

EDUCATION

Washington University in St. Louis

Doctor of Philosophy in Computer Science

St. Louis, MO, U.S.

2022 - May 2025

University of Kentucky

Master of Science in Electrical Engineering (GPA: 4.0/4.0)

Lexington, KY, U.S.

2018 - 2020

Nitte Meenakhshi Institute of Technology

Bachelors in Electronics and Communication Engineering (GPA: 9.54/10 - Gold Medalist)

Bengaluru, India

2012 - 2016

WORKING EXPERIENCE

Valuation and Market Dynamics

Zillow Group

Applied Scientist - Intern

May 2024 - August 2024

- Explored directions for improving Zillow's flagship product, Zestimate, by incorporating a diverse set of features.
- Developed a scale-aware multimodal model for sales price estimation, learning from both structured tabular data and floor plan images of homes.
- The proposed multimodal model achieved approximately 3% improvement across all metrics compared to the baseline.

Multimodal Vision Research Lab

Washington University in St. Louis

Graduate Research Assistant

August 2022 - Present

- Developed multi-modal deep learning frameworks for geospatial understanding of global soundscapes.
 - **GeoCLAP** (BMVC 2023): Introduced a tri-modal embedding space integrating satellite imagery, audio, and textual descriptions for zero-shot soundscape mapping across large geographic areas.
 - **PSM** (ACM Multimedia 2024): Enhanced GeoCLAP with a probabilistic, multi-scale, and metadata-aware embedding space for improved zero-shot soundscape mapping.
 - **Sat2Sound** (Under Review 2025): Leveraged a Vision-Language Model and a shared soundscape concept codebook to enhance multimodal soundscape mapping and introduced location-based soundscape synthesis for immersive experiences.
- Worked on developing additional multimodal embedding spaces:
 - **Sat2Cap** (EarthVision 2024), **GeoBind** (IGARSS 2024), and **TaxaBind** (WACV 2025) for query-driven geospatial mapping.
- Worked on developing frameworks for ecological modeling and visual classification:
 - **LD-SDM** and **BirdSAT** (WACV 2024) for species distribution modeling and fine-grained classification.
- Worked on diffusion-based conditional generation methods:
 - **GeoSynth** (EarthVision 2024) for satellite image synthesis and **Mixed View Panorama Synthesis**, which generates panoramic views using satellite imagery as additional input.
- Built comprehensive datasets:
 - **GeoSound**: Combined multi-resolution satellite imagery, geotagged sounds, and textual sound descriptions.
 - A global dataset with ~ 2.5 million satellite images and ~ 10 million auditory and visual captions, covering the entire Earth, created using a state-of-the-art multimodal LLM.
- Contributed to the IARPA-funded SMART project:
 - Developed large-scale self-supervised learning (SSL) methods, including Masked Autoencoders (MAE), for remote sensing tasks such as semantic change detection.

Lin Brain Lab

University of Kentucky

Graduate Research Assistant

August 2020 - August 2022

- Provided applied Machine Learning (ML) and data science support to advance Alzheimer's disease (AD) research while working on different modalities such as medical imaging, electronic health records, and genomics.
- Designed CNN and Vision Transformers (ViT) based models trained on MRI/PET imagery for AD prediction.
- Focusing on interpretability, designed CAT-XPLAIN, an inherently interpretable ViT model that uses causality in predictions to identify the most important image patches.
- Built ML models trained on genetics, electronic health records and imaging features for biomarkers discovery and early prediction of Alzheimer's disease.

Speech and Signal Processing Lab

University of Kentucky

Graduate Research Assistant

August 2018 - August 2020

- Performed analysis of articulatory differences in speech of native and non-native speakers of English.
- Built Automatic Speech Recognition (ASR) based Mispronunciation Detection and Diagnosis (MDD) framework. ASR was trained using Recurrent Neural Networks (RNN) on articulatory as well as acoustic features.

Kantipur Engineering College

Lalitpur, Nepal

- Taught courses: Microprocessor, Instrumentation
- Designed and conducted lab on Digital Signal Processing (DSP), Microprocessor.

KEY SKILLS

- **Languages and Tools:** Python (fluent), Pytorch (fluent), Git (fluent), Docker (familiar), QGIS (familiar).
- **Research Interests and Relevant Courses:** Computer Vision, Multimodal Machine Learning, Deep Learning, Self-Supervised Learning, Generative AI, Geospatial AI, Data Science, Data Structures and Algorithms.

AWARDS AND ACHIEVEMENTS

- COMPEX Scholarship offered by the Indian Embassy in Nepal for undergraduate study in India, 2012–2016.
- ECE Gold Medal, 2016 for graduating with Rank 1 in the department.

