

# Wonjun Park

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## SUMMARY

- Strong research background in **digital signal analysis**, focusing on sound separation, EEG/fMRI decoding, and bio-inspired representation learning.
- First-author of an IEEE conference paper (AIMHC 2024, published) and an ICASSP 2026 manuscript (under review); additional works under revision or in preparation
- Hands-on expertise in **self-supervised learning, cross-modal representation, and neural signal modeling**, with additional experience building scalable MLOps pipelines (PyTorch, TensorFlow, CUDA, Kubernetes, Kubeflow)
- Proven achievements in real-world benchmarks, including **Top-5/85 in Auditory EEG Decoding Challenge** and development of open datasets and challenges (Dog Vocalization, [Barkopedia](#))
- Aspiring Ph.D. researcher aiming to build **computational and mathematical models of neural systems** with insight from analyzing neural signals and implementing brain-machine interface applications

## EDUCATION

<b>M.S. in Computer Science</b> (GPA: 4.0 / 4.0)	<b>Aug 2024 – May 2026</b>
<i>University of Texas at Arlington, Arlington, Texas, U.S.A.</i>	<b>(Expected)</b>
<b>Scholarships:</b> Youngho Kim Scholarship (2025), Dean of Engineering Scholarship (2024)	
<b>Relevant Coursework:</b> Machine Learning, Neural Networks, Bioinformatics, Data Mining, GPU Programming, Algorithms	
<b>B.S. in Computer Science and Engineering</b> (GPA: 3.95 / 4.5 Major, 3.67 / 4.5 Overall)	<b>Mar 2018 – Aug 2024</b>
<i>Konkuk University, Seoul, South Korea</i>	
<b>Scholarships:</b> Merit-based Academic Scholarship (2022), SW Activities Scholarship (2019), Internationalization Scholarship (2019)	
<b>Relevant Coursework:</b> Natural Language Processing, Computer Vision, Statistical AI, Signal Processing, Computer Security	
<b>Visiting Scholar, Computer and Information Technology</b>	<b>Mar 2023 – Jun 2023</b>
<i>Purdue University, West Lafayette, Indiana, U.S.A.</i>	
<b>Audit Course:</b> CNIT 34400 Network Engineering Fundamentals	

## SKILL

**Programming Language** – Python, C, C++, Java, JavaScript, Shell Scripting  
**Framework / Library**: PyTorch, TensorFlow, JAX, Transformers, CUDA, Kubernetes, Docker, Vagrant, Git, Linux/VIM

## PROFESSIONAL & RESEARCH EXPERIENCE

<b>Arlington Computational Linguistic Lab (ACL^2)</b>	<b>Supervisor: Dr. Kenny Q. Zhu</b>
<b>Research Student</b>	<b>Feb 2025 – Present</b>
<b>Realistic Data Synthesis for Universal Sound Source Separation (Feb 2025 – Present)</b>	
<ul style="list-style-type: none"><li>• <b>Challenge:</b> Addressed the fundamental limitation of Universal Sound Separation (USS) models, which traditionally train on randomly mixed synthetic data (Mixture of Mixtures, MoMs) that diverges from real-world acoustic distributions, leading to degraded performance in animal vocalization analysis</li><li>• <b>Innovation:</b> Pioneered a <b>knowledge-guided audio synthesis strategy</b> leveraging Large Language Models (LLMs) to introduce <i>co-occurrence</i> knowledge (which sounds plausibly occur together) and <i>distance</i> knowledge (relative loudness / position of sources), generating realistic training mixtures that align with natural soundscapes</li><li>• Formulated research hypothesis and designed comparative experiments for realistic vs. random synthetic data</li></ul>	

- Implemented LLM-driven data synthesis pipeline and trained separation models (MixIT, AudioSep) across multi-dataset audio-text pairs
- Built evaluation framework combining human preference tests and SI-SDR metrics on diverse real-world benchmarks
- Led end-to-end paper writing and revisions as first author, coordinating direction and interpretation with advisor
- Demonstrated **2x improvement in human evaluation preference** (up to 87% preference over baselines) and consistent SI-SDR gains when training with realistic MoMs
- Showed that models trained with knowledge-guided synthesis generalize better to natural recordings, a critical advance for *animal language processing* and other domains where clean ground truth is infeasible
- Established a **data-centric perspective on multimodal AI**, integrating LLM world knowledge with signal processing. This cross-modal methodology directly informs scalable, generalizable approaches in audio understanding and could extend to robotics and cognitive AI
- **Publication:** First Author (with Tuan Dang and Kenny Q. Zhu). *ICASSP 2026, submitted*

