

# KRISHNAKANT V. SABOO

## PERSONAL INFORMATION

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WEBPAGE <https://kvsaboo.github.io/>

## RESEARCH INTERESTS

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Developing machine learning and computational models to improve the diagnosis, treatment, and understanding of neurological disorders using brain imaging, electrophysiology, multiomics, and clinical data.

## WORK EXPERIENCE

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<b>University of California, San Francisco, CA</b> – Postdoctoral Scholar <i>Mentor: Prof. Edward Chang   ML-based brain stimulation for epilepsy.</i>	OCT 2023 - PRESENT
<b>Microsoft Research</b> , Cambridge, MA – Research Intern <i>Mentor: Dr. Kristen Severson   Probabilistic modelling of Parkinson's disease progression.</i>	MAY - AUG 2022
<b>Cisco</b> , San Jose, CA – Research Intern <i>Mentor: Mr. Aparup Banerjee   Deep learning-based anomaly detection in networking data.</i>	MAY - AUG 2017
<b>Innovation Labs, Tata Consultancy Services</b> , India - Summer Intern <i>Mentor: Dr. R. Karumanchi   Estimation of option combination penetration in vehicle sales.</i>	MAY - JUL 2015
<b>Texas Instruments</b> , India - Summer Intern <i>Mentor: Mr. Sandeep Rao   Gesture recognition using FMCW radar with low angle resolution.</i>	MAY - JUL 2014

## EDUCATION

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<b>University of Illinois, Urbana-Champaign</b> <i>Doctoral Degree, Electrical and Computer Engineering</i> <i>Advisor: Prof. Ravishankar K. Iyer</i>	2016 – 2023
<b>Indian Institute of Technology Bombay, Mumbai, India</b> <i>Dual Degree (Bachelor of Technology + Master of Technology), Electrical Engineering</i> <i>Advisor: Prof. Vivek Borkar</i>	2011 – 2016

## AWARDS AND HONORS

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Schmidt Science Fellows postdoctoral fellowship	2023 – 2025
Young Investigator Award, American Epilepsy Society (AES) 2022 Annual Meeting	2022
Landmark paper, European Association for the Study of the Liver	2022
Dissertation Completion Fellowship, Graduate College, UIUC	2022 – 2023
Paul D. Doolen Scholarship for the Study of Aging, University of Illinois System	2021
Elsa and Floyd Dunn Award for outstanding research in bioengineering, UIUC	2021
Mavis Future Faculty Fellowship for distinction in research and teaching, UIUC	2020
Rambus Fellowship in Electrical and Computer Engineering, UIUC	2020
Outstanding Teaching Assistant Award, UIUC	2019
Mayo Clinic/Illinois Fellowship for Technology-based Healthcare Research	2017 – 2020
Undergraduate Research Award for outstanding research contribution, IIT-B	2016
Institute Academic Prize for ranking 2 <sup>nd</sup> in Dual Degree EE Program, IIT-B	2015
Gold medal, Indian National Chemistry Olympiad	2011

## PUBLICATIONS

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(\* denotes equal contribution and † denotes alphabetical ordering)

### Journal

11. **K. V. Saboo**, Y. Cao, V. Kremen, V. Sladky, N. M. Gregg, P. M. Arnold, P. J. Karoly, D. R. Freestone, M. J. Cook, G. A. Worrell, R. K. Iyer, “Individualized seizure cluster prediction using machine learning and chronic ambulatory intracranial EEG”, *IEEE Transactions on NanoBioscience* 2023 [\[Link\]](#).
10. C. Topcu, V. S. Marks, **K. V. Saboo**, M. Lech, P. Nejedly, V. Kremen, G. A. Worrell, M. T. Kucewicz, “Hotspot of human verbal memory encoding in the left anterior prefrontal cortex”, *eBioMedicine*, 2022 [\[Link\]](#).
9. **K. V. Saboo**, 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 [\[Link\]](#).
8. **K. V. Saboo**, 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* 2022 [\[Link\]](#).
7. V. S. Marks, **K. V. Saboo**, 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 [\[Link\]](#).
6. **K. V. Saboo\***, 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 [\[Link\]](#).
5. C. Hu, V. Anjur, **K. V. Saboo**, 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* 2021 [\[Link\]](#).
4. **K. V. Saboo\***, 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* 2021 [\[Link\]](#).
3. **K. V. Saboo**, 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 [\[Link\]](#).
2. M. T. Kucewicz, **K. V. Saboo**, 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 [\[Link\]](#).
1. V.S. Borkar†, R. Karumanchi†, **K. V. Saboo†**, “An index policy for dynamic pricing in cloud computing under price commitments”, *Applications Mathematicae Journal* 2017 [\[Link\]](#).