PUBLICATIONS

- **Khanal Subash**, Sastry Srikumar, Dhakal Aayush, Ahmad Adeel, Jacobs Nathan. "Sat2Sound: A Unified Framework for Soundscape Mapping", Under Review, 2025.
- **Khanal Subash**, Xing Eric, Sastry Srikumar, Dhakal Aayush, Xiong Zhexiao, Ahmad Adeel and Jacobs Nathan. "PSM: Learning Probabilistic Embeddings for Multi-scale Zero-Shot Soundscape Mapping.", ACM Multimedia, 2024.
- **Khanal Subash**, Sastry Srikumar, Dhakal Aayush and Jacobs Nathan. "Learning Tri-modal Embeddings for Zero-Shot Soundscape Mapping.", BMVC, 2023.
- Sastry Srikumar, **Khanal Subash**, Dhakal Aayush, Ahmad Adeel and Jacobs Nathan. "TaxaBind: A Unified Embedding Space for Ecological Applications.", WACV, 2025.
- Dhakal Aayush, Ahmad Adeel, **Khanal Subash**, Sastry Srikumar, Kerner Hannah and Jacobs Nathan. "Sat2Cap: Mapping Fine-Grained Textual Descriptions from Satellite Images." CVPRW (EarthVision), 2024. **Best Paper Award**.
- Sastry Srikumar, **Khanal Subash**, Dhakal Aayush, and Jacobs Nathan. "GeoSynth: Contextually-Aware High-Resolution Satellite Image Synthesis" CVPRW (EarthVision), 2024.
- Dhakal Aayush, **Khanal Subash**, Sastry Srikumar, Ahmad Adeel, Jacobs Nathan. "GeoBind: Binding text, image, and audio through satellite images" IGARSS, 2024.
- Sastry Srikumar, **Khanal Subash**, Dhakal Aayush, Di Huang and Jacobs Nathan. "BirdSAT: Cross-View Contrastive Masked Autoencoders for Bird Species Classification and Mapping.", WACV, 2024.
- Sastry Srikumar, Xin Xing, Dhakal Aayush, **Khanal Subash**, Ahmad Adeel, and Jacobs Nathan. "LD-SDM: Language-Driven Hierarchical Species Distribution Modeling", arXiv:2404.06637, 2024.
- Xiong Zhexiao, Xing Xin, Workman Scott, **Khanal Subash** and Jacobs Nathan. "Mixed-View Panorama Synthesis using Geospatially Guided Diffusion", arXiv arXiv:2407.09672, 2024.
- Carter Woods Carter, Xing Xin, **Khanal Subash**, Lin Ai-Ling "Machine Learning-Driven Prediction of Brain Age for Alzheimer's Risk: APOE4 Genotype and Gender Effects", Bioengineering, 2024.
- **Khanal Subash**, Brodie Benjamin, Xing Xin, Lin Ai-Ling and Jacobs Nathan. "Causality for inherently explainable transformers: CAT-XPLAIN." Accepted for spotlight presentation at the Explainable Artificial Intelligence for Computer Vision Workshop at CVPR 2022.
- Xing Xin, Liang Gongbo, Zhang Yu, **Khanal Subash**, Lin Ai-Ling and Jacobs Nathan. "Advit: Vision transformer on multi-modality pet images for alzheimer disease diagnosis." In 2022 IEEE 19th International Symposium on Biomedical Imaging (ISBI), pp. 1-4. IEEE, 2022.
- **Khanal Subash**, Chen Jin, Jacobs Nathan and Lin Ai-Ling. "Alzheimer's Disease Classification Using Genetic Data." In 2021 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), pp. 2245-2252. IEEE, 2021.
- **Khanal Subash**, Johnson Michael T., Soleymannpour Mohammad and Bozorg Narjes. "Mispronunciation Detection and Diagnosis for Mandarin Accented English Speech." In 2021 International Conference on Speech Technology and Human-Computer Dialogue (SpeD), pp. 62-67. IEEE, 2021.
- Brodie Benjamin, **Khanal Subash**, Rafique Muhammad Usman, Greenwell Connor and Jacobs Nathan. "Hierarchical Probabilistic Embeddings for Multi-View Image Classification." In 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, pp. 1011-1014. IEEE, 2021.
- **Khanal Subash**, Johnson Michael T. and Bozorg Narjes. "Articulatory Comparison of L1 and L2 Speech for Mispronunciation Diagnosis." In 2021 IEEE Spoken Language Technology Workshop (SLT), pp. 693-697. IEEE, 2021.
- **Khanal Subash**, "Mispronunciation Detection and Diagnosis for Mandarin Accented English Speech". Theses and Dissertations–Electrical and Computer Engineering. 156, 2020