K V Vijay Girish

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Research Interests

I am interested in designing innovative mathematical and machine learning models to analyze, process and extract information from signals and data captured from various domains like audio, vision and text. I enjoy analytical and emperical modelling, and out of the box thinking to solve practical problems. My broad areas of interest are:

Artificial Intelligence, Machine Learning, Deep learning, Data Analytics, Signal Processing, Sparse Representations, Dictionary Learning and Adaptation, Speech and Audio Analysis, Source Separation, Acoustic Noise and Speaker Classification, Speech Recognition, Keyword Spotting, Image and Video Processing

I am especially passionate about audio and speech research, deep tech problems, mathematical modeling, and their applications to real world problems.

PhD Thesis Summary

Thesis title: Speech and noise analysis using sparse representation and acoustic phonetics knowledge

Abstract This thesis addresses different aspects of speech and noise analysis using two different approaches:

1. A supervised and adaptive sparse representation based approach for identifying the type of background noise and the speaker and separating the speech and background noise, and
2. An unsupervised acoustic-phonetics knowledge based approach for detecting transitions between broad phonetic classes and significant excitation instants called as glottal closure instants (GCIs) in a speech signal, for applications like speech segmentation, recognition and modification

The **areas** and **techniques** explored in the research contributing to the thesis include the following:

- Audio Classification and Analysis pertaining to Speaker, Background Noise and Language Classification, Source Separation, Audio Signal Analysis, Audio Segmentation, Speech Enhancement, Event Detection
- **Machine learning techniques** used are feature extraction, feature selection, dictionary learning, model adaptation, semi-supervised learning, using validation set to learn the parameters, support vector machine (SVM), clustering, non-negative matrix factorization, linear and histogram based classifiers, heirarchical and rule based classifiers
- **Signal processing techniques** like frame wise analysis, frequency domain analysis, linear prediction analysis, envelope extraction, extrema based analysis, bandpass filtering, sparse coding and non-negative sparse representations

Work Experience

- *Senior Machine Learning Scientist, Observe.AI* **October 2020- Present**
  - Speech analysis
- *Data Scientist Tech Lead, Belong.co,* **June 2019- October 2020**
  - Designed and developed deep learning and auto encoder based models for learning candidate embeddings which captures candidate career journey
  - Developed innovative algorithms for Resume Parsing product such as section detection and classification using joint statistical modelling, character sequence based noise invariant heading text classification/ detection, text continuation algorithm using language modelling, unsupervised multilevel bounding box extraction and merging algorithm for getting logical and coherent text from resumes and tables
  - Lead the team involved in building the best Resume Parser in India right from data analysis, creating training data, modelling to deployment of the algorithms
  - Technical breakdown, prioritization, documentation, future roadmap and guiding the Resume Parsing team
  - Devised new algorithms for improving Resume Parsing using statistical approaches, image processing, prior assumptions and deep learning based approaches
  - Planning, coding, deploying, maintaining, bug fixing and fine tuning the resume parsing algorithm
- *Data Scientist, Belong.co,* **February 2018- May 2019**
  - Data analysis, cleaning and pre-processing and co-ordinating with Data Operations team to get manually tagged data

- Devised sequence level primary and secondary labels for email classification based on long term use cases
- Devised the format and pipeline for data labelling using active learning techniques, and deep learning architecture for the email classification model
- Developed the sequence based LSTM model using a combination of character sequence and pre-trained word embeddings (fine-tuned on email database) for email classification and deployed and maintained the model in production
- Devised and deployed unsupervised image processing based approaches for heading extraction and localise text boxes in resumes
- Devised semi-supervised algorithms and post-processing to improve email classification accuracy

- *Senior Technical Leader, Huawei Technologies India,* **April 2017- February 2018**
  - Analysis and review of machine learning services on various cloud platforms
  - Artificial intelligence and machine learning resource analysis both in industry and academia
  - Gave technical lectures and guidance on machine learning concepts and algorithms and mathematical background to relevant teams
  - Created proposals for patents and getting new project on audio classification and noise analysis, speaker classification and voice assistant on Edge and Cloud platform
  - Designed and developed a system for face detection and recognition algorithms for IOT devices over Edge network single handedly using various feature extraction and supervised classification methods
- *Senior Engineer, Relay and Integrated Solutions, Larsen and Toubro Limited, Mumbai,* **August 2008- July 2010**
  - Development, testing, documentation and analysis of new product: Intelligent Motor Protection Relay, MCOMP
- *Industrial Training: Inplant Practical Training at the Bharat Heavy Electricals Limited, Electronics Division, Bangalore,* **May 2006-June 2006**

Industrial Consultancy and Mentorship

July, 2020 - present Consultant, Lumos Learning

July, 2020 - present Data Science Career Track Mentor, Springboard

Research Mentorship

May-July, 2016 Veena Vijai, from Birla Institute of Technology and Science, Pilani - K. K. Birla Goa Campus on Relationship between spoken Indian languages by clustering of long distance bigram features of speech

