Deep Pujara

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SUMMARY

Ph.D. student at Arizona State University with a focus on Solar, Signal Processing, and Embedded Machine Learning (ML). Experienced in hardware and software development, with a track record of IEEE publications, internships in industries and research organizations, awards, and a notable presence in industry meetings and hackathons, seeking a challenging position to showcase my skills.

EDUCATION

Doctor of Philosophy in Electrical Engineering **(Jan 2024 – Present)**
- Arizona State University, Tempe, Arizona, USA (GPA: 3.83/4)
- Specialization: Solar, Signal Processing, and Embedded Machine Learning

Master of Science in Electrical Engineering **(Aug 2021 – Dec 2023)**
- Arizona State University, Tempe, Arizona, USA (GPA: 3.82/4)
- Specialization: Solar, Signal Processing, and Machine Learning

Bachelor of Technology in Electronics and Communication Engineering **(August 2017 – May 2021)**
- Nirma University, Ahmedabad, Gujarat, India (GPA: 8.11/10)

WORK EXPERIENCE

SenSIP Lab, School of ECEE, Arizona State University **Tempe, AZ, USA**
Graduate Research Associate Sep 2021 - Present
- Developed a compact embedded ML algorithm utilizing **Pruning**, **Quantization-Aware Training**, and **8-bit Post-Training Quantization** for efficient and accurate topology classification in solar energy systems.
- Conducted experimental **topology reconfiguration** research on a 3*3 solar array to **optimize power output** in **solar panels** under varying shading conditions, employing both simulation modelling (via **Simulink**) and practical experiments.
- Deployed an optimized Embedded ML algorithm on an Arduino Nano BLE 33 using **TensorFlow** and **TensorFlow Lite Micro** Libraries, achieving real-time fault detection with 85.97% test accuracy. Leveraged Edge Computing for rapid identification and response to solar system anomalies.
- Designed a **Monitoring Device Hardware** using various **sensors and microcontrollers** to measure important PV parameters such as Voltage, Current, Temperature, and Irradiance with a better transmission rate (1 second), and high accuracy (above 95%).

Tempe Campus, School of ECEE, Arizona State University **Tempe, AZ, USA**
Graduate Teaching Associate Jan 2023 – Present
- Providing support to students in understanding the concepts of **Fast Fourier Transform, Filters, Sampling, and related topics.**
- Conducting 2-3 interactive live sessions every semester and providing problem-solving support to students, facilitating a practical understanding of the DSP concepts and their real-life applications.

SenSIP Lab, School of ECEE, Arizona State University **Tempe, AZ, USA**
Graduate Research Mentor May 2024 – July 2024
- Participated in an NSF-funded program to mentor undergraduate students from diverse backgrounds across the U.S. in foundational machine learning concepts and applications.
- Guided students in developing a machine learning model for photovoltaic (PV) system monitoring, enhancing their understanding of renewable energy applications and practical ML deployment.

Skyworks Solution **Austin, TX, USA**
Broadcast Application Engineering Intern May 2023 – Aug 2023
- Engineered an advanced USB to SPI bridge (REV 2.0) using **ORCAD**, incorporating 4 chip select and reset lines. Optimized **MISO**, **MOSI**, and **SCK** pins, ensuring seamless replacement for Rev 1.0 with improved functionality.
- Built driver code in **C++** enabling efficient **USB-SPI communication**, facilitating smooth data transfer with maintained compatibility and enhanced performance compared to REV 1.0.

Indian Space Research Organization (SAC-ISRO) - Link **Ahmedabad, GJ, India**
Student Research Intern (Co-Op) Jan 2021 – Jun 2021
- Led a team and refined an algorithm via **Covariance**, **Eigen Analysis**, and **Walsh-Hadamard Transform** to identify the Initial Sequence, Scrambling Polynomial (Up to 15 degrees), and Initial Seed from the scrambled transmitted data within 1-2 minutes.
- Blindly identified the value of carrier frequency, bandwidth, and the modulation scheme of a signal in 0 dB or higher SNR value using **FFT**, **Down Sampling**, **Down Conversion**, and **Convolution**, and gained an **Accuracy of 95%** in carrier frequency and bandwidth identification.

ACADEMIC PROJECTS

Real Time Object Detection for Edge Devices   Nov 2024 – Dec 2024
- Created a **custom dataset** by sourcing and augmenting images from the internet, resizing and preprocessing them to meet model input requirements, ensuring a diverse and balanced dataset for accurate object detection training.
- Developed an optimized object detection model using **TensorFlow Lite** and **YOLO** for real-time inference on resource-constrained edge devices.
- Implemented model **quantization and pruning** to enhance efficiency while maintaining high detection accuracy.
- Deployed the model on an embedded system for applications such as surveillance, automation, and assistive technologies.

