theoretical and Applied Aspects of Resource/Systems Aware Machine Learning
Others: Optimization, Interpretable and Robust ML, Machine Perception, Robotics, Intelligent Devices
Scalable Software and Systems for ML

Education

Indian Institute of Technology Patna *India*
Bachelor of Technology, Computer Science and Engineering *July '13 - May '17*

Publications

Multiple Instance Learning for Sequential Data Classification on Resource Constrained Devices
Don Kurian Dennis, Chirag Pabbaraju, Harsha Simhadri, Prateek Jain
In *Advances in Neural Information Processing Systems (NIPS), 2018.* [Link]

GesturePod: Programmable Gesture Recognition for Augmenting Assistive Devices
Shishir Patil, **Don Kurian Dennis**, Chirag Pabbaraju, Harsha Simhadri, Manik Varma, Prateek Jain
In submission at *ACM Conference on Human Factors in Computing Systems (CHI), 2019.* [Link]

Single Cycle RISC-V Micro Architecture Processor and its FPGA Prototype
Don Kurian Dennis, Ayushi Priyam, Sukhpreet Virk, Sajal Agrawal, Tanuj, Arijit Mondal, Kailash Ray
International Symposium on Embedded Computing and System Design (ISED), 2017. [Link]

Workshop Presentations

EdgeML: Edge of Machine Learning - Demonstration of Low resource Keyword Spotting
Don Kurian Dennis, Harsha Simhadri, Prateek Jain
Workshop on Machine Learning on the Phone and other Consumer Devices (at NIPS 2018).

Talk-Bot: Federated Human Detection for Collaborative Multi-Angle Videography
Don Kurian Dennis, Harshit Singh, Karan Jakhar, Prashant Baghel
Demonstration at *International Symposium on Embedded Computing and System Design (ISED), 2016.*
★ Runner-up, ISED Grand Challenge.

Research Experience

Faster Recurrent Networks and Convolutional Networks
Advisors: Dr. Prateek Jain & Prof. Venkatesh Saligrama *Ongoing,* ***Microsoft Research***

Exploring feed-forward approximations and rolling predictions for efficient RNN inference. Working on adapting these and other techniques like *tree RNNs* to computer vision techniques to enable object detection on resource constrained devices. Inspired by recent theoretical advances in feed-forward approximations for recurrent networks.

Multiple Instance Learning For Fast and Accurate Sequential Data Classification [Preprint]
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri *Jan - May '18,* ***Microsoft Research***

Developed a multiple-instance-learning based algorithm, EMI-RNN, that recovers the distinguishing signature of minimum length for each class in time series classification. Smaller signatures result in lower computational costs and effective use of model capacity thereby improving performance while reducing compute by up to 72x. For nice data, showed linear convergence to global optimum in the number of non-noise samples in a non-homogeneous setting.

★ Accepted at NIPS '18

Keyword Spotting in Low Resource Settings
Advisors: Dr. Prateek Jain & Dr. Harsha Simhadri *Nov '17 - Sep '18,* ***Microsoft Research***

Developed a small, fast and accurate classifier based on LSTM and ProtoNN to enable real-time keyword spotting on Raspberry Pi3. Developed EMI-RNN to make it possible on even smaller devices (Raspberry Pi0, MXChip).

★ Demonstration part of NIPS '18.

Machine Learning Based Gesture Recognition on Resource Constrained Devices [Preprint]

Advisors: Dr. Prateek Jain, Dr. Harsha Simhadri & Dr. Manik Varma *July - Dec, '17,* ***Microsoft Research***

Developed an efficient machine learning pipeline to enable *GesturePod*, a low resource microcontroller based device, to perform robust, low-latency gesture recognition. The ProtoNN algorithm powered prediction pipeline along with communication and storage stack works under 32kB RAM on a 48MHz processor.

★ In submission, CHI '19 & Microsoft's demonstration at NIPS '18

Talk-Bot: Federated Human Detection for Collaborative Multi-angle Videography [Prototype]

Advisors: Dr. Arijit Mondal & Dr. Jimson Mathew *Oct - Dec '17,* ***IIT Patna***

Developed a cluster of Raspberry Pi3s with a computer vision stack that collaborate with each other in real time to track a presenter so as to provide a multi-angle video stream to be used for cost efficient live streaming of talks.

★ Runner up at Grand Challenge, ISED '16

Nagging Naagin: The Q-Learning Snake [Demo, GitHub & Report]

Advisor: Dr. Arijit Mondal *Feb - April '17,* ***IIT Patna***

Taught an agent to play the classic game *Snake* through reinforcement learning. Created a custom version of the game to allow for a multi-bandit formulation (snake, adversarial food placement). Implemented and analyzed various search and RL algorithms — reflex agents, min-max and expectimax trees, Q-learning and approximate Q-learning with DQN.

