**Calvin A. Perumalla**

Email: [calvinapollos@gmail.com](mailto:calvinapollos@gmail.com) Telephone: 813.508.0752 | linkedin.com/in/calvin-perumalla

**EDUCATION**

**University of South Florida** May 2017

Tampa, FL

*PhD in Electrical Engineering:*

Dissertation: ‘Machine learning and adaptive signal processing techniques for electrocardiographic applications’

**University of South Florida** May 2014

Tampa, FL

*MS in Electrical Engineering*

**Malla Reddy Engineering College (JNTU)** May 2011

Hyderabad, India

*Bachelor’s in Technology (B.Tech) in Electronics and Communication*

**RESEARCH EXPERIENCE**

# Postdoctoral Researcher, *Department of Surgery, Stanford School of Medicine, CA* Feb 21 – Present

# *Deep Learning for Surgical Activity Recognition*

* Recognizing and tracking basic hand maneuvers are helpful in understanding surgical performance.
* Trained an AI based system (CNN + LSTM) architecture model on simulated bowel enterotomy repairs to recognize knot-tying, suture throws and cutting.
* Achieved state of the art results in detecting hand gestures, which is an important step in performance assessment.

# *Sensor Implementation for Scoliosis Force Mapping*

* Tracking long-term forces applied by braces at key pressure points on scoliosis patients allows the study of effectiveness of braces and patient compliance.
* Led a team of engineers to design and implement sensor and data acquisition system.
* Fabric-based piezo-resistive sensors were used to enable comfortable wearability and high accuracy of tracking pressure points.
* Performed a successful pilot initiative to test this with more than 10 patients.
* Novel dataset generated from this invention will support the study of ongoing research of long-term efficacy of brace use and compliance.

# *Sensor Implementation for Ultrasound Force Mapping*

* Pressure applied during an ultrasound procedure is indicative of performance. But this is poorly studied due to lack of acoustically transparent and conformable pressure sensors.
* Conducted experiments with ultrasound phantom with off-the-shelf pressure mat to learn the range of ultrasound pressures and show variance between high and low performers.
* Collaborated with Stanford lab to develop carbon-based pressure sensor array that is conformable and acoustically transparent to track ultrasound forces and identify forces associated with good outcomes.

# *Machine Learning for Performance Assessment using EEG*

* Advancements in wearable EEG devices allow the tracking of brain state in high stress surgical environment.
* Designed and implemented a data collection strategy to collect EEG data in the OR and simulated settings.
* Collected data from 70+ cases in the OR and 120+ cases in the simulated setting from attendings, residents and medical students characterizing a wide range of skill level.
* Preprocessed data to extract features from time-series data and built an LSTM-based algorithm to detect differences in high and low performance based only on EEG signals.
* Achieved moderate accuracy and showed that brain state measure with commercial wearable EEGs devices is an interesting feature in performance assessment identifying a promising future direction.

**Co-Principal Investigator, *Catalyst Program*, *Stanford School of Medicine, CA***April 2024 – Current

* Provided input as part of start-up core team in the development and roll-out strategy of a novel sensor-based system to assess surgeons in the operating room.
* Secured $350K in seed funding.

# Ph.D Research Assistant, *iWin Lab, Electrical Eng. Dept., USF, Tampa, FL* Jan 2013 – Aug 2017

*Machine Learning for Predictive Analytics in Heart Monitoring*

* Designed novel algorithms using **neural networks** and **SVMs** to predict **paroxysmal atrial fibrillation (PAF)** with 24 hour ECG recordings (~20 GB)
* Achieved **near perfect prediction accuracy (>99%)** for predicting PAF by developing novel features.

*Machine Learning for Diagnosis in Heart Monitoring*

* Tackled problem of **diagnosis** of heart conditions through novel use of ML algorithms.
* Achieved **98% accuracy** in heart condition classification using **neural networks** on data set of long term ECG recordings.