#### **Estimation of Co-occurrence Knowledge in Latent Space for Sound Separation (Jun 2025 – Present)**

- **Challenge:** Universal Sound Separation models lack explicit **co-occurrence knowledge**, unlike other domains where context embeddings are available, limiting their ability to capture natural structure in mixtures
- Proposed a framework to **estimate co-occurrence embeddings in latent space** using CLAP, under a low-dimensional assumption – bridging missing contextual cues without requiring explicit labels at inference
- Designed estimation strategies for latent co-occurrence vectors (text- and audio-space approximations)
- Demonstrated performance gains in ablation studies vs. target-only conditioning
- Extends representation learning in latent space, directly relevant to modeling hidden structure in neural signals (fMRI/EEG) where contextual information
- First Author (with Kenny Q. Zhu). Manuscript in preparation

#### **Barkopedia Challenge on Dog Vocal Separation, IJCAI 2025 ([Barkopedia](#)) (Feb 2025 – Aug 2025)**

- **Challenge:** Advanced research interest in dog vocal analysis by defining benchmark problems and hosting the first Dog Vocal Separation challenge
- Constructed dataset by curating clean dog vocal recordings and synthesizing mixtures with background noise (AudioSet, LLM-guided sound source selection, Sound Event Detection filtering, manual validation)
- Managed challenge platform and participant communication (website, inquiries)
- Established **HTDemucs** as baseline model with competitive performance and presented challenge results at **IJCAI 2025** (sole presenter, representing the lab)

#### **EmotionalCanines: A Dataset for Analysis of Arousal and Valence in Dog Vocalization, ACM Multimedia 2025 (Feb 2025 – May 2025)**

- **Challenge:** Scarcity of open-source datasets capturing **emotional dimensions (arousal, valence)** in dog vocalizations limited systematic study of animal emotional communication
- Assisted in constructing and annotating the Dog Emotion Dataset by labeling bark recordings with arousal and valence categories, ensuring inter-rater reliability and annotation quality
- Supported creation of the largest dataset to date (1,400 bark sequences, Husky & Shiba Inu breeds), enabling supervised learning benchmarks (MFCC, eGeMAPS, Wav2Vec2, ViT)

## EEmaGe: EEG-based Image Generation for Visual Reconstruction ([GitHub](#)) (Sep 2023 – Jun 2024)

- **Challenge:** Explored how to align **EEG Signals with visual representations** for reconstructing images from neural activity, addressing the gap between current AI-based reconstruction and human visual system modeling
- Proposed **EEmaGe**, a self-supervised framework employing autoencoders and downstream tasks to learn robust EEG representations, in contrast to prior supervised, label-dependent methods
- Designed cross-modal encoding-decoding pipeline combining EEG and image features in a shared latent module
- Demonstrated improved EEG encoder quality (**+0.8% gain in image-label classification**) and robustness even when EEG-image pairs were shuffled
- Highlights potential of self-supervised EEG-image alignment for advancing our understanding of **human visual perception** and developing **bio-inspired AI systems**

## Auditory EEG Decoding Challenge (Sep 2023 – Dec 2023)

- **Challenge:** Decode speech information from EEG-speech paired data, with tasks in classification and reconstruction (regression)
- Re-implemented **EEGChannelNet** encoder from TensorFlow to PyTorch
- Integrated EEG features with HuBERT speech embeddings, optimizing training via cosine similarity maximization
- Achieved **5th place among 85 teams** worldwide in Task 2 (Regression)

