Nitthilan Kannappan Jayakodi

Curriculum Vitae

School of Electrical Engineering and Computer science
Washington state University
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Professional Summary

- Pursuing PhD in AI/ML for Video/Image/3D Graphics (GCN/CNN). Interested in image and video based motion capture using pose based estimation (SMPLX, FrankMocap, SMPLify-X), clothing and hair 3D model representation using Implicit Neural Representation (NeRF, NSVF, Neural Body) and Deep generative models (GAN, VQVAE) .

- 12 years of product development experience with wide exposure in building end to end systems from embedded to web technologies.

- Passionate about developing optimized algorithms and exploring different domains. Developed video applications for conferencing, broadcast, and storage. Worked on ME/RC for H264/MPEG and developed plugin/webRTC/Html5 based video endpoints

Current Focus Area: AI in Animation

- Extracting facial pose and full body motion capture (dance steps, sport stances, exercise and fitness poses) data from monocular video (YouTube, TikTok) using SMPLX prior (FrankMocap, SMPLify-X, VIBE)

- Controllable cloth, hair attribute and facial mocap of dynamic humans using SMPLX anchored latent codes (NeuralBody, FrankMocap, HumanParser)

- Accelerating learning of the 3D Neural Scene representation using smaller neural nets and latent representation at a voxel level [NeRF, NSVF, KiloNeRF].

PhD Research Summary

My PhD research is at the intersection of Machine Learning (ML) and Computing Systems (Sys). The overarching theme of my research is to bridge these two areas. Specifically, I'm working towards the vision of *Edge AI* to efficiently deploy AI solutions for emerging applications (e.g., robotics, self-driving cars, augmented/virtual reality, and smart health) on edge platforms that are constrained by resources (power, compute, and memory).

- Developed a novel hardware-aware design and optimization framework to trade-off power, performance, and accuracy for performing inference using deep neural networks.

- Studied effective instantiations of this framework for different applications: CNN for image classification, GCN for 3D computer vision, and GAN for image manipulation tasks.

- Published papers at top-tier venues including three journal papers (ACM/IEEE Transactions on CAD and Embedded Computing Systems) and four conference papers (AAAI, DAC, DATE, ICCAD). One journal paper is under review at Journal of Artificial Intelligence Research.

Professional Appointments (Full Project List)

Research Assistant, Washington State University, EECS   Aug 2017 – current

Deep Learning Research Scientist Intern,
Ampere Computing(OnSpecta acquired),   July - Aug 2021

Senior Staff Engg. (Architect - Individual Contributor)
Polycom R&D, India   May 2012 - Jun 2017

Lead and Senior Engineer, Media Processing (Led small team of 3-4 people)
Ittiam Systems, India   Oct 2009 - Apr 2012

Senior Design/Dev. Engineer, Product R & D Engineering
Tata Elxsi, India   Oct 2004 - Apr 2009

Teaching Assistant, Washington State University, EECS   Aug 2018 – May 2019
CptS 437: Introduction to Machine Learning / CptS 315: Introduction to Data Mining

EDUCATION

Washington State University, Pullman, WA   Fall 2017 –
Doctor of Philosophy in Electrical and Computer Engineering (GPA 3.95)
Advisor: Prof. Jana Doppa
Research Topic: *Towards Edge AI: A Hardware-Aware Design and Optimization Framework to Efficiently Deploy Deep Neural Networks on Edge Platforms*

Anna University College of Engineering, Guindy, Chennai, India   2000 – 2004
Bachelor of Engineering, ECE Department, 8.9 CGPA *First class with distinction*

DAV, Mogappair, Chennai, India.   1998 – 2000
12th and 10th standard: 92.75% and 88%

HIGHLY-REFEREED JOURNAL AND CONFERENCE PUBLICATIONS

1. **Nitthilan Kannappan Jayakodi**, Janardhan Rao Doppa **A General Hardware and Software Co-Design Framework for Energy-Efficient Edge AI** *Proceedings of 40th IEEE/ACM International Conference On Computer Aided Design (ICCAD), 2021.*

2. Shubhomoy Das, Md Rakibul Islam, **Nitthilan Kannappan Jayakodi**, and Janardhan Rao Doppa **Active Anomaly Detection via Ensembles: Insights, Algorithms, and Interpretability.** *Journal of Artificial Intelligence Research (JAIR), 2020.* Under Review.

