

# VARUN MACHHALE KUMAR

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## EDUCATION

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<b>Purdue University</b> <i>M.S. in Electrical and Computer Engineering; CGPA: 3.71/4</i>	Aug 2022 – Dec 2024 West Lafayette, US
<b>National Institute of Technology Karnataka</b> <i>BTech. in Electronics and Communication Engineering; CGPA: 9.70/10; Rank: 2/106</i>	Jul 2017 – May 2021 Mangalore, India

## EXPERIENCE

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<b>Visiting Research Scholar: Software developer</b> <i>Advisor: Dr. A. A. Chubykin, Biological Sciences, Purdue University</i> Project title: End-to-end software pipeline for neural data analysis using Neuropixels probes <ul style="list-style-type: none"><li>Spearheaded the development of a modular Python package for neural data analysis, improving data preprocessing and analysis efficiency of Neuropixels recordings by 10x</li><li>Mentored team members on implementation, version control (Git), and reproducible workflows to deliver scalable and maintainable solutions</li></ul> Project title: Theta oscillatory recurrent network simulation using Izhikevich spiking neuron model <ul style="list-style-type: none"><li>Reproduced and validated the Izhikevich spiking neuron model in Python while ensuring accurate dynamical behavior of cortical network simulation</li><li>Designed and implemented a 3-population network visual cortical network (L4, L2/3, L5) to investigate how feedback from Layer 5 to Layer 4 inhibitory neurons contribute to theta oscillations following visual familiarity</li></ul>	June 2025 – Feb 2026 West Lafayette, US
<b>Graduate Research Assistant</b> <i>Advisors: Dr. A. A. Chubykin, Biological Sciences and Dr. J. G. Makin, ECE, Purdue University</i> Thesis Title: Probing memory encoding using theta oscillations in deep neural networks   <a href="#">Thesis</a> <ul style="list-style-type: none"><li>Modeled a wet-lab experimental finding by using predictive coding theory in a deep neural network to elicit theta-band oscillations post familiarity to stimuli</li><li>Validated biological plausibility of the neural network by observing a 4% increase in theta-band power for familiar stimuli and 0.8% decrease for novel stimuli</li></ul> Thesis title: Studying impairments in FragileX mice using machine learning   <a href="#">Thesis</a> <ul style="list-style-type: none"><li>Designed a machine learning decoder to distinguish input stimuli and mice genotypes achieving upto 96% accuracy, demonstrating strong skills in both ML and neuroscience</li><li>Corroborated experimental findings with ML-driven neural data analysis and suggested a probable model of dysfunction in FragileX mice</li></ul>	Aug 2023 – Dec 2024 West Lafayette, US
<b>Undergraduate Research Intern</b> <i>Advisor: Dr. H. J. Pandya, Department of Electronic Systems Engineering, IISc</i> Thesis Title: Automated epilepsy subtype classification using EEG Signals   <a href="#">Publication</a> <ul style="list-style-type: none"><li>Developed and patented a classification algorithm that uses time-series EEG signals to classify epileptic subtypes with 91% accuracy, demonstrating strong experience with non-invasive neural data and signal processing</li><li>Worked with an interdisciplinary team comprising doctors to automate extraction of clinically observed epileptic signatures for classification to aid and reduce workload of neurologists in epilepsy screening</li></ul>	Jul 2020 – Sep 2021 Bangalore, India