EdgeVoice: Real-Time Wake Word Detection on Embedded Systems   July 2024 – Sep 2024
- Collected and curated a **custom speech dataset** using recorded audio samples and publicly available data, preprocessing it with **Audacity** for noise reduction and normalization.
- Engineered a **Convolutional Neural Network (CNN)** architecture optimized for low-power devices, utilizing **MFCC feature extraction** (13 coefficients, 256 FFT length) to recognize speech with **78.63% test accuracy**.
- Implemented the model on **Arduino Nano 33 BLE Sense** with **TensorFlow Lite for Microcontrollers**, enabling **efficient real-time voice command processing** for edge AI applications.

PUBLICATIONS

1. J. Larson, **D. Pujara**, D. Ramirez, L. Miller, T. Patel, N. Babar, A. Spanias, "WIP: Building a Research Experience for Undergraduates in Quantum Machine Learning" *2024 Frontiers in Education (FIE)*, Washington DC, USA.
2. D. Ramirez, **D. Pujara**, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Infrared Computer Vision for Utility-Scale Photovoltaic Array Inspection," *2024 15th International Conference on Information, Intelligence, Systems & Applications (IISA)*, Volos, Greece, 2024. *(Paper recently presented at the conference)*
3. **D. Pujara**, D. Ramirez, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Real-time PV Fault Detection using Embedded Machine Learning," 2024 IEEE 7th International Conference on Industrial Cyber-Physical Systems (ICPS), St. Louis, MO, USA, 2024, pp. 1-5.
4. W. Chao, A. Sharma, G. Uehara, L. Miller, **D. Pujara**, W. Barnard, J. Larson, and A. Spanias. "Introducing Quantum Computing in a Sophomore Signals and Systems Course." *2023 IEEE Frontiers in Education Conference (FIE)*, pp. 1-5. IEEE, 2023.
5. **D. Pujara**, D. Ramirez, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Design of a New Photovoltaic Intelligent Monitoring and Control Device," *2023 14th International Conference on Information, Intelligence, Systems & Applications (IISA)*, Volos, Greece, 2023, pp. 1-4.
6. S. Rao, **D. Pujara**, A. Spanias, C. Tepedelenlioglu and D. Srinivasan, "Real-time Solar Array Data Acquisition and Fault Detection using Neural Networks," *2023 IEEE 6th International Conference on Industrial Cyber-Physical Systems (ICPS)*, Wuhan, China, 2023, pp. 1-5.
7. **D. Pujara**, P. Patel and S. Gajjar, "Geo Tracking of Waste, Triggering Alerts and Mapping Areas with High Waste Index," *2020 IEEE 17th India Council International Conference (INDICON)*, New Delhi, India, 2020, pp. 1-5.
8. **D. Pujara**, P. Kukreja and S. Gajjar, "Design and Development of E-Sense: IoT based Environment Monitoring System," *2020 IEEE Students Conference on Engineering & Systems (SCES)*, Prayagraj, India, 2020, pp. 1-5.

INVITED PRESENTATIONS

- **D. Pujara**, D. Ramirez, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Real-time PV Fault Detection using Embedded Machine Learning," *2024 SenSIP Industry Consortium*, Arizona State University, Arizona, USA, 2024.
- **D. Pujara**, D. Ramirez, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Design of a New Photovoltaic Intelligent Monitoring and Control Device," *2023-2024 Arizona Student Energy Conference*, Arizona, USA, 2023.
- **D. Pujara**, C. Tepedelenlioglu, D. Srinivasan and A. Spanias, "Design and Implementation of a Photovoltaic Monitoring Device," *2022-2023 SenSIP Industry Consortium*, Arizona State University, Arizona, USA, 2022-2023.

SKILLS AND EXPERTISE

- **Programming:** Python, MATLAB, C++
- **Packages:** Scikit-Learn, TensorFlow, TensorFlow Lite, PyTorch, NumPy, Matplotlib, Pandas
- **Software:** Microsoft Office, Visual Studio Code, Arduino IDE, Raspberry Pie, LaTeX, Jira, Confluence, Simulink, Git
- **Sensors Used**: Arduino UNO, Arduino BLE 33 Sense, ESP 32 (Wi-Fi), XBee S2C, MCP2210 (USB to SPI Bridge)
- **Relevant Coursework:** Digital Signal Processing, Communication System, Machine Learning, Embedded ML (Edge Computing), Deep Learning, Speech Processing, Artificial Neural Computation, Python Programming, Random Signal Theory, Microcontrollers, and Microprocessors