3. Syrine Belakaria, Aryan Deshwal, **Nitthilan Kannappan Jayakodi**, and Janardhan Rao Doppa. **Uncertainty-Aware Search Framework for Multi-Objective Bayesian Optimization.** *Proceedings of AAAI Conference on Artificial Intelligence (AAAI), 2020.* Acceptance rate: 20.6%.

4. **Nitthilan Kannappan Jayakodi**, Janardhan Rao Doppa, and Partha Pratim Pande. **SETGAN: Scale and Energy Trade-off GANs for Image Applications on Mobile Platforms.** *Proceedings of 39th IEEE/ACM International Conference On Computer Aided Design (ICCAD), 2020.* Acceptance rate: 23.9%

5. **Nitthilan Kannappan Jayakodi**, Janardhan Rao Doppa, and Partha Pratim Pande **PETNet: Polycount and Energy Trade-off DeepNetworks for Producing 3D Objects from Images.** Proceedings of *Proceedings of IEEE/ACM 57th Design Automation Conference (DAC), 2020.* Acceptance rate: 21%

6. **Nitthilan Kannappan Jayakodi**, Syrine Belakaria, Aryan Deshwal, and Janardhan Rao Doppa. **Design and Optimization of Energy and Accuracy Trade-Off Networks for Mobile Platforms via Pretrained Deep Models** *ACM Transactions on Embedded Computing Systems (TECS),19(1): 4:1-4:24, 2020.*

7. Biresh Kumar Joardar, **Nitthilan Kannappan Jayakodi**, Janardhan Rao Doppa, Partha Pratim Pande, Hai (Helen) Li, and Krishnendu Chakrabarty. **GRAMARCH: A GPU-ReRAM based Heterogeneous Architecture for Neural Image Segmentation.** *Proceedings of 23rd IEEE/ACM Design, Automation and Test in Europe (DATE) Conference, 2020.* Acceptance rate: 23%. Nominated for Best Paper Award

8. Aryan Deshwal, **Nitthilan Kannappan Jayakodi**, Biresh Kumar Joardar, Janardhan Rao Doppa, and Partha Pratim Pande. **MOOS: A Multi-Objective Design Space Exploration and Optimization Framework for NoC enabled Manycore Systems.** *ACM Transactions on Embedded Computing Systems (TECS), 18(5s): 77:1-77:23, 2019.*

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9. **Nitthilan Kannappan Jayakodi**, Anwesha Chatterjee, Wonje Choi, Janardhan Rao Doppa, and Partha Pratim Pande. **Trading-off Accuracy and Energy of Deep Inference on Embedded Systems: A Co-Design Approach** *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), 37(11): 2881-2893, 2018.*

Grant Proposals

1. Jana Doppa (PI), Umit Ogras, and Partha Pande. *Small: Dynamic Resource Management in Heterogeneous Mobile SoCs: Novel Algorithms and Efficient Deployment of Emerging Applications.* National Science Foundation (NSF), Core Program. $500K (8/2020–8/2023). Pending.
   - My research work on design and optimization framework for EdgeAI contributed to half of this proposal.

Patents

1. U.S. Provisional Patent Application filed on August, 2020, entitled, **Heterogeneous GPU-RERAM Architecture for Neural Networks,** Biresh Kumar Joardar, **Nitthilan Kannappan Jayakodi**, Janardhan Rao Doppa, Partha Pratim Pande.

Products @ Polycom

1. **Video Conferencing plugin** for chrome 64 bit using PPAPI

2. **RTP, RDP and HTML5 based Content Collaboration** between MCU, Lync and Browser endpoints

3. Automation Platform for bringing up Infrastructure for **Video as a service on VMWare**

4. **Platform Director:** Life cycle management of virtual instances on VMWare using viJava

