Suhas Bettapalli Nagaraj

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Education

- **The Pennsylvania State University, University Park** — University Park, PA
  MS in Electrical Engineering (Communications & Signal Processing) — *Aug 2019 - May 2021 (expected)*
  Thesis topic: Federated Learning based Anxiety & Depression assessment using multimodal signals (Adviser : Dr. Saeed Abdullah)

- **PES University** — Bangalore, India
  B.Tech in ECE specializing in Signal Processing & Minors in CS — *Aug 2014 - May 2018*
  Thesis title: Real time condition monitoring of railway tracks using Wireless Sensor Networks (Adviser : Prof. Suresh Padmanabhan)

Coursework

- **Graduate**: Wireless & Mobile Sensing in the age of IoT, Electrochemical Biosensors, Neural Networks, Graphs & Algorithms, Emerging Topics in Networking, Probability, Convex Optimization, Wavelets & Sparse Signal Processing, Image Processing II
- **Undergraduate**: Linear Algebra, Computer Networks, Digital Signal Processing, Computer Vision, Pattern Recognition & Classification, Wireless Network Design, Embedded System Design, Data Structures, Operating Systems

Publications

1. **[In Progress] Suhas BN**, Saeed Abdullah. "Federated learning based Anxiety & Depression assessment in the age of COVID-19 using multimodal signals"

2. **[Accepted]** CogMI 2020 **Suhas BN**. "Automatic bird sound detection in long range field recordings using Wavelets & Mel filter bank features" (Github Code) (Paper Link: Preprint)

3. SPCOM 2020 **Suhas BN**, J. Mallela, A. Illa, B. K. Yamini, N. Atchayaram, R. Yadav, D. Gope, and PK Ghosh. "Speech task based automatic classification of ALS and Parkinson's Disease and their severity using log Mel spectrograms." In 2020 International Conference on Signal Processing and Communications (SPCOM), pp. 1-5. IEEE, 2020.
   (Paper Link: DOI: 10.1109/SPCOM50965.2020.9179503) (Gitlab Code)

4. ICASSP 2020 Mallela, J, A Illa, **Suhas BN**, S. Udupa, Y. Belur, N. Atchayaram, R. Yadav, P. Reddy, D. Gope, and PK Ghosh. "Voice based classification of patients with Amyotrophic Lateral Sclerosis, Parkinson's Disease and Healthy Controls with CNN-LSTM using transfer learning." In ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 6784-6788. IEEE, 2020.
   (Paper Link: DOI:10.1109/ICASSP40776.2020.9053682)

5. INTERSPEECH 2019 **Suhas BN**, D. Patel, NR Koluguri, Y. Belur, P. Reddy, A. Nalini, R. Yadav, D. Gope, and PK Ghosh. "Comparison of Speech Tasks and Recording Devices for Voice Based Automatic Classification of Healthy Subjects and Patients with Amyotrophic Lateral Sclerosis." In INTERSPEECH, pp. 4564-4568. 2019.
   (Paper Link: DOI:10.21437/Interspeech.2019-1285)

6. IC4 2018 **Suhas BN**, S. Bhagavat, V. Vimalanand, and P. Suresh. "Wireless Sensor Networks Based Monitoring of Railway Tracks." In 2018 International CET Conference on Control, Communication, and Computing (IC4), pp. 187-192. IEEE, 2018. (Paper Link: DOI: 10.1109/CETIC4.2018.8531029)

Talks

1. MIMO in 5G Wireless Systems [School of EECS, Penn State, Dec 19]
2. Performance characterization of Sound Recorders [EE Dept, Indian Institute of Science, Aug 19]
3. Introduction to Music Information Retrieval, Audio licensing & Blockchains [EE Dept, Indian Institute of Science, Nov 18]

Skills

- **Certifications**: Lean Six Sigma Yellow Belt, Agile Methodologies
- **Languages**: MATLAB, Python, C, C++, Bash scripting, R, SQL, HTML
- **Frameworks**: Keras, PyTorch, TensorFlow, TF Federated, Pandas, NumPy, Scikit-learn, Matplotlib, spaCy, OpenCV
- **Tools**: Cisco Packet Tracer, GNS3, Wireshark, Git, AWS, GCP
- **Test Scores**: Penn State AEOCPT (**300/300**)

Teaching

College of Information Science & Technology, Penn State University — University Park, PA
Graduate Instructional Assistant (Mentor: Dr. Fenglong Ma) — *Jan 2020 - Present*

- Spring 2020 : TA for DS 310 (Machine learning for Data Analytics)
- Fall 2020 : TA for DS 310 (Machine learning for Data Analytics)
- Spring 2021 : TA for DS 402 (Data Science in Healthcare)

Experience

3M Health Information Systems, Inc (formerly M*Modal) Remote (COVID-19)
Speech Recognition Research Intern (Mentor: Dr. Mark Fuhs) *Jun 2020 - Aug 2020*

- Implemented speaker separation using deep learning methods for improving physician-patient conversations.
- Generated reverberated audio and extended ConvTasNet with phase difference information using 2+ mic data.
- Conducted market research, interacted & presented key results to the 3M HIS Core Speech management group.
- Wrote LibriMixR code (Github Link): To Extend LibriMix with reverb parameters.

