Duc Vu

☐ +1 (517)505−8554 | ✉ vuduc2@msu.edu | ⌂ https://tienducvunguyen.github.io | 🔗 https://www.linkedin.com/in/ducvu04/

Education

Michigan State University   *East Lansing, MI*

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING   *Aug 2022 - May 2026*

Honors: Dean's List, Honors College

Awards & Grants

Outstanding Undergraduate Researcher Award, Nominee (Results Pending), Computing Research Association (CRA)   *2025*

NSF REU Scholar, Mid-SURE Program, National Science Foundation (NSF)   *2024*

Professorial Assistantship, Michigan State University (MSU)   *2023,2024*

Research Experience

Signal Processing Lab, Michigan State University   *East Lansing, MI*

NSF-FUNDED UNDERGRADUATE RESEARCH ASSISTANT – PROF. SELIN AVIYENTE   *Aug 2022 – Present*

- Advanced research on Graph Signal Processing (GSP) and Graph Neural Networks (GNN) through developing novel algorithms.
- Led research projects and manuscript writing in collaboration with faculty,PhD students and postdocs.
- Developed a scalable processing pipeline using SLURM, AWS S3, MRtrix3, and FreeSurfer to analyze structural connectomes from 122 Human Connectome Project (HCP) subjects.
- Designed and implemented a novel hypergraph construction method from fMRI data to uncover overlapping communities in brain networks.
- Built graph filter optimization algorithms in MATLAB and applied them to EEG, fMRI, and dMRI datasets
- Improved on Non-negative Matrix Factorization (NMF) methods using hypergraph regularizers and alternating optimization.

Semantic Signals Lab, Carnegie Mellon University   *Pittsburgh, PA*

SUMMER RESEARCH INTERN – PROF. JUSTIN CHAN   *May 2025 – July 2025*

- Conducted user studies with 30+ participants to capture seismocardiogram (SCG) and electroocculogram (EOG) signals.
- Built motion artifact removal methods and designed 11-class classification pipeline for depth-based eye gestures.
- Engineered a high SNR heart-sound acquisition system using repurposed earbud speakers and custom-fitted in-ear adapter.
- Developed VR simulations on Meta Quest 2 and prototyped hardware like auto-adjustable focus glasses for potential applications.

Publications

PUBLISHED

Ortiz-Bouza, M.*, **Vu, D.***, Karaaslanli, A., Aviyente, S. (2025). Learning Graph Filters for Structure-Function Coupling based Hub Node Identification. *IEEE Transactions on Signal and Information Processing over Networks(TSIPN)*, 2025. doi:10.1109/TSIPN.2025.3595070 (*Equal Contribution)

- Processed fMRI and DWI data from 122 subjects in the Human Connectome Project (HCP), downloaded via AWS S3 and used FreeSurfer with MRtrix3 to construct both structural connectomes and fMRI time-series signals.
- Implemented and evaluated a learning-based graph filter framework using Alternating Direction Method of Multiplier (ADMM) alongside conventional machine learning models to generate hubnode results.
- Proposed a novel hyperparameter selection strategy based on cross-method result consistency and validated hub nodes based on global efficiency metrics.

- Parcellated connectomes to Glasser atlas (360-region) and mapped results to Yeo functional networks for inter-atlas comparison and performed consistency analysis using entropy-based metrics.
- Co-wrote the manuscript and contributed to the design, analysis, and presentation of results.

Vu, D., Ortiz-Bouza, M., Aviyente, S. (2024). Graph Filtering for Hub Node Identification in Brain Networks. *2024 IEEE International Symposium on Biomedical Imaging (ISBI)*, 1–5. doi:10.1109/ISBI56570.2024.10635215

- Adapted and optimized a learnable graph filter framework in MATLAB for application on EEG-derived brain networks.
- Applied the framework and conventional algorithms such as One-Class SVM and Eigenvector Centrality to EEG data from 20 patients, generating comparative results.
- Proposed a validation strategy using percentage of hub nodes in each region and analyzing temporal significance of hub node activity.

Vu, D., Aviyente, S. (2025). Hypergraph Overlapping Community Detection for Brain Networks. *2025 IEEE 35th International Workshop on Machine Learning for Signal Processing (MLSP)*, 1–6. doi:10.1109/MLSP62443.2025.11204303

- Proposed a non-supervised hypergraph-based overlapping community detection method using Lasso and Spectral Clustering for fMRI-derived brain networks.
- Validated detected communities by aligning with known ICA-derived networks and assessed consistency through randomized network scoring.
- Led the project from idea to result generation and wrote the majority of the manuscript.
- Clustered hyperedges using Jaccard Similarity and derived node overlapping membership through inheritance.

In Review

Zhang, S.*, Zhang, X.*, **Vu, D.**,*, Qiang, T.*, Palacios, C., Zhu, J., Wang, Y., Goel, M., Chan, J. (2025). LubDubDecoder: Bringing Micro-Mechanical Cardiac Monitoring to All Hearables. *2026 ACM CHI Conference on Human Factors in Computing Systems (CHI)*. arXiv:2509.10764 (*Equal Contribution)

- Co-wrote the manuscript in preparation for submission to CHI 2026.
- Designed and implemented an in-ear high-SNR heartbeat detection system using microphones and speaker-turned-microphone configurations, amplified via the Babyface Pro FS interface.
- Developed real-time MATLAB feedback tools for troubleshooting and signal monitoring.
- Conducted a user study across 60 sessions with 24 participants to collect physiological data and survey responses.

Zhang, X.*, **Vu, D.**,*, Shen, C., Wang, Y., Shi, Y., Chan, J. (2025). VergeIO: Depth-Aware Eye Interaction on Glasses. *2026 ACM/IEEE International Conference on Embedded Networked Sensor Systems (SenSys)*. arXiv:2507.02187 (*Equal Contribution)

- Developed a motion artifact detection system; conducted false-positive analysis and proposed preamble gestures (e.g., eyebrow raise) and adaptive filtering for noise suppression.
- Built an 11-class classification model to verify system's performance with previous works' gestures.
- Co-wrote the manuscript and created the majority of the figures for analysis and publication.
- Led power consumption profiling using the Monsoon Power Monitor ,conducted latency measurements with the Teensy 4.1 microcontroller, and designed hardware prototypes like auto-adjustable focus glasses and stereoscopic displays.

Technical Skills

- **Languages:** Python, C++, C, MATLAB, LaTeX, Verilog
- **Developer Tools:** Git, HPC clusters, CLion, MATLAB, AWS, Jupyter Notebook, Linux, Unity, Arduino
- **Libraries:** pandas, Matplotlib, TensorFlow, Tensor Toolbox, PyTorch, NetworkX, FreeSurfer, MRtrix3, Nilearn, LFR