Suhas Bettapalli Nagaraj

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Education

Aug 2021 - Present	**PhD Informatics** (ML/HCI/Health), Penn State, University Park, PA **Graduate Minor in Engineering Management**, Penn State
Aug 2019 - May 2021	**MS Electrical Engineering** (Signal Processing), Penn State
Aug 2014 - May 2018	**B.Tech ECE**, PES University, Bangalore, India

Work Experience

Jun 2020 - Aug 2020
3M (M*Modal)
Speech Recognition R&D Intern
* Implemented speaker separation using deep learning for improving physician-patient conversations.
* Generated reverberated audio & extended ConvTasNet with phase difference information (2+ mic data).
* Wrote LibriMixR code (Github Link): To Extend LibriMix with reverb parameters.
* Conducted market research & presented decisive results to the 3M HIS Core Speech management group.

May 2018 - Aug 2019
Indian Institute of Science (SPIRE Lab)
Project Lead for ALS/PD Detection
* Collected requirements for developing an automated method to detect neurological disorders from speech.
* Recorded and collected Speech (150+ hours), Video (10+ hours), and Electromyography (EMG) data of subjects. Extracted features from data and trained models. Presented results at ICASSP 2020 and INTERSPEECH 2019.
* Interacted with 500+ patients / 20+ doctors. Drove alignment between engineering & management teams.
* Designed, developed, and evaluated use case scenarios and proofs-of-concept of an offline inference smartphone app for use in a clinical setting at NIMHANS, Bangalore.

Jun 2017 - May 2018
Locotrax
Founder & Head of Engineering
* Partnered with design, engineering and finance teams across the Indian Railway board to create **Vision 2030** for simple, agile and efficient railways. Worked to identify railway track fracture/cracks to prevent train derailments.
* Projected business cost savings of USD 15.32 million over the next ten years.
* Established relationships with material partners for more evident roadmap creation and knowledge transfer.
* Developed two creative solutions to the problem of reducing incidents by 51% over the next decade. The solutions enabled us to pass the pilot phase. Mentioned on Financial Express.

Teaching

Fall 2021	Data Integration & Fusion (Supervisor: Dr. Yasser Elmanzalawi)
Spring 2021	Data Analytics for Healthcare (Supervisor: Dr. Fenglong Ma)
Spring & Fall 2020	Data Analytics for Machine Learning (Supervisor: Dr. Fenglong Ma)

Relevant Coursework

Data Mining, Human Centered Design, Research Design, Social Informatics, Probability, Convex Optimization, Pattern Recognition, Database Management Systems, Data Structures & Algorithms, Wireless Networks & IoT

Publications

1. Submitted to UbiComp 2021 **Suhas BN**, Saeed Abdullah. "Privacy Sensitive Speech Analysis using Federated Learning to Assess depression"
2. CogMI 2020 **Suhas BN**. "Automatic bird sound detection in long range field recordings using Wavelets & Mel filter bank features" (Paper Link: DOI: 10.1109/CogMI50398.2020.00035) (Github Code)
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. Privacy-preserving assessment of depression using Speech signal processing (MS EE Thesis Defense) [School of EECS, Penn State, Apr 21] – View the Thesis here
2. MIMO in 5G Wireless Systems [School of EECS, Penn State, Dec 19]
3. Performance characterization of Sound Recorders [EE Dept, Indian Institute of Science, Aug 19]
4. Introduction to Music Information Retrieval, Audio licensing & Blockchains [EE Dept, Indian Institute of Science, Nov 18]

Projects

1. **SwingSense - The bat swing analyzer**: Collected & analyzed Real-time sensor & video dataset, provided feedback of bat/racquet swing (baseball, tennis, cricket, etc.) to improve athletic performance. Includes 3D visualizations such as Swing & Impact speed, % of grounded & Middle shots, and timing index.
2. **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)
3. **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 a clinical setting that takes 8 hours.
4. **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 ALS/PD classification applications. (Based on Dehak, 2011).

Software

Bash, SQL, Python, MATLAB, GCP, AWS, Git, LaTeX, Office, SoX, FFmpeg, Kaldi
Keras, Tensorflow, PyTorch, Pandas, NumPy, Scikit-learn, Matplotlib, spaCy, OpenCV
JIRA, Pendo, Tableau, Keynote, Confluence, Visio, Microsoft Teams, Zoom

Interests and Extracurricular Activities

Finance, Percussion, Game Theory, Puzzles, Speedcubing, Technology.