Krishnakant V. Saboo

Personal Information

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Education

2016 – **University of Illinois, Urbana-Champaign**
Doctoral Degree
Electrical and Computer Engineering
GPA: 3.75/4

2011 – 2016 **Indian Institute of Technology Bombay**, Mumbai, India
Dual Degree (Bachelor of Technology + Master of Technology)
Major in Electrical Engineering
Specialisation in Communication and Signal Processing
GPA: 9.02/10

Awards and Honors

2020	Mavis Future Faculty Fellowship
2020	ISBI Student Travel Grant
2020	Rambus Fellowship in Electrical and Computer Engineering
2019	Mayo/Illinois Fellowship 2019-2020
2019	Outstanding Teaching Assistant Award
2017	Mayo/Illinois Fellowship 2017-2019
2016	Undergraduate Research Award for outstanding research contribution
2015	Recognition for outstanding contribution as Institute Student Mentor, IIT Bombay
2015	Felicitated for outstanding work done as coordinator of dept. academic mentorship program
2015	Institute Academic Prize for ranking 2nd in Dual Degree EE Program, IIT Bombay
2015	IEEE CIS Student Travel Award
2011	Gold medallist in Indian National Chemistry Olympiad

Publications and Patent

Patent

KVS and S. Rao, "Gesture Recognition using Frequency Modulated Continuous Wave (FMCW) Radar with low angle resolution", *U.S. Patent 9,817,109.*

Journal

KVS, et al., "Deep learning identifies proxy brain reserve measures that predict longitudinal cognition and aid in coping with pathologies in the aging population", *in preparation.*

KVS*, I. Balzekas* et al., "Cognitive task and seizure focus: Electrographic functional connectivity during task enhances inter-ictal seizure onset zone localization compared to non-task", *in preparation.*

C. Hu, V. Anjur, **KVS**, et al., "Low predictability of Readmissions and Death Using Machine Learning in Cirrhosis", *American Journal of Gastroenterology, 2020 (in print).*

KVS, et al., "Sex is associated with differences in gut microbial composition and function in hepatic encephalopathy", *Journal of Hepatology, 2020.*

KVS, et al., "Unsupervised Machine Learning Classification of Electrophysiologically Active Electrodes during Human Cognitive Task Performance", *Nature Scientific Reports 9, 2019.*

M. T. Kucewicz, **KVS**, et al., "Human Verbal Memory Encoding is Hierarchically Distributed in a Continuous Processing Stream", *eNeuro 6.1, 2019.*

V.S. Borkar, R. Karumanchi, **KVS**, "An Index Policy for Dynamic Pricing in Cloud Computing Under Price Commitments", *Applicationes Mathematicae Journal, 2017.*

CONFERENCE

KVS, et al., "Predicting Longitudinal Cognitive Scores using Baseline Imaging and Clinical Variables", *IEEE International Symposium on Biomedical Imaging, 2020.* (Oral presentation)

KVS, et al, "A Computationally Efficient Model for Predicting Successful Memory Encoding Using Machine-Learning-based EEG Channel Selection", *International IEEE EMBS Conference on Neural Engineering, 2019.*

Y. Varatharajah, M.J. Chong, **KVS** et al., "EEG-GRAPH: A Factor-Graph based Model for Capturing Spatial, Temporal, and Observational Relationships in Electroencephalograms", *Advanced in Neural Information Processing Systems 2017.*

C. P. Narisetty*, **KVS***, and B. Rajendran, "Composer Classification based on Temporal Coding in Adaptive Spiking Neural Networks", *International Joint Conference on Neural Networks 2015.*

WORKSHOP

Y. Varatharajah, S. Przybelski, C. Schwarz, **KVS**, et al, "A Joint Model for Predicting Structural and Functional Brain Health in Elderly Individuals", *IEEE International Conference on Bioinformatics and Biomedicine, 2019 Workshop.*

K. Avrachenkov, V.S. Borkar and **KVS**, "Distributed and Asynchronous Methods for Semi-Supervised Learning", *Workshop on Algorithms and Models of the Web Graph, 2016.*

ABSTRACT

KVS et al, "Artificial intelligence techniques demonstrate better prediction for 90-day readmission and death in women than in men with cirrhosis", *Digestive Diease Week, 2020.* (Oral presentation)