RISC-V Micro-architecture Processor for Embedded Devices [GitHub & Publication]

Advisor: Dr. Arijit Mondal *Thesis project,* ***IIT Patna***

Developed a RISC-V based single cycle micro architecture processor optimized for low-cost embedded devices, a bare bones simulator and an FPGA prototype. Additionally wrote a custom assembler-linker-loader tool chain to run native programs on the prototype.

★ Published at ISED '17

Work Experience

Microsoft Research Lab India

Advisor: Dr. Prateek Jain & Dr. Harsha Simhadri ***Since July '17, Research Fellowship***

Working on bringing machine learning to severely resource constrained edge and end point devices (IoT devices, embedded systems, etc). Research involves designing new novel theoretical frameworks and algorithmic tools to for such settings as well as implementing these algorithms on concrete real-world systems.

Center for Smart Systems, SUTD/NUS Singapore [Report]

Advisors: Dr. Vishram Mishra & Prof. Lim H Beng ***Summer Internship '16***

Developed a Universal IoT Gateway - a gateway that can interact with any IoT device, regardless of its manufacturer or communication protocol (BLE, Bluetooth, WiFi or ZigBee). Works on an ontology based kernel that understands device specific properties and communication atoms. Protocol agnostic communication allows the device to double as a disaster resilient communication pathway - a mesh network at the MAC layer.

★ Currently being commercialized by ST Engineering

Indraprastha Institute of Information Technology (IIIT), Delhi [GitHub & Report]

Advisor: Dr. Debajyoti Bera ***Summer Internship '15***

Explored a new Breadth First Search algorithm with multi-point initialization for efficiency on the distributed map-reduce framework. Worked on *ear-decomposition* algorithms on Map-Reduce.

Google Summer of Code '15 [GitHub]

Advisors: David Anders & Tom King, Intel ***Summer Internship '15***

Developed the first complete simulation of the Harwell WITCH, a dekatron based computer used at the Atomic Energy Research Establishment, Oxfordshire during early 1950s. Worked with the very few details of its working that had survived and was declassified recently.

★ Helped win £50,000 funding.

Open Source Contributions

EdgeML: Machine Learning for Edge and End-Point Devices [GitHub]

Open Source ***Microsoft Research***

Core developer of EdgeML, Microsoft Research India's machine learning library for edge and end-point devices. Developed ProtoNN and EMI-RNN for EdgeML's Tensorflow submodule. Maintainer of the python codebase.

★ Approx. 1000 unique clones

Mixxx: Open Source DJ Mixing Software [GitHub]

Open Source

Worked on improving various aspects of the Auto-DJ feature. My improvements released as part of Mixxx 1.12.

Entrepreneurial Experience

ChironX [Web]

Research Consultant

ChironX is an early-stage start-up working on retinal medical image analysis. Helped build the core differential diagnosis engine based on semi-supervised knowledge graphs, and the core image analysis engine. Was involved in every step of the pipeline from data collection to machine learning to productization and subsequent sales. Was involved in designing product road-maps, clinical trials and research road-maps.

Weave

Co-founder ,

Co-founded a start-up called Weave, that had a nice product on human body visualizations and virtual trial rooms for fashion e-commerce for marginalized weavers of India. Secured a few clients, and garnered interest from investors but could not crack product-market fit or unit economics. Realized that fundamental flaws in strategies were overlooked. We had made the classic mistake of running after products without going through customer development.

Entrepreneurship Club, IIT Patna [Web]

Coordinator

Was coordinator of IIT Patna's Entrepreneurship Club for the 2015-2016 term. As part of E-Club, was responsible for encouraging and supporting entrepreneurial spirit in campus, hosting well known entrepreneurs for talks and interaction sections, organizing workshops on various relevant topics like patent filing, attracting investors etc.

★ Awarded Certificate of Leadership by the National Entrepreneurs Network of India.

Positions of Responsibility

2017	Mentor, Machine Learning Summer School	Microsoft Research
2015-16	Coordinator, NJACK, (Computer Science Club)	IIT Patna
2015-16	Instructor, Lecture Series on Operating Systems, NJACK (Computer Science Club)	IIT Patna
2015-16	Coordinator, Entrepreneurship Club	IIT Patna
2014-15	Sub-coordinator, Anwesha '15, IIT Patna's Annual Techno-cultural Fest	IIT Patna

References

Prateek Jain
Senior Researcher
Microsoft Research India
prajain@microsoft.com

Harsha Vardhan Simhadri
Researcher
Microsoft Research India
harshasi@microsoft.com

Arijit Mondal
Assistant Professor
Indian Institute of Technology (IIT), Patna
arijit@iitp.ac.in

Vishram Mishra
CEO & Co-founder
MicroSec
vishram1@e.ntu.edu.sg