Products @ ITTIAM

1. Mpeg2 (MP@HL) HD(1080i@30fps) **Encoder/Transcoder for Broadcast** on Netra (IVAHD Accel)

2. MPEG4 Simple Profile (SP) HD(720p@30fps) **Encoder for Smart Phones** on OMAP34xx (Arm+DSP+IVA)

3. Mpeg4 SP D1 (480p@30fps) **Encoder for Portable Media Player and Recorder** on OMAP3430.

Skills

1. DL Frameworks: PyTorch, Keras, Caffe, TensorFlow, Numpy

2. C, C++, Java, Javascript, Torch, Lua, Python, Unix

3. MPEG2, MPEG4, H264/5, H263, SVC, RTP, RTCP, RTSP, HLS, Ffmpeg, Gstreamer

4. Web Interface: WebRTC, Socketio, REST, MVC , Frontend (Angularjs, Html5, Threejs, Canvas), Backend (Nodejs, Spring, Apache)

5. OpenCV, Android (libGDX, phonegap, ionic)

6. Database: nosql, mongo, mongoose, postgres,

7. Embedded: OMAP3430 (TI), IVA HD[OMAP4, Netra] (TI), ARM*, ADSP 219x, INTEL MMX/SSE/SSE2

Awards and Honors

Richard Newton Young Fellowship, Special Interest Group on Design Automation	2020
Nominated for Best Paper Award, DATE Conference	2020
Selected to Present at DAC PhD Forum, Design Automation Conference (DAC)	2020
Three-Minute VCEA Thesis Competition, Runner-Up, WSU	2020
Harold and Diana Frank Electrical Engineering Fellowship, WSU (Thrice)	2018 - 2020

Crimson Code Hackathon, Runner-Up, WSU   2018

Suksdorf Fellowship, WSU (Thrice)   2017-2019

I-Corps, WSU Innovation Corps program participant   2019

WESKA, WSU Entrepreneurship program participant   2019

CEO Award, a Polycom worldwide recognition for outstanding technical contribution   2016

Member of Technical Staff Recognition for technical leadership at Ittiam Systems   2012

164th rank of 100000 students in Tamil Nadu Professional Courses Entrance Examination, India.

Top 0.1% across India in Mathematics in 10th Standard

PROJECTS @ ITTIAM , TATA ELXSI AND UNDER-GRADUATION:

1. Mpeg4 Advanced Simple Profile HD Decoder on OMAP3430

2. Mpeg4, H.263 and Mpeg2 Encoders for catalogue products on C64x+ DSP

3. Handling 3:2 pulldown by reducing frame rate and generation of Timestamp information

4. Migrating the mpeg4 ME optimizations to MPEG2 non-accelerated workspace

5. Adding MV cost for Motion Estimation [MPEG4 non-accelerated]

6. H263 Encoder and its extensions D1 on C64x+ DSP

7. Added XDM 1.0 API support for Mpeg4 non accelerated version

8. Optimization of MPEG4 non accelerated encoder

9. 'N' mb level optimization of core loop Difference+DCT+Q+IQ+IDCT.

10. Study of SD H.264 Scalable Video Codec on SCP

11. Real Time HD (High Definition) MPEG2 Video Encoder on Multiple SCP (S5) Processors

12. Real Time HD H.264 Video Encoder On Multiple SCP (S5) Processors

13. H.264 Encoder modules development

14. Real Time Preview of HD bit streams on PC

15. Study on video transcoding of HD MPEG2 bit streams to SD (Standard Definition) bit streams

16. Visualization of White Matter Fiber Tract from DT-MR (Diffusion Tensor Magnetic Resonance) Image.

17. Micro-Controller based Personal Data Assistant using MC89C51

PROFESSIONAL AND OUTREACH ACTIVITIES

1. Conference and Journal Reviewer for IJCAI-2019, AAAI-2019, ESWEEK-2019, DAC-2020, AAAI-2020, IEEE TCAD 2019, 2020, ACM TODAES 2019, 2020, ACM TECS 2019

2. Volunteer for ICML 2019, Embedded Systems Week 2018

ONLINE COURSES

1. Deep Learning, Oxford. Nando de Freitas (youtube)

2. Heterogeneous Parallel Programming , University of Illinois Urbana-Champaign (98.6%)

3. Introduction To Finance , University of Michigan (100%)

4. CS184.1x: Foundation of Computer Graphics, UCB

5. Introduction to Artificial Intelligence, Stanford University (91.9%)