Nishchal Sapkota

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Education

University of Notre Dame (UND)   Notre Dame, IN
Ph.D. in Computer Science and Engineering   05/2026
M.S. in Computer Science and Engineering   08/2024
Research Areas: **Computer Vision, Self-supervised Learning, Data-efficient Deep Learning Models, AI for Healthcare**

The University of Southern Mississippi (USM)   Hattiesburg, MS
B.S. in **Computer Science** | *B.S.* in **Mathematics** – *Honors, summa cum laude (GPA: 3.91)*   08/2020
Thesis: *Probabilistic Analysis of Revenues in Online Games*

Experiences

Mayo Clinic   Rochester, MN
Computational Pathology and AI Intern   01/2025 – 05/2025, 08/2025 – 12/2025
- 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.
- 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   Research Triangle Park – Durham, NC
Senior Data Science & AI PhD Intern   05/2025 – 08/2025
- 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   Notre Dame, IN
Graduate Researcher   08/2020 – Present
- Currently working on surgical video segmentation using agglomerative foundation models to advance AI-assisted surgery .
- Developed 3 self-supervised learning models achieving state-of-the-art segmentation performances. [4][5][6]
- Built transformer-based data-efficient 3D segmentation models with upto 11% performance improvement.[1][2][3]
- Developed 3 novel methods leveraging foundation models for medical image and cancer survival analysis. [10][12][13]
- Proposed multimodal learning frameworks and shape-aware segmentation methods using implicit neural representations 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   Hattiesburg, MS
Undergraduate Researcher   08/2017 – 05/2020
- Introduced a novel dynamic food chain model for three species and analyzed its long-term behavior. [16]
- Analyzed online games using Markov Chain 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

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

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, 2024*

[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 Implicit Neural 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*