

Bishal Ranjan Swain

📍 Gumi, South Korea | ✉ bishalswain@kumoh.ac.kr | 📞 +82 010 4683 3356 | 🌐 bluesaiyancodes.github.io

Summary

Ph.D. candidate in Computer Science at Kumoh National Institute of Technology working on robust computer vision for scientific and medical imaging. My research focuses on segmentation under distribution shift, combining continuous-time neural dynamics and associative memory mechanisms to improve generalization and stability.
Expected graduation: July 2026.

Education

- Kumoh National Institute of Technology (KIT)**, Ph.D. in Computer Science Sept 2022 – Present
Gumi, South Korea **Advisor:** Prof. Dr. Jaepil Ko
Research Areas: Computer Vision; OOD generalization; medical & materials imaging
- Chonnam National Institute of Technology**, Interdisciplinary Academic Degree Sept 2021 – Aug 2022
Gwangju, South Korea; completed Level 4 Korean language
- Pondicherry University**, M.Sc. in Computer Science Jul 2018 – May 2020
Puducherry, India; First Class with Distinction; **GPA: 9.36**
Thesis: *Study and Development of 3D Wind Pattern Visualization Models*
- College of Basic Science and Humanities, OUAT**, B.Sc. in Computer Science Jul 2015 – May 2018
Odisha, India; First Class with Distinction; **GPA: 8.59**

Research & Work Experience

- Research Associate**, Dream Lab, Indian Institute of Science (IISc) Jun 2020 – Jul 2021
– Contributed to develop a distributed platform for emulating large-scale networks using containerized infrastructure across multi-node clusters with support for dynamic topology and runtime resource configuration.
- Research Intern**, National Atmospheric Research Lab (NARL) Nov 2019 – May 2020
– Research internship aligned with wind-pattern visualization / atmospheric data analysis.

Recent Publications

- Coupling Liquid Time-Constant Encoders with Modern Hopfield Memory** 2026
– B. Swain, K. J. Cheoi, J. Ko. *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*.
- Guided Texture Segmentation via Coordinate-Aware Class-Ratio Mapping** 2026
– B. Swain, K. J. Cheoi, J. Ko. *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*.
- Out-of-Distribution Nuclei Segmentation in Histology Imaging via Liquid Neural Networks with Modern Hopfield Layer** 2025
– B. Swain, K. J. Cheoi, J. Ko. *Medical image computing and computer-assisted intervention (MICCAI)*. Springer.
- SAM Guided Task-Specific Enhanced Nuclei Segmentation in Digital Pathology** 2024
– B. Swain, K. J. Cheoi, J. Ko. *Medical image computing and computer-assisted intervention (MICCAI)*. Springer.
- Nuclei Segmentation in Histopathological Images with Enhanced U-Net3+** 2024
– B. Swain, K. J. Cheoi, J. Ko. *Medical Imaging with Deep Learning (MIDL)*. PMLR.
- Phase Fraction Calculation in Multiphase Steel Microstructures Through Semantic Segmentation** 2024
– B. Swain, K. J. Cheoi, J. Ko. *International Conference on Applied System Innovation (ICASI)*.
- Complex-Phase Steel Microstructure Segmentation Using UNet: Analysis across Different Magnifications and Steel Types** 2023
– B. Swain, Dahee Cho, J. park, JS Roh, J. Ko. *Materials (MDPI)*.

Recent Projects

★ Medical, ▲ Materials, ▼ Inter-discipline

Adaptive Ratio-Guided Segmentation for Metallurgical Microstructures ▲ Feb 2023 – Aug 2025

- Developed a ratio-aware texture segmentation framework that incorporates class-distribution priors and adaptive feature fusion to improve robustness under varying microstructure compositions.
- Achieved +6.1% average Dice improvement with less than 2% additional parameters.

Data-Centric Batch Sampling for Robust Learning under Limited and Imbalanced Data in Nuclei Segmentation ★ Nov 2025 – Jan 2026

- Proposed a feature-driven batch construction strategy using DINOv2 embeddings and density-based clustering to enforce heterogeneity within batches, ensuring diverse representation of the data distribution for training.
- Demonstrated that sampling strategy alone yields significant performance gains, improving Dice score from 88.07% to 91.70% when integrated into the training pipeline, highlighting the importance of data organization beyond model architecture.

Semi-Supervised Instance Segmentation of Battery Particles with Human-in-the-Loop Refinement ▲ Jan 2025 – May 2025

- Designed a three-stage pipeline: SAM-based mask proposal; expert-guided boundary refinement; LoRA-based adaptation for SEM particle images.
- Introduced a labeling protocol to handle ambiguous regions (binder vs particle, merged vs split instances) and enforce fine-grained boundary consistency. Achieved 96.14 pp Dice on instance-level particle segmentation.

Transformer-Based Multi-Variable Rainfall Forecasting from Regional Radar ▼ Aug 2025 – Dec 2025

- Built a multi-variable forecasting model using RegionalClimaX on Korean composite radar data, supporting prediction horizons up to 72 hours.
- Improved test accuracy to 62.1% compared to 56.7% using single-variable inputs.

Ultra-Low Latency Fire Detection via Hybrid Vision Models ▼ Dec 2024 – Aug 2025

- Developed a hybrid pipeline combining classical vision (GMM-based masking) with patch-level classification for efficient fire detection.
- Achieved 97.8% accuracy, 97.2% F1 score, and approximately 0.44 ms per patch inference latency.

Robust Diagnosis of Allergic Rhinitis from Nasal Endoscopic Images ★ Sep 2022 – Jan 2023

- Investigated deep learning pipelines for automated diagnosis of allergic rhinitis under high variability in illumination, anatomical structure, and imaging conditions.
- Achieved strong diagnostic performance with F1 scores of 93.10 (RGB), 92.13 (Lab), and 89.13 (Ab), demonstrating the importance of preserving discriminative color and structural cues.

Leadership & Service

Vice President, MICCAI Student Board 2025 – Present

Volunteer, Animal Shelter 2022 – Present

Participate in regular volunteer activities and additional outreach programs with recognized 150+ official hours.

Certifications

- TOPIK II (Lv. 5) (Korean proficiency) — National Institute for International Education (2025)
- Korean Social Integration Evaluation (Lv. 4) — KIIP (2025)
- TOEIC (910) — ETS (2022)
- Global Korea Scholarship Recipient — NIIED (2021)
- DeepLearning.AI Specializations (2019–2020) including CNNs, Sequence Models, ML Projects Structuring
- RHCSA — Red Hat (2016); EC-Council certifications (2017–2018)

Technologies

Core: Python, PyTorch, TensorFlow, CUDA, Git, Linux

Research Interests: Robust Computer Vision, OoD Generalization, Medical Image Segmentation, Neural Dynamical Systems, Associative Memory