Krishnakant V. Saboo

Personal Information

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Research Interests

- Machine Learning for Healthcare
- Alzheimer's disease
- Epilepsy
- Microbiome

Education

2016 – **University of Illinois, Urbana-Champaign**
Doctoral Degree
Advisor: Prof. Ravishankar K. Iyer
Electrical and Computer Engineering (ECE)

2011 – 2016 **Indian Institute of Technology Bombay**, Mumbai, India
Dual Degree (Bachelor of Technology + Master of Technology)
Advisor: Prof. Vivek Borkar
Electrical Engineering (EE) with specialisation in Communication and Signal Processing

Awards and Honors

2021	Paul D. Doolen Scholarship for the Study of Aging, University of Illinois System
2021	Selected (top 5%) for the Center for Brain, Minds, and Machines Summer School 2021
2021	Elsa and Floyd Dunn Award for outstanding research in bioengineering, UIUC
2020	Mavis Future Faculty Fellowship for distinction in research and teaching, UIUC
2020	IEEE ISBI Student Travel Grant
2020	Rambus Fellowship in Electrical and Computer Engineering, UIUC
2019	Mayo Clinic/Illinois Fellowship for Technology-based Healthcare Research 2019-2020, UIUC
2019	Outstanding Teaching Assistant Award, UIUC
2017	Mayo Clinic/Illinois Fellowship for Technology-based Healthcare Research 2017-2019, UIUC
2016	Undergraduate Research Award for outstanding research contribution, IIT-B
2015	Recognition for outstanding contribution as Institute Student Mentor, IIT-B
2015	Outstanding performance as Coordinator, Dept. Academic Mentorship Program, IIT-B
2015	Institute Academic Prize for ranking 2nd in Dual Degree EE Program, IIT-B
2015	IEEE CIS Student Travel Award
2011	Gold medal, Indian National Chemistry Olympiad

Publications

(* denotes equal contribution and † denotes alphabetical ordering)

Journal

- **KVS**, C. Hu, Y. Varatharajah, S. A. Przybelski, R. I. Reid, C. G. Schwarz, J. Graff-Radford, D. S. Knopman, M. M. Machulda, M. M. Mielke, R. C. Petersen, P. M. Arnold, G. A. Worrell, D. T. Jones, C. R. Jack Jr., R. K. Iyer*, P. Vemuri*, "Deep learning identifies brain structures that predict cognition and explain heterogeneity in cognitive aging", ***NeuroImage*** 2022 [Link].
- **KVS**, N. Petrakov, A. Shamsaddini, A. Fagan, E. A. Gavis, M. Sikaroodi, S. McGeorge, P. Gillevet, R. K. Iyer, J. S. Bajaj, "Stool microbiota are superior to saliva in distinguishing cirrhosis and hepatic encephalopathy using machine learning", ***Journal of Hepatology*** 2021 [Link].
- V. S. Marks, **KVS**, C. Topcu, T. P. Thayib, P. Nejedly, V. Kremen, G. A. Worrell, M. T. Kucewicz, "Independent dynamics of slow, intermediate, and fast intracranial EEG spectral activities during human memory formation", ***NeuroImage*** 2021 [Link].