V. Anjur, C. Hu, **KVS**, R. K. Iyer, P. M. Arnold "A Naive Bayes Model to Predict 3-Month Post-Surgical Survival in Metastatic Epidural Spinal Cord Compression Patients", *Spine Summit of American Association of Neurological Surgeons, 2020.* (Oral presentation)

V. Marks, **KVS** et al, "Human intracranial EEG reveals neural correlates of verbal memory processing across the large-scale of brain dynamics", *Society for Neuroscience, 2019.*

C. Topcu, **KVS** et al, "Human verbal memory encoding is distributed across a broad range of electrophysiological activities and brain regions", *Society for Neuroscience, 2019.*

I. Balzekas*, **KVS*** et al, "Measuring the response of epileptic tissue to cognitive tasks: Event related potentials in hippocampal seizure onset zone", *Annual Meeting of the American Epilepsy Society, 2018.*

RESEARCH PROJECTS

NOV 2019 – PRESENT

Microbiome analyses of liver cirrhosis patients with brain dysfunction

Guide: Prof. Ravishankar Iyer, *UIUC*; Dr. Jasmohan Bajaj, *Virginia Commonwealth University*

Developing machine learning and analytics methods to study gut microbiome of patients in whom liver cirrhosis leads to brain dysfunction to reveal disease mechanism.

AUG 2018 – PRESENT

Modelling cognitive decline in aging population

Guide: Prof. Ravishankar Iyer, *UIUC*; Dr. Prashanthi Vemuri, *Mayo Clinic*

Modelled human cognition in aging and diseased population for predicting cognitive decline from multi-modal imaging data and clinical variables. Model achieved state-of-the-art performance and model interpretation is highlighting brain regions important for cognition.

Jul 2018 – Present
Memory task-based biomarker for epilepsy seizure onset zone localization
Guide: Prof. Ravishankar Iyer, *UIUC*; Dr. Gregory Worrell, *Mayo Clinic*

Studying the memory task induced difference in EEG signal spectrum from epileptogenic tissue and normal tissue to define a task-based biomarker for localizing epileptogenic tissue in the brain.

May 2018 – Sep 2018
Electrode selection for memory encoding prediction model
Guide: Prof. Ravishankar Iyer, *UIUC*; Dr. Gregory Worrell, *Mayo Clinic*

Designed a heuristic for selecting a fraction of electrodes in brain-implants to reduce computational cost of human memory prediction model. Achieved 35% reduction in cost of inference with negligible loss in accuracy.

Jan 2017 – May 2018
Electrode selection for understanding memory
Guide: Prof. Ravishankar Iyer, *UIUC*; Dr. Gregory Worrell, Dr. Michal Kucewicz *Mayo Clinic*

Designed a fully-automated, machine learning based method for identifying a subset of intracranial EEG electrodes measuring memory related activity by using data from multiple subjects. More than 95% of the results from electrode selection were in agreement with electrodes identified by an expert visually.

Jan 2016 – Jun 2016
Index Policy for Dynamic Pricing
Guide: Prof. Vivek Borkar, *IIT Bombay*; Dr. Ravikumar Karumanchi, *Innovation Labs, TCS*

Modelled the arrival and service of jobs in a cloud computing system and cast the resource allocation and pricing problem in the Multiarmed Bandit framework. Proved Whittle indexability and demonstrated the fairness of Whittle pricing policy compared to other pricing policies.

Jul 2015 – Jun 2016
Parallel and distributed approaches to Graph based Semi-Supervised Learning
Guide: Prof. Vivek Borkar, *IIT Bombay*; Dr. Konstantin Avrachenkov, *INRIA Sophia Antipolis*

The aim was to develop a method to classify each node in a multi-class graph given a few labelled nodes from each class and the structure of the graph. We developed a distributed and asynchronous algorithm for graph based semi-supervised learning and tested its performance on real and synthetic graphs.