Signal Processing Interpretation & Representation Lab, Indian Institute of Science Bangalore, India
Research Assistant (Mentor: Dr. Prasanta Kumar Ghosh) *May 2018 - Aug 2019*

- Collaborated with NIMHANS, Bangalore to develop methods for detecting neuro-disorders from speech signals.
- Collected speech (150+ hours) & video data (10+ hours) corpus, interacted with stakeholders (500+ patients, 20+ doctors) and responsible for the end-to-end project implementation. Analyzed signals and extracted features.
- Developed & ported ML models to build an Android app that is now used by neurologists for real time detection of ALS & Parkinson's subjects at NIMHANS. Improved ALS/Parkinson's detection rate by 44%.

LocoTrax (Undergrad startup) Bangalore, India
Head of Product & Technology (Mentor: Prof. S. Padmanabhan) *Jun 2017 - May 2018*

- Led product & technology strategies for identifying track fractures and help prevent train derailments in India.
- Proposed SMART sensor methods to reduce incidents by 51% from 2018-28. **Mentioned on Financial Express.**

Projects

• **SwingSense - The bat swing analyzer** : Collected & analyzed Real time sensor & video dataset, provided feedback of bat/racquet swing (baseball, cricket, tennis, etc.) to improve athletic performance. Includes 3D visualizations such as Swing & Impact speed, % of grounded & Middled shots and timing index.

• **Real time Bird sound detection** : Proposed wavelet based features that can work on par with Mel filterbank based features for real time detection of bird sounds. CNN & SVM used for classification. (Github Code)

• **Identifying Obstructive Sleep Apnea (OSA)** : Developed a no-cost, oximeter-less, smartphone based method to identify OSA from a subject's snore recording. Used Hidden Markov Models (HMM) for classification. The results can be obtained within a few minutes and are comparable with that of a clinical setting that takes 8 hours.

• **Language identification via I-Vectors and Dimensionality Reduction** : Used Mann-ki-baat dataset translated from Hindi to other languages. Built a classifier to perform language ID among 13 Indian languages, for a given speech utterance using PCA and LDA with potential applications to ALS/PD classification. (Based on Dehak '11).

• **RL using Value and Policy algorithms** : Solved a reinforcement learning based IP packet routing problem. A network of adaptive and cooperative agents are to transport data following shortest route in time from a source to destination. Value (Bellman, 1957) and Policy (Howard, 1960) iteration algorithms were used for implementation.

University Leadership

• **EGT Chair**, Engineering Graduate Student Council (EGSC), Penn State (2020-21)
• **Executive Board Member**, EGSC - Leading a forum of 2800+ graduate students on discussions, seminars and talks related to engineering on a biweekly basis
• **Co-Editor**, College of Engineering Research Symposium : Supervise over 200+ students to publish/present their research every year informing the college community of Penn State's cutting-edge engineering research.

Extra Curricular

• Performed 100+ concerts - watch a 10 year old me (front left), • Speedcubing (Best solve of 11.2 sec on 3x3 and 2.4 sec on 2x2), • Yoga, • Ranked ELO 1550 in Chess, • Photography (some of my clicks here)

Service

- **Sri Shankara Cancer Hospital** : Fundraising and community volunteer.
- **Jnana Sanjeevini Medical Center** : Introduced doctors to machine learning methodologies to help improve detection rate of Diabetes and faster applicability of insights in everyday consultation. Community volunteer.
- **Anything is POssible for Girls in Electrical Engineering (APOGEE)** camp : Facilitated a workshop for middle & high school students on electrical engineering and wearable technology.
- **PESU CSR Initiative** : Led PES University's efforts in CSR by organizing blood donation camps, collecting food and clothing for less privileged, fundraising for NGO's in environment, education and healthcare.

References

1. Dr. Prasanta Kumar Ghosh,
   Indian Institute of Science, India
   Email : prasantg@iisc.ac.in
2. Dr. Saeed Abdullah, Penn State, PA
   Email : saeed@psu.edu
3. Dr. Fenglong Ma, Penn State, PA
   Email : fenglong@psu.edu
4. Dr. Mark Fuhs, 3M Health Info Systems, Inc., PA
   Email : mark.fuhs@mmm.com
5. Suresh Padmanabhan, Collins Aerospace, India