- **KVS***, I. Balzekas*, V. Kremen, Y. Varatharajah, M. T. Kucewicz, R. K. Iyer, G. A. Worrell, "Leveraging electrophysiologic correlates of word encoding to map seizure onset zone in focal epilepsy: Task-dependent changes in epileptiform activity, spectral features, and functional connectivity", ***Epilepsia*** 2021 [Link].
- C. Hu, V. Anjur, **KVS**, K. R. Reddy, J. O'Leary, P. Tandon, F. Wong, G. Garcia-Tsao, P. S. Kamath, J. C. Lai, S. W. Biggins, M. B. Fallon, P. Thuluvath, R. M. Subramaian, B. Maliakkal, H. Vargas, L. R. Thacker, R. K. Iyer, J. S. Bajaj, "Low predictability of Readmissions and Death Using Machine Learning in Cirrhosis", ***American Journal of Gastroenterology*** 2020 [Link].
- **KVS***, A. Shamsaddini*, M. V. Iyer, C. Hu, A. Fagan, E. A. Gavis, M. B. White, M. Fuchs, D. M. Heuman, M. Sikaroodi, R. K. Iyer, P. M. Gillevet, J. S. Bajaj, "Sex is associated with differences in gut microbial composition and function in hepatic encephalopathy", ***Journal of Hepatology*** 2020 [Link].
- **KVS**, Y. Varatharajah, B. M. Berry, V. Kremen, M. R. Sperling, K. A. Davis, B. C. Jobst, R. E. Gross, B. Lega, S. A. Sheth, G. A. Worrell, R. K. Iyer, M. T. Kucewicz, "Unsupervised machine learning classification of electrophysiologically active electrodes during human cognitive task performance", ***Nature Scientific Reports*** *9* 2019 [Link].
- M. T. Kucewicz, **KVS**, B. M. Berry, V. Kremen, L. R. Miller, F. Khadjevand, C. S. Inman, P. Wanda, M. R. Sperling, R. Gorniak, K. A. Davis, B. C. Jobst, B. Lega, S. A. Sheth, D. S. Rizzuto, R. K. Iyer, M. J. Kahana, G. A. Worrell, "Human verbal memory encoding is hierarchically distributed in a continuous processing stream", ***eNeuro*** 6.1, 2019 [Link].
- V.S. Borkar†, R. Karumanchi†, **KVS**†, "An index policy for dynamic pricing in cloud computing under price commitments", ***Applicationes Mathematicae Journal*** 2017 [Link].

Conference (Peer-reivewed full papers)

- **KVS**, A. Choudhary, Y. Cao, G. A. Worrell, D. T. Jones, R. K. Iyer, "Reinforcement learning-based disease progression model for Alzheimer's disease", *Advances in Neural Information Processing Systems (**NeurIPS**)* 2021 [Link].
- **KVS**, C. Hu, Y. Varatharajah, P. Vemuri, R. K. Iyer, "Predicting longitudinal cognitive scores using baseline imaging and clinical variables", *IEEE International Symposium on Biomedical Imaging (**ISBI**)* 2020 [Link]. (Oral presentation)
- **KVS**, Y. Varatharajah, B. M. Berry, M. R. Sperling, R. Gorniak, K. A. Davis, B. C. Jobst, R. E. Gross, B. Lega, S. A. Sheth, M. J. Kahana, M. T. Kucewicz, G. A. Worrell, R. K. Iyer, "A computationally efficient model for predicting successful memory encoding using machine learning-based EEG channel selection", *International IEEE EMBS Conference on Neural Engineering (**NER**)* 2019 [Link].
- Y. Varatharajah, M.J. Chong, **KVS**, B. M. Berry, B. Brinkmann, G. A. Worrell, R. K. Iyer, "EEG-GRAPH: A factor graph-based model for capturing spatial, temporal, and observational relationships in electroencephalograms", *Advances in Neural Information Processing Systems (**NeurIPS**)* 2017 [Link].
- C. P. Narisetty*, **KVS***, and B. Rajendran, "Composer classification based on temporal coding in adaptive spiking neural networks", *International Joint Conference on Neural Networks (**IJCNN**)* 2015 [Link].

Book Chapter

- M. T. Kucewicz, **KVS**, G. A. Worrell, "How can we identify electrophysiological iEEG activities associated with cognitive functions?", *to appear.*

Workshop

- Y. Varatharajah, **KVS**, R. K. Iyer, S. Przybelski, C. Schwarz, R. Petersen, C. R. Jack Jr., P. Vemuri, "A joint model for predicting structural and functional brain health in elderly individuals", *IEEE International Conference on Bioinformatics and Biomedicine (**BIBM**), BHI Workshop* 2019 [Link].
- K. Avrachenkov, V.S. Borkar and **KVS**, "Distributed and asynchronous methods for semi-supervised learning", *Workshop on Algorithms and Models of the Web-Graph (**WAW**)* 2016 [Link].