### Conference (Peer-reviewed proceedings papers)

9. A. Choudhary, A. Hwang, J. Kechter, **K. V. Saboo**, B. Bordeaux, P. Bhullar, N. Comfere, D. DiCaudo, S. Nelson, E. Johnson, L. Swanson, D. Murphree, A. Mangold, R. K. Iyer, “RACR-MIL: Weakly Supervised Skin Cancer Grading using Rank-Aware Contextual Reasoning on Whole Slide Images”, *under review* 2023 [\[Link\]](#).
8. C. Hu, **K. V. Saboo**, A. H. Ali, B. D. Juran, K. N. Lazaridis, R. K. Iyer, “REMEDI: REinforcement learning-driven adaptive MEtabolism modeling of primary sclerosing cholangitis DIsease progression”, *Machine Learning for Health (ML4H)* 2023 [\[Link\]](#).
7. Y. Cao, **K. V. Saboo**, V. Kremen, V. Sladky, N. M. Gregg, P. M. Arnold, S. Pappu, P. J. Karoly, D. R. Freestone, M. J. Cook, G. A. Worrell, R. K. Iyer, “A Transfer Learning-based Model for Individualized

Clustered Seizure Prediction using Intracranial EEG”, *International IEEE EMBS Conference on Neural Engineering (NER)* 2023 [[Link](#)].

6. **K. V. Saboo**, Y. Cao, V. Kremen, V. Sladky, N. M. Gregg, P. M. Arnold, P. J. Karoly, D. R. Freestone, M. J. Cook, G. A. Worrell, R. K. Iyer, “Individualized seizure cluster prediction using machine learning and ambulatory intracranial EEG”, *IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* 2022 [[Link](#)]. (Oral presentation)
5. **K. V. Saboo**, 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](#)].
4. **K. V. Saboo**, 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)
3. **K. V. Saboo**, 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](#)].
2. Y. Varatharajah, M.J. Chong, **K. V. Saboo**, 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](#)].
1. C. P. Narisetty\*, **K. V. Saboo\***, 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

1. M. T. Kucewicz, **K. V. Saboo**, G. A. Worrell, “How can we identify electrophysiological iEEG activities associated with cognitive functions?”, *Intracranial EEG: A Guide for Cognitive Neuroscience*. Springer, 2023 [[Link](#)].

### Workshop

2. Y. Varatharajah, **K. V. Saboo**, 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](#)].
1. K. Avrachenkov, V.S. Borkar and **K. V. Saboo**, “Distributed and asynchronous methods for semi-supervised learning”, *Workshop on Algorithms and Models of the Web-Graph (WAW)* 2016 [[Link](#)].

### Patent

1. **K. V. Saboo** and S. Rao, “Gesture recognition using frequency modulated continuous wave radar with low angle resolution”, *U.S. Patent 9,817,109*.

### Select Abstracts

5. **K. V. Saboo** et al., “Exploring the Relationship Between Multiday Cycles in Intracranial EEG Features and Cycles in Seizure Clusters”, *Annual Meeting of the American Epilepsy Society (AES)*, 2023.
4. S. Mosovsky, **K. V. Saboo**, et al., “An Open-Access Model for Parkinson’s Disease Progression”, *International Congress of Parkinson’s Disease and Movement Disorders*, 2023.
3. **K. V. Saboo** et al., “Predicting Seizure Clusters using Ambulatory Intracranial EEG in People with Focal Epilepsy”, *Annual Meeting of the American Epilepsy Society (AES)*, 2022. (Oral presentation)
2. **K. V. Saboo** et al., “Microbiota in stool are superior to saliva in differentiating cirrhosis and hepatic encephalopathy using artificial intelligence approaches”, *Digestive Disease Week (DDW)* 2021. (Oral presentation)
1. **K. V. Saboo** et al., “AI techniques demonstrate better prediction for 90-day readmission and death in women than in men with cirrhosis”, *Digestive Disease Week (DDW)* 2020. (Oral presentation)

## TALKS AND PRESENTATIONS

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UCSF Deep Brain Stimulation Data Analysis Meeting, San Francisco CA. (Invited)	Mar 2023
CSL Student Conference Computational Biology and Healthcare session, UIUC. (Conference)	Feb 2023
IEEE International Conference on Bioinformatics and Biomedicine, Las Vegas NV. (Conference)	Dec 2022
American Epilepsy Society Annual Meeting, Nashville TN. (Conference)	Dec 2022
Data Science for Mental Health SIG, Alan Turing Institute, UK. (Invited)	Nov 2021
Coordinated Science Laboratory Social Hour, UIUC. (Invited)	Oct 2021
The Center for AI Driven Health Data Systems and Analytics, UIUC. (Invited)	Apr 2021
IEEE International Symposium on Biomedical Imaging, Iowa. (Conference)	Apr 2020
Coordinated Science Laboratory Social Hour, UIUC. (Invited)	Sep 2019
CompGen Student Lightning talk, Institute for Genomic Biology, UIUC. (Invited)	Sep 2017
DARPA Restoring Active Memory Project update. (Invited)	May 2017