June-August, 2016 B Shubashree, from SSN College of Engineering, Chennai on Unsupervised background noise change identification using dictionary learning

Education

PhD, M.Sc(Engg) **August 2010 - September 2017 (Thesis Defense)**
Indian Institute of Science, Bangalore, India
Advisors: Prof. A. G. Ramakrishnan, Electrical Engineering, IISc and Dr. T. V. Ananthapadmanabha, Voice and Speech Systems, Bangalore, India

Bachelor of Technology **August 2004-May 2008**
Electrical and Electronics Engineering
National Institute of Technology Karnataka, Surathkal, India

Relevant Academic Projects

During PhD (apart from thesis) *August 2010- April 2017:*

- Relationship Between Indian Languages Using Bigram Language Models- Group project under Prof. T. V. Sreenivas of Dept of Electrical Communication Engineering, Indian Institute of Science
- Voiced and Unvoiced feature classification of Speech data using multiple features- Individual course project under Prof. A. G. Ramakrishnan of Dept of Electrical Engineering, Indian Institute of Science
- Implementation of Modification of Pitch contour , Duration and Energy for change in Prosody in Tamil Speech Synthesis under Prof. A. G. Ramakrishnan of Dept of Electrical Engineering, Indian Institute of Science
- Voice Modification system using change of sampling frequency and duration normalization under Prof. A. G. Ramakrishnan of Dept of Electrical Engineering, Indian Institute of Science

- Implementation of Parts of Speech and Pause Rules Tagging of Tamil text in Matlab and C under Prof. A. G. Ramakrishnan of Dept of Electrical Engineering, Indian Institute of Science
- Created interactive Matlab demos for voice modification, noise classfication and audio source separation for IISc Open Day

During B.Tech *August 2004 - May 2008:*

- Graphic Equalizer implementation using Matlab 7.0 - individual project under Prof. Jora M Gonda of Dept of Electrical and Electronics Engineering, NITK Surathkal
- Implementation of Image Processing Techniques using Graphical User Interface in Matlab 7.0.1- group project under Mrs. Vinatha U. of Dept of Electrical and Electronics Engineering, NITK Surathkal

Additional Research Exposure

Project Associate **August 2016 – April 2017**
Project on *Speaker and background change detection*, MILE Lab, IISc
Defence Research and Development Organization, Mentor: Prof. A G. Ramakrishnan

Teaching Assistantship

Linear and Nonlinear Optimization offered by Prof. Muthuvel Arigovindan at Indian Institute of Science, Bangalore during August-December, 2013: Responsibilities included conducting tutorial classes

Speech Information Processing offered by Prof. A G Ramakrishnan at Indian Institute of Science, Bangalore during January-May, 2014: Responsibilities included preparing assignments and projects

Matrix Theory offered by Prof. A G Ramakrishnan at Indian Institute of Science, Bangalore during August-December, 2014: Responsibilities included preparing assignments, clearing doubts, evaluation and grading of students.

Graduate Courses

Credited: Matrix Theory, Linear and Non Linear Optimization, Stochhastic Models and Applications, Pattern Recognition and Neural Networks, Data Mining, Compressive Sensing and Sparse Signal Processing, Advanced Digital Signal Processing, Speech Information Processing, Automatic Speech Recognition Algorithms
Audited: Time Frequency Analysis, Convex Optimization , Digital Image Processing, Machine Learning

Online Courses

Pattern Recognition (NPTEL), Machine Learning (Coursera), Natural Language Processing (Dan Jurafsky), Introduction to Python for Data Science (edx), Neural Networks and Deep Learning by deeplearning.ai on Coursera: Certificate earned on Monday, February 5, 2018 3:11 AM GMT (Coursera)

Programming Languages and Computer Skills

Python, Matlab, C

Operating system usage UNIX and MacOS

Report documentation with LaTeX 2_ε

Publications

Conference and Workshop papers:

- Vinodh Kumar Ravindranath, Devashish Deshpande, K V Vijay Girish, Darshan Patel and Neel Jambhekar Vikash Singh, *Inferring Structure and Meaning of Semi-Structured Documents by using a Gibbs Sampling Based Approach*, IEEE ICDAR-WML 2019, Sydney
- K V Vijay Girish, A G Ramakrishnan and Neeraj Kumar, *A system for distributed audio classification using sparse representation over cloud for IOT*, IEEE COMSNETS 2018, Bangalore
- K V Vijay Girish and A G Ramakrishnan, *Enhancement of noisy Tamil speech for improved quality of perception for the hearing impaired*, 16th Tamil Internet Conference 2017, Toronto
- K V Vijay Girish, T V Ananthapadmanabha and A G Ramakrishnan, *Cosine similarity based dictionary learning and source recovery for classification of diverse audio sources*, IEEE INDICON 2016, IISc Bangalore
- K V Vijay Girish, Veena Vijai and A G Ramakrishnan, *Relationship between spoken Indian languages by clustering of long distance bigram features of speech*, IEEE INDICON 2016, IISc Bangalore
- K V Vijay Girish, A G Ramakrishnan and T V Ananthapadmanabha, *Hierarchical classification of speaker and background noise and estimation of SNR using sparse representation*, Interspeech 2016, September 8-12, 2016, San Francisco
- Vikram R L, K V Vijay Girish, Harshavardhan S, A G Ramakrishnan, T V Ananthapadmanabha, *Subband Analysis of Linear Prediction Residual for the Estimation of Glottal Closure Instants*, Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2014), May 4-9, 2014, Florence, Italy

