

Saad Rasheed Abbasi | Curriculum Vitae

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My technical expertise lies in developing algorithms for automatic discovery of efficient neural network models. In particular, I research and develop techniques to **automatically discover efficient hardware-specific neural network architectures**. I previously worked professionally as an embedded hardware/software engineer and transitioned to developing machine-vision based inspection systems. I'm now pursuing a Ph.D. in Deep Learning with a focus on **neural architecture search** and **latency prediction**.

Key skills:

- Leveraging **Neural Architecture Search** to discover hardware-specific optimal neural networks.
- Leveraging **domain adaptation & meta-learning** for neural network **latency prediction**.
- Deploying DL models on a wide variety of devices (ARM, Embedded GPUs, Intel) with **ONNX & OpenVINO**.
- Developing **automated workflows for DL** model construction, training, evaluation and deployment.
- Developing **embedded system software** using **C, C++, Assembly** for Atmel, Microchip and ARM microcontrollers.
- Significant experience in **C, C++ (embedded development), Python (machine learning) and MATLAB (laser imaging reconstruction)**
- FPGA (Altera), CPLD (Altera), Microcontroller (Atmel, Microchip & ARM) based **embedded hardware design/systems design**.
- Significant experience in **end to end electronics manufacturing** (from concept to deployment, including component sourcing, supplier management, PCB verification)
- Multi-layer PCB layout (significant experience in **laying out 200+ components board**)
- Excellent competence in using **PyTorch, Tensorflow, Linux, Altium Designer and Git**.

RESEARCH EXPERIENCE:

Conferences:

- **S. Abbasi**, A. Wong, J Shafiee "*MAPLE: Microprocessor A Priori for Latency Estimation*" New In ML workshop at NeurIPS 2021 (Presented virtually)
- **S. Abbasi**, M. Famouri, J. Shafiee, A. Wong "*OutlierNets: Highly Compact Deep Autoencoder Network Architectures for On-Device Acoustic Anomaly Detection*" Embedded Vision Workshop, June 25th 2021 (Presented virtually)
- A. MacLean, **S. Abbasi**, A. Ebadi, A. Zhao, M. Pavlova, H. Gunraj, P. Xi, S. Kohli, A. Wong "*COVID-Net US: A Tailored, Highly Efficient, Self-attention Deep Convolutional Neural Network Design for Detection of COVID-19 Patient Cases from Point-of-Care Ultrasound Imaging*", Domain Adaptation and Representation Transfer, and Affordable Healthcare and AI for Resource Diverse Global Health, 2021
- **S. Abbasi**, J. Shafiee, E. Chan, A. Wong "*Does Form Follow Function? An Empirical Exploration of the Impact of Deep Neural Network Architecture Design on Hardware-specific Acceleration*" tinyML Research Symposium, Burlingame, USA. March 2021 (Presented virtually)
- **S. Abbasi**, M. Le, B. Sonier, D. Dinakaran, G. Bigras, K. Bell, J. R. Mackey & P.H. Reza "*All-optical Reflection-mode Microscopic Histology of Unstained Human Tissues*" OSA Biomedical Optics, Fort Lauderdale, Florida. April 2020 (Talk, presented via Zoom) **Best Student Paper, Optical Society of America's Biophotonics Congress 2020**
- **S. Abbasi**, K. Bell, B.R. Ecclestone, P.H. Reza. "*Real-Time and 3D Photoacoustic Remote Sensing*" SPIE Photonics West, San Francisco, USA. 2020
- **S. Abbasi**, D. Dinakaran, G. Bigras, K. Bell, J. R. Mackey & P.H. Reza "*All-optical Reflection-mode Microscopic Histology of Unstained Human Tissues*" SPIE Photonics West, San Francisco, USA. February 2020 (Talk)
- **S. Abbasi**, K. Bell, P.H. Reza, "*Towards Non-Contact Microscopic Histology of Unstained Human Tissues*" World Molecular Imaging Congress, Montreal, Canada. September 2019 (Talk)
- **S. Abbasi**, K. Bell, B.R. Ecclestone, P.H. Reza. "*Photoacoustic Remote Sensing*" Celebratory Waterloo-Rochester Photonics Symposium, University of Waterloo, Canada. July 2019 (Poster)

Journal Publications:

