Biplab Poudel

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Education

University of Missouri — **Columbia, MO, USA**
Ph.D. in Computer Science — *Aug 2021 – May 2026*

University of Missouri — **Columbia, MO, USA**
MS in Computer Science — *Dec 2025*

Tribhuvan University — **Kathmandu, Nepal**
B.E. in Computer Engineering — *Aug 2019*

Experience

Graduate Research Assistant — Aug 2021 – Present
University of Missouri – Digital Biology Lab (DBL) — *Columbia, MO*

- Designed and implemented deep learning frameworks for biomedical and environmental image analysis, integrating computer vision with interdisciplinary data-driven research.
- Developed **CryoFSL**, a few-shot learning framework using SAM2 with adapter modules for automated protein particle picking in Cryo-EM micrographs, enabling accurate detection with minimal annotations and outperforming state-of-the-art methods such as Topaz and CrYOLO.
- Pioneered **real-time oil spill concentration assessment** using fluorescence imaging and MobileNetV3-based regression models, deployed via **Oilix mobile application** and web platform for environmental monitoring.
- Developed **histopathological image segmentation models** for nuclei and gland detection using transformer-based architectures and foundation models (e.g., SAM2), enabling precise tissue region delineation and quantitative feature extraction for downstream analysis.
- Explored **histopathological image-based prediction of platinum treatment response** in ovarian cancer (TCGA-OV dataset) using multi-scale vision transformers and multi-instance learning approaches for robust patient-level outcome modeling.
- Explored and compared multiple **prompting techniques** for foundational model adaptation in Cryo-EM micrographs, optimizing prompt-based fine-tuning strategies to enhance protein identification and segmentation performance under limited annotation settings.
- Developed advanced post-processing and particle localization pipelines using multi-scale peak detection, watershed segmentation, and geometric feature validation to improve model interpretability and detection accuracy.
- Mentored undergraduate and master's students on research projects, model debugging, and scientific writing.

PhD Research Intern – Responsible AI — May 2024 – Aug 2024
Microsoft — *Redmond, WA*

- Conducted research on **responsible and interpretable AI** with a focus on detecting violent, harmful, and self-harm imagery using advanced computer vision models.
- Designed attention visualization and interpretation methods for vision transformers such as **DaViT**, enhancing model explainability and bias detection in sensitive image domains.
- Developed a framework that leverages **ChatGPT** to refine and optimize **DALL·E** image generation prompts through adaptive prompt engineering, improving the quality and ethical alignment of generated content.
- Collaborated with cross-disciplinary teams to evaluate and document AI system robustness, transparency, and fairness in alignment with Microsoft's Responsible AI standards.

Data Analyst — May 2023 – Aug 2023
Microsoft — *Redmond, WA*

- Optimized large-scale vision transformer models (**DaViT**) by implementing **ONNX**, **TensorRT**, and **Torch-TensorRT** acceleration frameworks, achieving substantial reductions in inference latency and boosting throughput for real-time applications.
- Developed and curated a comprehensive **captcha classification dataset** and trained a high-performing classifier designed to evaluate and mitigate vulnerabilities of multimodal AI systems (e.g., GPT-4V) in solving visual captchas.
- Collaborated with team members using version control systems such as Git to organize modifications.

Lecturer **Nov 2019 – Jul 2021**
Janakpur Engineering College, Tribhuvan University *Kathmandu, Nepal*

- Taught undergraduate courses including **Data Structures and Algorithms**, **Object-Oriented Programming**, **Artificial Intelligence**, **Image Processing**, **Numerical Methods**, and **Data Mining**.
- Led **curriculum development and syllabus refinement** efforts to modernize course content and align it with emerging trends in computer science education.
- Supervised and mentored undergraduate **final-year research and capstone projects**, guiding students through project design, implementation, and presentation.
- Served in a **departmental leadership role** as **Coordinator of computer science faculty**, managing academic schedules, class routines, and coordination among faculty members.

Lecturer (Part-time) **Sept 2020 – July 2021**
Budhanilkantha Technical College *Budhanilkantha, Nepal*

- Taught courses including **C Programming**, **Digital Logic**, and **Software Engineering**, emphasizing conceptual clarity and practical implementation.
- Conducted and supervised **laboratory sessions** for C programming and Python coding, facilitating hands-on learning and debugging practices.
- Assisted in developing lab exercises, grading assignments, and providing individualized feedback to enhance student programming proficiency.

Instructor **Jan 2017 – June 2019**
United Scholars Academy *Kathmandu, Nepal*

- Taught secondary-level courses in **Mathematics** and **Computer Science**, focusing on conceptual clarity and practical application.
- Conducted and supervised **computer laboratory sessions**, guiding students through programming fundamentals and hands-on exercises.
- Managed and regularly updated the school's **website and digital content**, improving information accessibility and institutional visibility.
- Collaborated with faculty and administration to integrate digital learning resources into the school's curriculum.