- Vikram Ramesh Lakkavalli, K V Vijay Girish, A G Ramakrishnan, *Sub-band Envelope Approach to Obtain Instants of Significant Excitation in Speech*, Proc. National Conference on Communications (NCC 2012), Feb 3-5, 2012, Kharagpur, India, pp. 19
- Sayan Ghosh, K V Vijay Girish, T V Sreenivas, *Relationship between Indian Languages Using Long Distance Bigram Language Models*, Proc. International Conference on Natural Language Processing (ICON 2011), Dec 16-19, 2011, Chennai, India, pp. 104-113

Journal paper:

- T V Ananthapadmanabha, K V Vijay Girish and A G Ramakrishnan, *Relative occurrences and difference of extrema for detection of transitions between broad phonetic classes*, Sadhana (2018) 43: 153. `https://doi.org/10.1007/s12046-018-0923-x`

Technical Reports:

- T V Ananthapadmanabha, K V Vijay Girish, A G Ramakrishnan, *Detection of transitions between broad phonetic classes in a speech signal*, arXiv:1411.0370 [cs.SD]
- K V Vijay Girish, A G Ramakrishnan and T V Ananthapadmanabha, *Adaptive dictionary based approach for background noise and speaker classification and subsequent source separation*, arXiv:1609.09764 [cs.SD]

Talks and Poster Presentations

- Gave an IEEE talk on "Throwing light on sound" in NIT Goa and BITS Goa, on 12th February, 2017
- Presented poster on "Adaptive and supervised sparse representation based approach for noisy speech analysis" in IISconnect: Industry Interaction Day at IISc Bangalore on 3rd October, 2016
- Gave a talk and presented poster on "Analysis of audio intercepts: Can we identify and locate the speaker? " at EECS Research Students Symposium - 2016, held at IISc Bangalore during 28-29 April, 2016
- Presented poster on my accepted paper in INTERSPEECH-2016 at San Francisco, USA during 8-12 September, 2016
- Presented poster on my accepted paper in IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2014) at Florence, Italy during 4-9 May, 2014
- Gave a talk on my accepted paper in National Conference on Communications, held at IIT Kharagpur, during 3-5 February, 2012
- Assisted Prof. A. G. Ramakrishnan in conducting a tutorial on Insights into Signal Processing,Transforms and Linear Algebra at International Conference on Biomedical Engineering, 2011 held at MIT Manipal, during 8-9 December, 2011

Technical Activities

- **Reviewer** of reputed conferences/ journals like Annual ISCA Interspeech conference, IEEE Signal Processing and Communication (SPCOM) Conference, and IEEE Transactions on Signal Processing
- Organization Committee member in Annual Electrical Sciences Divisional Symposium, 2013, IISc, an annual symposium for graduating students of IISc to talk about their findings and collaborate with industries.
- **Writing** technical blogs in Medium: https://medium.com/@girish.vijay
- Showcased Interactive Matlab Demos in Open Day 2012, 2014, 2015, 2016 and 2017, an annual one day event hosted at Indian Institute of Science, Bangalore to make public familiar with activities at the institute.
- Participated in Google Code Jam regularly
- Bagged 2nd prize in Foxhunt in the TechFest Engineer 2006 conducted by NITK Surathkal
- Secured 5th position in Simplicity, an International Online Matlab Programming contest conducted during Engineer 2008, a Technical Festival conducted by NITK Surathkal
- Bagged 3rd prize in Science Slam in Pravega Sci-Tech 2014 conducted by Swissnex at IISc Bangalore

Awards and Achievements

Awarded 40 Under 40 Data Scientists at MLDS 2020, organized by Analytics India Magazine	**2020**
Secured an All India Rank of 4525 and State Rank (West Bengal) of 53 in AIEEE 2004	**2004**
Secured 98.8 percentile in GATE 2010 (Electrical Engineering)	**2010**
PhD Scholarship, Ministry of Human Resource and Development, Govt. of India	**2010-2016**
Distinctive performance in National Science Olympiad	**2000**

Extra-curricular activities

- Active Member of Spicmacay, Voice club, IEEE and Management Forum at NITK Surathkal
- Active member of Mess committee at IISc Bangalore from July 2013 - May 2015
- Playing badminton, running, swimming, biking, triathlon, programming, technology, guitar, photography, writing blogs
- Finished Ironman 70.3 in Hyderabad triathlon and Olympic triathlon in Goa triathlon events in 2017

Languages known

English, Hindi and Telugu

References

Available on request