- **S. Abbasi**, M. Famouri, J. Shafiee, A. Wong "OutlierNets: Highly Compact Deep Autoencoder Network Architectures for On-Device Acoustic Anomaly Detection." *Sensors* (2021): 21.
- H. Aboutalebi, **S. Abbasi**, J. Shafiee, A. Wong "COVID-Net CT-S: 3D Convolutional Neural Network Architectures for COVID-19 Severity Assessment using Chest CT Images", ICLR 2021
- **S. Abbasi**, M. Le, B. Sonier, D. Dinakaran, G. Bigras, K. Bell, J. R. Mackey & P.H. Reza, "All-optical Reflection-mode Microscopic Histology of Unstained Human Tissues." *Scientific reports* 9.1 (2019): 1-11. **Best Student Paper, Optical Society of America's Biophotonics Congress 2020**
- **S. Abbasi**, M. Le, B. Sonier, D. Dinakaran, G. Bigras, K. Bell, J. R. Mackey & P.H. Reza, "Chromophore selective multi-wavelength photoacoustic remote sensing of unstained human tissues." *Biomedical Optics Express* 10.11 (2019): 5461-5469.
- **S. Abbasi**, K. Bell, P.H. Reza, "Rapid High-Resolution Mosaic Acquisition for Photoacoustic Remote Sensing" *Sensors* 2020, 20(4), 1027;
- **S. Abbasi**, D. Dinakaran, G. Bigras, K. Bell, J. R. Mackey & P.H. Reza "All-optical Label-free Human Breast Tissue Block Histology using Photoacoustic Remote Sensing" *Optics Letters* 2020, 45.17 (2020): 4770-4773.
- **S. Abbasi**, K. Bell, B.R. Ecclestone, P.H. Reza. "Live feedback and 3D photoacoustic remote sensing". *Quant Imaging Med Surg* 2020. doi: 10.21037/qims-20-758
- K. Bell, **S. Abbasi**, D. Dinakaran, G. Bigras, Frank van Landeghem, J. R. Mackey & P.H. Reza, "Reflection-mode virtual histology using photoacoustic remote sensing microscopy" *Scientific reports* 10.1 (2020): 1-13.

Patents

- P.H. Reza, Z. Hosseinaee, B. Kevan, **S. Abbasi**, B. Ecclestone "PARS imaging methods", *US Patent App.* 11/122,978, 2021

Media Coverage:

- "UW researchers develop imaging tech that could 'revolutionize' cancer surgery" CTV News. Available at: <https://kitchener.ctvnews.ca/uw-researchers-develop-imaging-tech-that-could-revolutionize-cancer-surgery-1.4613166>
- "New imaging technology could 'revolutionize' cancer surgery" *Waterloo News*. Available at: <https://uwaterloo.ca/news/news/new-imaging-technology-could-revolutionize-cancer-surgery>

GRANTS & AWARDS:

- 2018-2020 – MITACS accelerate fellowship
- 2018-2020 – University of Waterloo International Master's Student Award
- 2019 – University of Waterloo Graduate Scholarship
- 2011 – Farnell Engineering Prize for Best Hardware Project
- 2011 – IET Prize for Best Performance in Electrical and Electronics Group
- 2008 – BAE Systems Prize for Best Performance in Signals & Systems

PROFESSIONAL EXPERIENCE:

Key skills:

- Developing **Machine Vision** based **industrial inspection systems for automotive wiring harness quality assessment** (see key projects).
- Developing **laser based optical systems for imaging** - including optical design, beam cleaning, beam alignment, photodetection, optical scanning, stage scanning, building free-space and optical based systems
- Significant experience in **Embedded Deep Learning** (via Neural Architecture Search, Latency Estimation)
- Developing **embedded system software** using **C, C++, Assembly** for Atmel, Microchip and ARM microcontrollers.
- Significant experience in **C, C++ (embedded development), Python (machine learning) and MATLAB (laser imaging reconstruction)**
- FPGA (Altera), CPLD (Altera), Microcontroller (Atmel, Microchip & ARM) based **embedded hardware design / systems design**.
- Significant experience in **end to end electronics manufacturing** (from concept to deployment, including component sourcing, supplier management, PCB verification)
- Multi-layer PCB layout (significant experience in **laying out 200+ components board**)
- **Mixed Signal and Digital Circuit Design**

- Excellent competence in using **Altium Designer, OpenCV, PyTorch, Quartus II, Git and MATLAB.**

Electronics Design Engineer – Ayenbee Ltd. (2011 – 2018)

Key Projects:

- Developed an **Automotive Fuse Arrangement Inspection System**. Utilized **HoG** for digit description and **SVM** to classify the fuse ratings. Text was extracted from the fuses via a combination of **thresholding** and **morphological (primarily dilation and erosion) operations**. The system makes a Pass/Fail decision by comparing the fuse arrangement with a given Pass arrangement. This task was previously entirely dependent on human vision.
- Developed a **Connector Assembly Inspection System**. The part to be assembled was yellow in colour so the problem was reduced to detecting yellow. By utilizing **HSV** color space, an **SVM** classifier was trained on the **color histograms** of the dataset. Previously this inspection was dependent on human vision and resulted in many partially assembled connectors being passed onto customers.
- Developed a programmable **Automotive Wiring Harness Circuit** Inspection System. This system was designed on an ATMEGA1281 microcontroller programmed in C and interfaced with the wiring harness via FPGAs configured in VHDL. **The FPGAs connected with the wiring harness using custom jigs with poka-yoke pins for deformity free circuit inspection.** The system replaced the earlier inspection systems that had to be custom designed for every wire harness, thereby reducing costs and time it took to set up an inspection system in a production line. This system is used for inspecting automotive wiring harnesses for **Suzuki Motor Company**.

EDUCATION:

Ph.D. in Systems Design Engineering (2020 - Present)

University of Waterloo, Canada

M.A.Sc. in Systems Design Engineering (2018 – 2020)

University of Waterloo, Canada

CGPA: 3.90/4.00

Thesis: All-optical Microscopic Histology of Unstained Human Tissues

B.Eng. in Electrical and Electronic Engineering (2008 – 2011)

University of Leicester, United Kingdom

First Class with Honors

GPA: 82%, Class Rank: 1/35