**Brain and Cognitive Science Community Member**

**Supported by Brain & Cognitive Sciences, Seoul National University Mar 2024 – Sep 2024**

- Proposed an experiment at the **3rd Idea Hackathon** on whether two brain organoids exchanging electrode signals could generate emergent activity patterns, inspired by **how languages emerge** from Sapiens, Yuval N. Harari
- Participated in interdisciplinary group study on **fMRI data analysis**; presented methods from **Hidden Markov Models to Transformers/Mamba architectures** for time-series modeling
- Applied **FreeSurfer** for cortical visualization in motor-task fMRI datasets; contributed to collaborative study report
- Attended 2024 KSCS Mind, Brain & Data Seoul conference, Neural and Cognitive Architecture and International Brain Initiative Daegu conference, and KIAS Lecture Series on Computational Neuroscience and AI

**M2M Lab, Purdue University Visiting Scholar**

**Supervisor: Dr. Eric T. Matson Mar 2023 – Jun 2023**

## Deploying a Sustainable Deep Learning Pipeline for Poison Ivy Image Classification (Mar 2023 – Jun 2023)

- **Challenge:** Poison ivy continues to affect ~50M people annually in the U.S., yet plant recognition research has focused almost exclusively on leaf images, ignoring stems, and lacked scalable ML pipelines for deployment
- Built the first **multi-view dataset** (leaf + stem images, > 2,000 samples) and proposed a dual-branch CNN architecture combining leaf and stem features
- Led end-to-end pipeline design and team coordination as project lead
- Collected field images, applied **Meta's Segment Anything Model (SAM)** for segmentation, and validated data quality (Fleiss' k = 0.9)
- Implemented sustainable **MLOps pipeline with Kubeflow** (CI/CD/CT) for automated training and deployment
- Achieved **93% accuracy (DenseNet201, leaf)** and **86% accuracy (stem)**, demonstrating feasibility of stem-based classification
- Demonstrated how sustainable MLOps pipelines can extend beyond medical AI into **environmental health and bio-surveillance**, relevant to scalable biomedical systems

**ViralPro (Startup, Ministry of SMEs and Startups Pre-Startup Package, ₩100M grant)**

**Dec 2018 – Feb 2020**

- **Challenge:** Addressed inefficiency in digital marketing by connecting small companies seeking cost-effective ads with micro-YouTubers (< 10K subscribers) eager for sponsorship
- Developed **data crawling and database management systems** to match advertisers with micro-influencers
- Startup team awarded **₩100M Pre-Startup Package grant** to build and pilot the platform

## PUBLICATION

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- **Wonjun Park**, Kenny Q. Zhu, “*Guidance of Co-occurrence Knowledge and its Estimation in Latent Space for Conditioned Sound Separation*”, Manuscript in preparation
- **Wonjun Park**, Tuan Dang, and Kenny Q. Zhu, “Towards distance-aware synthetic audio mixtures for universal sound separation”, **2026 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**, 2026
- **Wonjun Park**, Sumin Cho, Subin Kim, Jiyeon Lee, Jack Mahedy, Nebey Gebresalssie, and Minji Lee, “Deploying a Sustainable Deep Learning Pipeline for Poison Ivy Image Classification”, **IEEE International Conference on Artificial Intelligence for Medicine Health and Care (AIMHC)**, 2024
- **(Named in Acknowledgement)** Tuan Minh Dang, Theron S. Wang, Hridayesh Lekhak, Kenny Q. Zhu, “*EmotionalCanines: A Dataset for Analysis of Arousal and Valence in Dog Vocalization*”, **ACM Multimedia (Dataset Track)**, 2025

## HONORS & AWARDS

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- Youngho Kim Scholarship, University of Texas at Arlington, 2025
- Dean of Engineering Scholarship, University of Texas at Arlington, 2024
- Unicorn Award (3rd), Google Developer Group Campus Korea Summer Hackathon, 2022
- Merit-based Academic Scholarship, Konkuk University, 2022
- SW Activities Scholarship, Konkuk University, 2019
- Internationalization Scholarship, Konkuk University, 2019
- Idea Award, Konkuk LINC+ Idea Contest, 2019

## CERTIFICATE

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- NVIDIA Certificate of Competency – *Getting Started with Accelerated Computing CUDA C/C++*, Jan 2025
- Certificate on Completion – Brain and Cognitive Science Community, Sep 2024
- Certificate of Merit – Purdue University, Jun 2023
- Certificate of Open Badge – Konkuk University, Mar 2023