*Signal Processing and Optimization for Heart Monitor (‘iVCG Device’)*

* Collaborated with team of physicians & engineers to build 24x7 **wireless heart monitoring device.**
* Used MMSE methods to convert signals to gold standard, 12-lead ECG and reduced **error** to **<6%.**
* Developed novel self-tracking algorithms using MMSE techniques and reduced **error** to **<5%.**

# *Deep Learning for Wireless Applications*

* Addressed pressing need for reducing latency in **5G mobile networks.**
* Formulated the problem with **Recursive Neural Nets (LSTM) and** learnt user mobility patterns from vehicle mobility data of size 20 GB.
* Achieved **95% accuracy** in predicting future base station connections for mobile user.

**INDUSTRY EXPERIENCE**

# Data Scientist, *Vectra, San Jose, CA* Oct 2017 – March 2020

* Wrote high performing SQL and PySpark to curate >1B row data sets; Built SparkML pipelines.
* Individually designed software architecture and wrote production code, implementing ML models on high performance computing environment.
* Achieved 80% workload reduction for security analysts by building a novel anomaly detection models to identify malicious cyber activity (data exfiltration over DNS traffic based on volume and URL entropy & DCE-RPC threat detection using collaborative filtering)

**PEER-REVIEWED ORIGINAL RESEARCH PUBLICATIONS (Total:14)**

1. Perrone K, Schultz CK, Wise BJ, **Perumalla C**. Measuring Surgical Decisions: Impact of Individual Operative Strategies on Procedural Efficiency during Simulated Laparoscopic Ventral Hernia Repair. In: Journal Of The American College Of Surgeons. Vol 239. Lippincott Williams & Wilkins Two Commerce Sq, 2001 Market St, Philadelphia; 2024:S415-S416.
2. Perrone K, Wise B, Yang S, **Perumalla C**. Quantification Of Motion During Colonoscopies At The Point Of Care With Comparison Of Attendings To Trainees. In: Diseases Of The Colon & Rectum. Vol 66. Lippincott Williams & Wilkins Two Commerce Sq, 2001 Market St, Philadelphia; 2023:257-257.
3. Korndorffer Jr JR, Schultz C, **Perumalla C**, Perrone K, Pugh C. Novel Use of Objective Sensor Technology: Creation of Individualized Education Plans to Develop Operative Mastery. Journal of the American College of Surgeons. Published online 2023:10.1097.
4. **Perumalla C**, Kearse L, Peven M, et al. AI-based video segmentation: procedural steps or basic maneuvers? Journal of Surgical Research. 2023;283:500-506.
5. Mohamadipanah H, **Perumalla C**, Yang S, et al. Artificial intelligence in surgery: A research team perspective. *Curr Probl Surg*. 2022;59(6):101125. doi:[10.1016/j.cpsurg.2022.101125](https://doi.org/10.1016/j.cpsurg.2022.101125)
6. Mohamadipanah H, **Perumalla CA**, Kearse LE, et al. Do individual surgeon preferences affect procedural outcomes? Annals of surgery. 2022;276(4):701-710.
7. D. Wickramasuriya, **C. Perumalla**, K. Davaslioglu and R. Gitlin, "Base Station Prediction and Proactive Mobility Management in Virtual Cells using Recurrent Neural Networks," Accepted to IEEE 18th Wireless and Microwave Technology Conference (WAMICON), April 2017
8. D. Wickramasuriya, **C. Perumalla** and R. Gitlin, "Predicting Episodes of Atrial Fibrillation using RR-Intervals and Ectopic Beats," IEEE BHI, October 2016
9. **C. Perumalla**, T. Ketterl, R. Gitlin and P. Fabri, "Integrated Vectorcardiogram (iVCG) Rotation Modeling and Compensation" IEEE CAMAD, September 2015
10. **C. Perumalla**, T. Ketterl, R. Gitlin and P. Fabri "Wireless iVCG Optimization Using A Least-Squares Fit," IEEE 16th Wireless and Microwave Technology Conference (WAMICON), April 2015
11. **C. Perumalla**, T. Ketterl, G. Arrobo R. Gitlin and P. Fabri "Wireless Vectorcardiogram System Optimization using Adaptive Signal Processing," (IMWS-BIO), December 2014
12. G. Arrobo, **C. Perumalla**, Y.Liu, T. Ketterl, R. Gitlin and P. Fabri "A Novel Vectorcardiogram System," 2014 IEEE 16th International Conference on e-Health Networking, Applications and Services (Healthcom), October 2014
13. G. Arrobo, **C. Perumalla**, T. Ketterl, S.Hanke, R. Gitlin and P. Fabri "An Innovative Wireless Cardiac Rhythm Management (iCRM) System," WTS 2014, April 9-11, 2014
14. **Perumalla C**, Goll C, Yang S, Wise B, Kearse L, Bowler A, Pugh C. Digitizing Clinical Procedural Skills Using Sensors: New Opportunities for Data Driven Performance Metrics. The Cutting Edge of Surgical Education (CESE). (accepted)