## RESEARCH PROJECTS

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<b>Predicting seizure clustering in epilepsy</b>	MAR 2022 –
<i>Guides:</i> Prof. Ravishankar Iyer, <i>UIUC</i> ; Dr. Gregory Worrell <i>Mayo Clinic</i>	SEP 2023
Demonstrated that bivariate features extracted from intracranial EEG data are indicative of seizures clustering. Developing a model to predict whether a seizure will recur shortly after another seizure (clustering) based on this insight to guide anticonvulsant drug administration.	
<b>Modelling pathology and recovery processes in Alzheimer's diseases</b>	AUG 2020 –
<i>Guides:</i> Prof. Ravishankar Iyer, <i>UIUC</i> ; Dr. Gregory Worrell, Dr. David Jones <i>Mayo Clinic</i>	NOV 2021
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.	
<b>Modelling cognitive decline in aging population</b>	AUG 2018 –
<i>Guides:</i> Prof. Ravishankar Iyer, <i>UIUC</i> ; Dr. Prashanthi Vemuri, <i>Mayo Clinic</i>	JAN 2022
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.	
<b>Memory task-based biomarker for epilepsy seizure onset zone localization</b>	JUL 2018 –
<i>Guides:</i> Prof. Ravishankar Iyer, <i>UIUC</i> ; Dr. Gregory Worrell, <i>Mayo Clinic</i>	AUG 2021
Studied 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.	
<b>Microbiome analyses of liver cirrhosis patients with brain dysfunction</b>	NOV 2019 –
<i>Guides:</i> Prof. Ravi Iyer, <i>UIUC</i> ; Dr. Jasmohan Bajaj, <i>Virginia Commonwealth University</i>	JUL 2020
Developed machine learning and statistical methods to reveal disease mechanism of gut microbiome-driven brain dysfunction in patients with advanced liver cirrhosis.	
<b>Active electrode selection for understanding verbal memory processing</b>	JAN 2017 –
<i>Guides:</i> Prof. Ravi Iyer, <i>UIUC</i> ; Dr. Gregory Worrell, Dr. Michal Kucewicz <i>Mayo Clinic</i>	SEP 2018
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

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<b>Head TA</b> , Data Science and Analytics, ECE, UIUC	SPRING 2021
Coordinated the efforts of other TAs, created lecture slides, conducted discussion sessions, and oversaw the preparation of homeworks, exams and mini-projects.	
<b>Instructor</b> , Machine Learning Summer Course, Virtual	SUMMER 2020
Envisioned and developed the course for students with a high school background in mathematics. Designed and marketed the course, and created and delivered interactive lectures.	

<b>Head TA</b> , Data Science and Analytics, ECE, UIUC Coordinated the efforts of other TAs, created lecture slides, conducted discussion sessions, and oversaw the preparation of homeworks, exams and mini-projects.	SPRING 2019
<b>TA</b> , Introduction to Probability, ECE, UIUC Prepared and graded homeworks, exams, and mini-projects and conducted office hours.	SPRING 2017
<b>TA</b> , Introduction to Probability, EE, IIT-B Graded homeworks and exams and addressed students' queries.	SPRING 2016
<b>TA</b> , Signals and Systems, EE, IIT-B Graded homeworks and exams and addressed students' queries.	FALL 2015

## MENTORSHIP AND LEADERSHIP

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<b>Undergraduate and Graduate Mentor</b> , CSL, UIUC Mentored several undergraduate and graduate students on their research projects.	SEP 2019 – JUL 2023
<b>Coordinator</b> , 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 <a href="#">online resources</a> .	APR 2014 – MAR 2015
<b>Institute &amp; Department Student Mentor</b> , Student Mentorship Program, IIT Bombay Mentored 24 freshmen in transitioning to university life and coping with academics. Counselling 3 students on a one-to-one basis as department mentor to help improve their academic standing.	APR 2013 – APR 2016
<b>Manager</b> , Robotics Club, IIT Bombay Led a team of 8 in organising competitions, workshops, and talks on robotics.	APR 2013 – MAR 2014

## SERVICE

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<b>Reviewer</b> , IEEE EMBC 2023; Expert Systems with Applications; <b>Review Editor</b> , Frontiers in Computational Neuroscience	2023
<b>Reviewer</b> , Cerebral Cortex; <b>Student Volunteer</b> , IEEE BIBM 2022	2022
<b>Reviewer</b> , NeurIPS ML4H Workshop; International Journal of Neural Systems	2020
<b>Session Chair</b> , 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.	FEB 2019 – FEB 2020