## PATENTS AND PUBLICATIONS

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- [1] **Varun M. Kumar**, M. Zimmerman, M. Yin, K. Cragg, M. Gao, Y. Tang, S. Kissinger, A. A. Chubykin, “*LemonPy: A python software package for neural data analysis of Neuropixels recordings*” (2026) (In preparation)
- [2] X. Cheng, S. Nareddula, P. Zhang, M. Mahmoodi, P. A. Edens, V. Saldarriaga, K. Cragg, **Varun M. Kumar**, F. Huang, A. A. Chubykin, “*Visual cortical circuits for generating visual experience-dependent oscillations*” (2026) (In preparation)
- [3] M. P. Zimmerman, S. Nareddula, M. Yin, **Varun M. Kumar**, K. Cragg, V. Saldarriaga, A. Rotger, R. Lehman, P. Edens, J. G. Makin, A. A. Chubykin, “*Failed Inhibitory Control in Fmr1 KO Mice Tied to Disrupted Theta Oscillations in Visual Cortex*”, Cell Reports (May 2026; Accepted)
- [4] R. K. Joshi, **Varun Kumar M.**, M. Agrawal, L. Mohan, M. Jayachandra and H. J. Pandya. 2022. Epileptic Seizure Classification. Indian Patent No.: 558139 (Filed: August 10, 2022; Granted: January 17, 2025) | [Patent](#)
- [5] R. K. Joshi, **Varun Kumar M.**, M. Agrawal, A. Rao, L. Mohan, M. Jayachandra and H. J. Pandya, “*Spatiotemporal analysis of interictal EEG for automated seizure detection and classification*”, *Biomedical Signal Processing and Control (Impact factor: 5.076)*, vol. 79, p. 104086 (2023), doi:[10.1016/j.bspc.2022.104086](https://doi.org/10.1016/j.bspc.2022.104086)

## INTERESTS AND SKILLS

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**Research interests:** Computational Neuroscience, NeuroAI, Predictive Modeling, Generative Models, Computer Vision, Electrophysiology, Neurodegenerative disorders, Bioinformatics, Computational Genomics, Medical Imaging

**Data analysis:** Feature Engineering, Data Cleaning, Data Visualization, Statistical Analysis, Exploratory Data Analysis

**Frameworks and libraries:** PyTorch, TensorFlow, Keras, Scikit-learn, NumPy, Pandas, Matplotlib, Seaborn, OpenCV

**Programming tools:** Python, MATLAB, C++, Git

## COURSE PROJECTS

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- Vision transformers with learnable resizer networks** | [Github](#) Aug 2022 – Nov 2022
- Examined the effect of integrating learnable resizer modules in Vision Transformer models for image classification
  - Assessed model on two datasets: Beans dataset (0.97 score) and a subset of CIFAR10 dataset (0.95 score)
- TC-SegNet: Fully automated two-chamber echocardiogram segmentation** | [Github](#) Feb 2021 – Jan 2022
- Designed and implemented a two-chamber echocardiogram segmentation algorithm using deep learning
  - Demonstrated improved generalization using various performance metrics over existing deep learning architectures
- Speech enhancement using CNN-GAN** | [Github](#) Jan 2021 – Apr 2021
- Collaborated in a team to evaluate a time-frequency mask based approach for speech enhancement through convolutional generative adversarial networks (CNN-GAN)
  - Evaluated speech quality metrics between mask (PESQ score: 2.34) and non-mask based models (PESQ score: 2.05)

## AWARDS AND ACHIEVEMENTS

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- MPOWER Monthly Scholarship** Feb 2023  
*United States*
- The scholarship is awarded to international students studying in the US based on the applicant's qualifications, quality of essays submitted and applicant's potential as a scientist to make positive impact
  - Honorary Mention Winner for the June 2022 monthly scholarship
- DAAD WISE Scholarship** | [Certificate](#) Feb 2020  
*Bonn, Germany*
- The program targets around 100 students all over India pursuing a degree in the fields of science and engineering who wish to do a 2-3 months research internship at a publicly-funded German higher education institution
  - The scholarship was officially rescinded due to the COVID-19 pandemic
- CeNSE Scholarship** | [Certificate](#) Apr 2019  
*Indian Institute of Science, Bangalore, India*
- The scholarship program provides an opportunity for 26 undergraduate and masters students from India and abroad to intern at the Centre for Nano Science and Engineering, IISc for a period of 10 weeks
- NITK Institute Scholarship** Jan 2018 - Sept 2021  
*National Institute of Technology Karnataka, Mangalore, India*
- Every year top five meritorious students in every department are awarded the Institute scholarship from NITK
  - Received the scholarship thrice (except during COVID-19): Jan 2018, Jan 2019 and Sept 2021
- National level competitive examinations** 2017
- JEE Main: All India Rank 3448 (out of 1.2M candidates)
  - JEE Advanced: All India Rank 7945 (out of 50k candidates)