

Nishchal Sapkota

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Education

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| University of Notre Dame (UND) <i>Ph.D. in Computer Science and Engineering</i> <i>M.S. in Computer Science and Engineering</i> Research Areas: Computer Vision, Self-supervised Learning, Data-efficient Deep Learning Models, AI for Healthcare | Notre Dame, IN 05/2026 08/2024 |
| The University of Southern Mississippi (USM) <i>B.S. in Computer Science B.S. in Mathematics – Honors, summa cum laude (GPA: 3.91)</i> Thesis: <i>Probabilistic Analysis of Revenues in Online Games</i> | Hattiesburg, MS 08/2020 |

Experiences

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| Mayo Clinic <i>Computational Pathology and AI Intern</i> | Rochester, MN 01/2025 - 05/2025, 08/2025 - 12/2025 |
| <ul style="list-style-type: none">Developed pathology image foundation models by training generalist self-supervised image encoders at varying model and data scales, designed for disease type-agnostic downstream applications, beating SOTA pathology foundation models.Identified and fixed scaling bottlenecks in self-supervised vision foundation models using a post-training regularization step, improving dense representations for pathology images to obtain superior performance in detection and segmentation tasks.Contributed to extending the vision encoder by integrating patient diagnosis reports with whole-slide pathology images for advanced multimodal diagnostics and personalized care.Assisted in building predictive healthcare models from large-scale clinical and non-clinical data and deploying them through scalable MLOps pipelines with cross-functional teams. | |
| IBM <i>Senior Data Science & AI PhD Intern</i> | Research Triangle Park – Durham, NC 05/2025 - 08/2025 |
| <ul style="list-style-type: none">Modeled user decision paths from web clickstream sequence data using linear (N-gram Markov) and non-linear (Transformer/Mamba) models to identify high-intent users with greater precision.Built session-level predictive models for conversion outcomes, enabling real-time agentic AI marketing interventions to recover up to 10,000 lost conversion opportunities.Collaborated cross-functionally to convert model insights into strategies, boosting campaign performance and engagement. | |
| The University of Notre Dame <i>Graduate Researcher</i> | Notre Dame, IN 08/2020 - Present |
| <ul style="list-style-type: none">Currently working on surgical video segmentation using <u>agglomerative foundation models</u> to advance AI-assisted surgery .Developed 3 <u>self-supervised learning</u> models achieving state-of-the-art segmentation performances. [4][5][6]Built transformer-based data-efficient <u>3D segmentation models</u> with upto 11% performance improvement.[1][2][3]Developed 3 novel methods leveraging <u>foundation models</u> for medical image and cancer survival analysis. [10][12][13]Proposed <u>multimodal learning</u> frameworks and shape-aware segmentation/classification models using <u>implicit neural representations</u> by handling label ambiguity and improving data efficiency by 30%. [7][8][11][12]Collaborated with multiple biology labs, hospitals, and anthropology departments to address medical and biological research challenges using AI-powered tools, resulting in several publications. [2][3][9][11][14]Mentored 1 high school and 4 undergraduate students, resulting in ML research publications and industry placements. | |
| The University of Southern Mississippi <i>Undergraduate Researcher</i> | Hattiesburg, MS 08/2017 - 05/2020 |
| <ul style="list-style-type: none">Introduced a novel <u>dynamic food chain model</u> for three species and analyzed its long-term behavior. [16]Analyzed online games using <u>Markov Chain</u> to maximize revenues for both players and the providers. [15]Predicted chemical compound toxicity using in-vitro computational methods and feature engineering. | |

Technical Skills

Programming: Python, R, C++, Bash, MATLAB, SQL

ML Packages: Pytorch, Numpy, Scikit-Learn, Keras, SciPy, OpenCV, Pandas, Tensorflow, Matplotlib, WandB, NLTK

Tools: Jupyter, LaTeX, FIJI, Microsoft 365, Adobe Illustrator, Training and Fine-tuning AI models on GPU, Docker, REST API

Concepts: Machine Learning, Computer Vision, CNN, LSTM, GAN, Transformers, VLM, Auto Encoders, Foundation Models, Self-supervised Learning, Generative AI, Multimodal Learning, Transfer Learning, INR, Diffusion Models, Time Series Forecasting, Mathematical Modeling, Distributed Training, Model Quantization, Temporal Modeling for Video, Low-latency Inference

Math Concepts: Data Analysis, Numerical Methods, Real Analysis, Modern Algebra, Number Theory, Statistics