**FUNDING**

August 2022 – December 2023 **Funding Source:** Wellcome Leap

PI: Carla Pugh

“Advanced Quantification and Acquisition of Surgical Skills Using the Wearable Sensing System”

Role: Key Personnel

August 2019 – December 2024 **Funding Source:** NIH (R01)

PI: Carla Pugh

“Quantifying the Metrics of Surgical Mastery: An Exploration in Data Science”

Role: Key Personnel

January 2023 – December 2024 **Funding Source:** Stanford Catalyst Program

PI: Carla Pugh

“The Quantified MD Project”

Role: Co-PI

August 2025 – Present **Funding Source:** NIH (R01)

PI: Carla Pugh

“Quantifying The Metrics Of Surgical Mastery: Improving Individual And Team Performance With

Biometric Data”

(awaiting funding, received high score)

Role: Key-Personnel

**TEACHING & MENTORSHIP**

* Mentored summer interns for several years and assisted in various data science projects ranging from AI assisted voice transcription tools to data annotation.
* Mentored 2nd place finalist in health++ initiative at Stanford.
* Teaching Assistant for 3 graduate level courses for 8 semesters. Held office hours and grading of all exams.
* Taught two graduate level course (Digital Communication and Wireless Networked Systems) for overflow class.
* Supervised and advised graduate and undergraduate, student research projects as PhD student.
* Collaborated with researchers across multiple domains in writing **research grants** including two NIH R01 grants.

**SERVICE**

* Reviewed papers and book chapters for peer-reviewed journals
* First point of contact with intellectual property attorneys in multiple patent applications.

**PATENTS**

* R. Gitlin, G. Arrobo, T. Ketterl, P. Fabri, and **C. Perumalla**, “Integrated Vectorcardiogram System and Method of Use.” US Patent No. 9,451,890, January 2016
* **Perumalla. C**, Gitlin. R, Wickramasuriya. D “System and method for the prediction of atrial fibrillation (AF)” US Patent No. 11,426,113, August 2022
* G. Arrobo, **C. Perumalla**, S. Hanke, T. Ketterl, P. Fabri, and R. Gitlin, “Systems and Methods for Managing Cardiac Rhythm.” *(Utility patent filed, pending submission)*

**TECHNICAL SKILLS**

* Core Tools: Python, PySpark, **SQL**, **Databricks**, MATLAB
* Python packages: **pytorch**, TensorFlow, **pandas**, **scikit-learn**, **SciPy**, networkx.
* Machine learning: Activity recognition, LSTM, Anomaly Detection, Logistic Regression, Neural Networks, SVMs, OLS optimization, PCA, HDBSCAN, k-means, Random forests.
* Other tools: Gephi, **C++**, **MongoDB**, MATLAB, AWS
* Operating systems: Windows, **Linux**, macOS

**HONORS & AWARDS**

* Member of the National academy of Inventors – USF Chapter
* 2021 Holman finalist for best paper selected for podium presentation

**PROFESSIONAL AFFILIATIONS**

* Student Member of IEEE

**REFERENCES**

Available upon request