Subash Khanal

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EDUCATION

Washington University in St. Louis — **St. Louis, MO, U.S.**
Doctor of Philosophy in Computer Science — *2022 - May 2025*

University of Kentucky — **Lexington, KY, U.S.**
Master of Science in Electrical Engineering (GPA: 4.0/4.0) — 2018 - 2020

Nitte Meenakhshi Institute of Technology — **Bengaluru, India**
Bachelors in Electronics and Communication Engineering (GPA: 9.54/10 - Gold Medalist) — *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.
- 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 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. Moreover, with focus on interpretability, designed an inherently interpretable ViT model.
- 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**
Lecturer — *April 2017 - July 2018*

- 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., Soleymanpour 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