Dec 2014 - Feb 2015
Composer Classification based on Temporal Coding in Adaptive Spiking Neural Networks
Guide: Prof. Bipin Rajendran, *Department of Electrical Engineering, IIT Bombay*

Identify the composer of a previously unheard composition given knowledge about composing style of various composers. We designed a 4-layer spiking neural network with spike timing dependent plasticity to classify musical compositions and achieved an accuracy of 95.4%

Academic Projects

Spring 2020 Microbiome analysis using graphical models | *Probabilistic Graphical Models*
Fall 2018 Multi-modal Classification of Alzheimer's Disease | *Machine Learning for Computational Biology*
Spring 2017 Classification of Intracranial EEG Signals using Hidden Markov Models | *Pattern Recognition*
Fall 2016 Pseudo Random Number Generation using Markov Chains | *Computer Systems Analysis*
Spring 2014 Audio to Image Wavelet Transform based Audio Steganography | *Wavelets*
Fall 2014 Music and Rhythms Perception using Spiking Neural Networks | *Neuromorphic Engineering*
Crowdsourcing and Collusion Detection | *Research and Development 1*
Formant Tracking using Extended Kalman Filter | *Estimation and Identification*

Teaching Assistant

Spring 2019 **Data Science and Analytics**, Electrical and Computer Engineering, UIUC
Head TA for the course with over 70 students; contributing to creating lectures, conducting discussion sessions and overseeing the preparation of homeworks, exams and mini-projects.

Spring 2017 **Introduction to Probability**, Electrical and Computer Engineering Department, UIUC
Prepared homeworks, quizzes, and exams, held office hours and graded answer scripts for over 70 students

Spring 2016 **Introduction to Probability**, Electrical Engineering Department, IIT Bombay
Prepared quiz questions and graded answer scripts for over 30 students

Fall 2015 **Signals and Systems**, Electrical Engineering Department, IIT Bombay
Conducted tutorial sessions, prepared quiz questions, and graded answer scripts for over 50 students

Industry Experience

Summer 2017 **Anomaly Detection for Networking Data**
Cisco, San Jose, CA | *Mentor*: Mr. Aparup Banerjee

Developed an unsupervised anomaly detection algorithm for networking data using Recurrent Neural Networks. Validated the algorithm's performance on two real world datasets.

Summer 2015 **ML methods for estimation of Option Combination penetration in Vehicle Sales**
Innovation Labs, Tata Consultancy Services, India | *Mentor:* Dr. R. Karumanchi

Built a probability model on vehicle sales data for estimating sales maximising options combination.

Summer 2014 **Gesture Recognition using FMCW Radar with low angle resolution**
Texas Instruments, India | *Mentor:* Mr. Sandeep Rao

Developed a gesture recognition algorithm for hand gestures performed in front of multi-radar chip; achieved a recognition accuracy of 87% within 1m of the chip

Mentorship and Leadership

Sep 2019 – Present **Undergraduate Mentor**, CSL, UIUC
Mentored two undergraduate students on research projects as part of their training.

Feb 2019 – Present **Session Chair**, Coordinated Sciences Lab Student Conference 2020, UIUC
Session chair for the Health Informatics and Computational Biology track in the conference. Invited faculty speaker, reviewed student abstract submissions, and organized the session.

Apr 2014 – Mar 2015 **Coordinator**, Department Academic Mentorship Program, EE Dept, IIT Bombay
Spearheaded a team of 24 mentors to counsel and motivate academically underperforming students. For that, we organised academic help sessions, enhanced faculty-student interaction by means of face-to-face sessions and created DAMP website for student welfare.

Apr 2013 – Apr 2016 **Institute** & **Department Student Mentor**, Student Mentorship Program, IIT Bombay
Guided 24 freshmen as an institute mentor, helping them cope up with the academics, hostel life and social culture of the university. Counselled 3 students on a one-to-one basis as department mentor, helping improve their academics.

Apr 2013 – Mar 2014 **Manager**, Robotics Club, IIT Bombay
Led a team of 8 to organise competitions, workshops and talks on robotics

Relevant Coursework

Graduate	Random Processes, Pattern Recognition, Machine Learning for Computational Biology, Applied Multivariate Statistics, Probabilistic Graphical Models
Undergrad-uate	Motor Control in Health and Disease, Adaptive Signal Processing, Markov Chains and Queuing, Optimization, Neuromorphic Engineering, Healthtech Innovation and Design
MOOC	Computational Neuroscience