Patent

- **KVS** and S. Rao, "Gesture recognition using frequency modulated continuous wave radar with low angle resolution", ***U.S. Patent*** *9,817,109.*

Talks and Presentations

Nov 2021	Data Science for Mental Health SIG, Alan Turing Institute, UK. (Invited)
Oct 2021	CSL Social Hour, UIUC. (Invited)
Apr 2021	The Center for AI Driven Health Data Systems and Analytics, UIUC. (Invited)
Apr 2020	IEEE International Symposium on Biomedical Imaging, Iowa. (Conference)
Sep 2019	CSL Social Hour, UIUC. (Invited)
Sep 2017	CompGen Student Lightening talk, Institute for Genomic Biology, UIUC. (Invited)
May 2017	DARPA Restoring Active Memory Project update. (Invited)

Research Projects

Aug 2020 – Present **Modelling pathology and recovery processes in Alzheimer's diseases**
Guides: Prof. Ravishankar Iyer, *UIUC*; Drs. Gregory Worrell, David Jones *Mayo Clinic*

Developed a domain knowledge and reinforcement learning-based model that integrates pathological and recovery processes in the brain to improve prognosis of Alzheimer's disease. Working on a probabilistic extension of the model to incorporate model uncertainty.

Aug 2018 – Jan 2022 **Modelling cognitive decline in aging population**
Guides: Prof. Ravishankar Iyer, *UIUC*; Dr. Prashanthi Vemuri, *Mayo Clinic*

Predicted 5-year future cognitive decline in aging and diseased populations from multi-modal imaging data and clinical variables. Model interpretation revealed brain structures important for coping with age-related neuropathologies.

Jul 2018 – Aug 2021 **Memory task-based biomarker for epilepsy seizure onset zone localization**
Guides: Prof. Ravishankar Iyer, *UIUC*; Dr. Gregory Worrell, *Mayo Clinic*

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

Nov 2019 – Jul 2020 **Microbiome analyses of liver cirrhosis patients with brain dysfunction**
Guides: Prof. Ravi Iyer, *UIUC*; Dr. Jasmohan Bajaj, *Virginia Commonwealth University*

Developed machine learning and statistical methods to reveal disease mechanism of gut microbiome-driven brain dysfunction in patients with advanced liver cirrhosis.

Jan 2017 – Sep 2018 **Active electrode selection for understanding verbal memory processing**
Guides: Prof. Ravishankar Iyer, *UIUC*; Dr. Gregory Worrell, Dr. Michal Kucewicz *Mayo Clinic*

Designed fully-automated, machine learning-based methods for identifying a subset of intracranial EEG electrodes measuring memory related activity to reduce computational cost of human memory performance prediction and understanding verbal memory processing.

Teaching

Spring 2021	Head TA, **Data Science and Analytics**, ECE, UIUC
Summer 2020	Instructor, **Machine Learning Summer Course**, Virtual
Spring 2019	Head TA, **Data Science and Analytics**, ECE, UIUC
Spring 2017	TA, **Introduction to Probability**, ECE, UIUC
Spring 2016	TA, **Introduction to Probability**, EE, IIT-B
Fall 2015	TA, **Signals and Systems**, EE, IIT-B

Industry Experience

Summer 2017 **Cisco**, San Jose, CA | *Mentor*: Mr. Aparup Banerjee
Deep learning-based anomaly detection in time series networking data

Summer 2015	**Innovation Labs, Tata Consultancy Services**, India | *Mentor:* Dr. R. Karumanchi *ML methods for estimation of option combination penetration in vehicle sales*
Summer 2014	**Texas Instruments**, India | *Mentor:* Mr. Sandeep Rao *Gesture recognition using FMCW radar with low angle resolution*

Mentorship and Leadership

Sep 2019 – Present	**Undergraduate and Graduate Mentor**, CSL, UIUC Mentored two undergraduate students and several graduate students on their research projects.
Apr 2014 – Mar 2015	**Coordinator**, Department Academic Mentorship Program, EE Dept, IIT Bombay Headed a team of 24 mentors to counsel academically underperforming students through one-on-one mentoring, academic help sessions, faculty-student interaction, and online resources.
Apr 2013 – Apr 2016	**Institute** & **Department Student Mentor**, Student Mentorship Program, IIT Bombay Mentored 24 freshmen in transitioning to university life and coping with academics. Counselled 3 students on a one-to-one basis as department mentor to help improve their academic standing.
Apr 2013 – Mar 2014	**Manager**, Robotics Club, IIT Bombay Led a team of 8 in organising competitions, workshops, and talks on robotics.

Service

2020	**Reviewer**, NeurIPS ML4H Workshop; International Journal of Neural Systems
Feb 2019 – Feb 2020	**Session Chair**, Coordinated Sciences Lab Student Conference (CSLSC) 2020, UIUC Session chair for Health Informatics and Computational Biology track, CSLSC. Invited a faculty speaker, reviewed student abstract submissions, and organized the session.