Scholarships, Grants, Honors, and Achievements

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| 2024 IEEE International Symposium on Biomedical Imaging (ISBI2024) Travel grant (\$800) | ISBI 2024 |
| Graduate School Professional Development Fund (\$1,250) and Conference Presentation Grant (\$450) | UND 2024 |
| CSE Select Fellowship Award (1/40 incoming Ph.D students; yearly stipend worth \$40,000) | UND 2020-2025 |
| Wright W. and Annie R. Cross Endowment (\$10,500) and Danny R. Carter Endowed Scholarship (\$4,000) | USM 2017-2020 |
| First Place , Mathematics Comprehensive Exam (MFT) | USM 2019 |
| Second Runner Up : Best Undergraduate Paper | MAA Meeting 2019 |
| Eagle SPUR grant for Undergraduate Research (\$2,000) and Honors Keystone Scholarship (\$2,000) | USM 2019 |
| Finalist , Integration Bee | MAA Meeting 2018 |
| Nominated for College of Science and Technology's Outstanding Sophomore Award | USM 2017 |
| Burner Science & Tech. Scholarship (\$800), Wallace C. & Lynn L. Pye Endowed Scholarship (\$800) | USM 2017 |

Teaching Experiences

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| The University of Notre Dame | Notre Dame, IN |
| Graduate Teaching Assistant | 08/2020 - 12/2025 |
| • Design & Analysis of Algorithms; Complexity & Algorithms; Mobile App. Design; Discrete Mathematics | |
| • Prepared lecture slides, graded submissions, created answer keys, and held office hours. | |
| STEM Project Leader Warrior-Scholar Project | 06/2023, 06/2024 |
| • Medical Image Analysis : Designed and conducted a Bootcamp to prepare veterans for undergraduate research. | |
| • Introduction to Data Science : Conducted a Bootcamp to prepare veterans for undergraduate coding classes. | |

Publications

Transformer-Based Segmentation Architectures

- [1] [When Swin Transformer Meets KANs: An Improved Transformer Architecture for Medical Image Segmentation](#) – arXiv, 2025
- [2] [Universal Conditional Networks for Cartilage Segmentation with Sparsely Annotated Data](#) – Nature Scientific Reports, 2025
- [3] [ConUNETR: A Conditional Transformer Network for 3D Micro-CT Embryonic Cartilage Segmentation](#) – ISBI, 2024

Self-supervised Learning

- [4] [A Point in the Right Direction: Vector Prediction for Spatially-aware Self-supervised Volumetric Rep. Learning](#) – ISBI, 2023
- [5] [Keep Your Friends Close & Enemies Farther: Debiasing Contrastive Learning with Spatial Priors in 3D Images](#) – BIBM, 2022
- [6] [Unsupervised Feature Clustering Improves Contrastive Representation Learning for Medical Image Segmentation](#) – BIBM, 2022

Implicit Neural Representations (INRs)

- [7] [Sperm Head Morphology Classification with Vision Foundation Models and Implicit Masks Representations](#) – Under Review, 2025
- [8] [SwIPE: Efficient and Robust Medical Image Segmentation with Implicit Patch Embeddings](#) – MICCAI, 2023

Medical Image Analysis & Computational Pathology

- [9] [H-CNN-ViT: A Hierarchical Gated Attention Multi-Branch Model for Bladder Cancer Recurrence Prediction](#) – BIBM, 2025
- [10] [IHCSurv: Effective Immunohistochemistry Priors for Cancer Survival Analysis in Gigapixel Multi-stain WSIs](#) – MICCAI, 2024
- [11] [SHMC-Net: A Mask-guided Feature Fusion Network for Sperm Head Morphology Classification](#) – ISBI, 2024
- [12] [Path-GPTOMic: A Balanced Multi-modal Learning Framework for Survival Outcome Prediction](#) – ISBI, 2024
- [13] [Boosting Medical Image Classification with Segmentation Foundation Model](#) – ISBI, 2024
- [14] [Embryonic Cranial Cartilage Defects in the Fgfr^{3Y367C/+} Mouse Model of Achondroplasia](#) – Anatomical Record, 2023

Applied Statistics & Mathematical Modeling

- [15] [Probabilistic Analysis of Revenues in Online Games](#) – University of Southern Mississippi, 2020
- [16] [Hunting Co-operation in the Middle Predator in Three Species Food Chain Model](#) – MAA Proceedings, 2020

Students Mentored

- **Haoyan Shi** (Undergraduate Intern, 2025) – Published author, applying to graduate programs
- **Zihao Zhao** (Undergraduate Intern, 2024) – Currently a PhD student at Rutgers
- **Maria Jose Gomez** (High School Intern, 2024) – Published author, applying to undergraduate programs
- **Sirui Li** (Undergraduate Intern, 2023) – Currently a PhD student at UCLA
- **Santiago Rodriguez** (Undergraduate Intern, 2023) – Now a Software Engineer at Apple