Instructor **Oct 2014 – Mar 2015**
Laxmi Narayan Secondary School *Lamjung, Nepal*

- Volunteered as an instructor at a remote public school, teaching secondary-level **Mathematics** and **Science** to enhance STEM education accessibility in rural Nepal.
- Led classroom instruction and organized **laboratory sessions** for science and computer classes, promoting experiential and inquiry-based learning.
- Collaborated with local teachers to integrate digital literacy into the curriculum, encouraging students' interest in computer education.

Publications

[1] **Poudel, B.**, Xie, J., Guo, C., Watt, O., Pulster, E., Patel, R.J., Steevens, J. and Xu, D. (2025). **Real-time Oil Spill Concentration Assessment through Fluorescence Imaging and Deep Learning**. *Journal of Hazardous Materials*.

[2] **Poudel, B.**, Gyawali, R., Dhakal, A., Cheng, J. and Xu, D. (2025). **CryoFSL: An Annotation-efficient Few-shot Learning Framework for Robust Protein Particle Picking in Cryo-EM Micrographs**. *bioRxiv*.

[3] **Poudel, B.**, Xie, J., Guo, C., Xu, D., Patel, R.J., Watt, O.E., Pulster, E.L. and Steevens, J.A. (2025). **Images of Two Standard Crude Oils Collected Using a Fluorescent Camera Device to Train and Optimize a Machine Learning Model for Real-time Oil Spill Concentration Assessment (Nov 2023–Jul 2024)**. *U.S. Geological Survey (USGS) Data Release*.

[4] Xie, J., Zhang, Z., **Poudel, B.**, Guo, C., Yu, Y., An, G., Tang, X., Zhao, L., Xu, C. and Xu, D. (2025). **TOM: An Open-Source Tongue Segmentation Method with Multi-Teacher Distillation and Task-Specific Data Augmentation**. *arXiv preprint*.

[5] Wang, D., Pourmirzaei, M., Abbas, U.L., Zeng, S., Manshour, N., Esmaili, F., **Poudel, B.**, ... Chen, J. and Xu, D. (2025). **S-PLM: Structure-Aware Protein Language Model via Contrastive Learning Between Sequence and Structure**. *Advanced Science*.

[6] He, F., Yang, Z., Gao, M., **Poudel, B.**, Dhas, N.S.E.S., Gyawali, R., Dhakal, A., Cheng, J. and Xu, D. (2024). **Adapting Segment Anything Model (SAM) through Prompt-based Learning for Enhanced Protein Identification in Cryo-EM Micrographs**. In *2024 IEEE International Conference on Medical Artificial Intelligence (MedAI)* (pp. 9–20). IEEE.

Awards and Honors

- **Best Lecturer Award**, Janakpur Engineering College, Nepal **2020**
- **College topper in Computer Engineering**, Advanced college of engineering and management **2019**
- **University second topper**, Tribhuvan University **2019**
- **Advanced college excellence scholarship**, Advanced college of engineering and management **2015-2019**
- **First position - Hardware project demonstration**, Tech Bihani 3.0 **2016**
- **Mahatma Gandhi Scholarship**, Embassy of India **2013**

Technical Skills

Languages: Python, C, C++, R, SQL, HTML/CSS
Frameworks/Tools: PyTorch, OpenCV, Flask, TensorRT, ONNX, Git, Docker, Scikit-learn, Linux, AWS
Data analysis: Power BI, MySQL, PostgreSQL, Pandas, Numpy, Data wrangling, Statistical modeling
Machine learning/AI: Convolutional neural networks (CNN), Transformers, Foundational model adaptation, Prompt engineering, Computer Vision, Image processing, NLP, Regression

Published Books

Insights on Internet and Intranet

This book provides a comprehensive overview of **internet and intranet technologies**, including network architecture, web protocols, and information security fundamentals. It has been **adopted by multiple universities in Nepal** as a reference and teaching resource for undergraduate computer science and information technology courses.

Invited Talks

- **Adapting segment anything model (SAM) through prompt-based learning for enhanced protein identification in cryo-EM micrographs**, University of Missouri **Feb 2025**
- **Deep learning and data science in Medical imaging**, Tribhuvan University, Nepal **Jun 2024**
- **Real-time oil spill concentration assessment through fluorescence imaging and deep learning**, NOAA and USGS, USA **Jan 2023**

Leadership

- **Secretary**, University of Missouri Nepalese Student Association (MUNSA) **2023-2024**
- **President**, Project Association for Computer and Electronics (PACE) **2018-2019**
- **National level event coordinator**, SRIJANA-The Innovation, Nepal **2018**
- **President**, Nepal Red Cross Society, Lamjung, Nepal **2011**

Academic and Social Contributions

- **Reviewer**, Plant Molecular Biology **2025-Present**
- **Program Committee Member**, 2024 IEEE international conference on Bioinformatics and Biomedicine, Lisbon, Portugal **Dec 3-6, 2024**
- **Poster Judge**, Summer undergraduate research forum, University of Missouri **2023**
- **Member**, Upsilon Pi Epsilon-Gamma Chapter, University of Missouri **2022-Present**