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.
- Analyzed clinical and non-clinical data at scale to develop predictive healthcare models and managed its full data science lifecycle in collaboration with cross-functional teams.
- Implemented MLOps pipelines for continuous integration and deployment, ensuring scalable, reliable, and automated delivery of predictive healthcare models across production environments.

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. [14][15] [16]
- Built data-efficient 3D segmentation models with upto 11% performance improvement on out-of-distribution data.[1][3][4][13]
- Developed 3 novel methods leveraging foundation models for medical image analysis and cancer survival prediction. [9][10][11]
- Proposed a multimodal learning framework for automated sperm analysis handling label ambiguity [5] and a shape-aware segmentation method using implicit neural representations improving data efficiency by 30%. [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. [3][4][5][13]
- 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. [6]
- Analyzed online games using Markov Chain to maximize revenues for both players and the providers. [7]
- 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

[1] **N. Sapkota**, H. Shi, Y. Zhang, X. Ma, B. Zheng, and D. Z. Chen. When Swin Transformer meets KANs: An improved transformer architecture for medical image segmentation. *arXiv:2511.04084*, 2025

[2] **N. Sapkota**, H. Shi, Y. Zhang, Y. Mariam, X. Ma, B. Zheng, and D. Z. Chen. Sperm morphology classification with implicit neural representations. *Under Review*, 2025

[3] **N. Sapkota**, Yejia Zhang, Zihao Zhao, Maria Jose Gomez, Yuhan Hsi, Jordan A Wilson, Kazuhiko Kawasaki, Greg Holmes, Meng Wu, Ethylin Wang Jabs, et al. Universal conditional networks (unicon) for multi-age embryonic cartilage segmentation with sparsely annotated data. *Nature Scientific reports*, 2025

[4] **N. Sapkota**, Y. Zhang, S. Perrine, Y. Hsi, S. Li, M. Wu, G. Holmes, A. Abdulai, E. Jabs, J. T. Richtsmeier, and D. Z. Chen. ConUNETR: A conditional transformer network for 3d micro-ct embryonic cartilage segmentation. *IEEE ISBI*, 2024

[5] **N. Sapkota**, Y. Zhang, S. Li, P. Liang, Z. Zhao, and D. Z. Chen. SHMC-Net: A mask-guided feature fusion network for sperm head morphology classification. *IEEE ISBI*, 2024

[6] **N. Sapkota**, R. Bhatta, P. Dabney, and Z. Xie. Hunting co-operation in the middle predator in three species food chain model. *Proceedings of the LA-MS Section of the Mathematical Association of America (MAA)*, 2020

[7] **N. Sapkota** and BSW Schröeder. Probabilistic analysis of revenues in online games. *University of Southern Mississippi*, 2020

[8] X. Li, Z. Wang, Y. Zhang, Z. Pan, Y.-J. Chen, **N. Sapkota**, G. Xu, D. Z. Chen, and Y. Shi. H-cnn-vit: A hierarchical gated attention multi-branch model for bladder cancer recurrence prediction. *BIBM*, 2026

[9] Y. Zhang, H. Chao, Z. Qiu, **N. Sapkota**, P. Gu, D. Z. Chen, K. Yan, D. Jin, and L. Lu. IHCSurv: Effective immunohistochemistry priors for multi-stain cancer survival analysis in gigapixel whole slide images. *MICCAI*, 2024

[10] H. Wang, Y. Yang, Z. Zhao, P. Gu, **N. Sapkota**, and D. Z. Chen. Path-GPTOmic: A balanced multi-modal learning framework for survival outcome prediction. *IEEE ISBI*, 2024

[11] P. Gu, Z. Zhao, H. Wang, Y. Peng, Y. Zhang, **N. Sapkota**, and D. Z. Chen. Boosting medical image classification with segmentation foundation model. *IEEE ISBI*, 2024

[12] Y. Zhang, P. Gu, **N. Sapkota**, Y. Peng, H. Zheng, and D. Z. Chen. SwIPE: Efficient and robust medical image segmentation with implicit patch embeddings. *MICCAI*, 2023

[13] S. Perrine, **N. Sapkota**, K. Kawasaki, Y. Zhang, DZ. Chen, M. Kawasaki, E. Durham, Y. Heuze, L. Legeai-Mallet, and JT. Richtsmeier. Embryonic cranial cartilage defects in the Fgfr$^{3Y367C/+}$ mouse model of achondroplasia. *Anatomical Record*, 2023

[14] Y. Zhang, P. Gu, **N. Sapkota**, H. Zheng, P. Liang, and D. Z. Chen. A point in the right direction: Vector prediction for spatially-aware self-supervised volumetric representation learning. *IEEE ISBI*, 2022

[15] Y. Zhang, **N. Sapkota**, P. Gu, Y. Peng, H. Zheng, and D. Z. Chen. Keep your friends close & enemies farther: Debiasing contrastive learning with spatial priors in 3d radiology images. In *IEEE BIBM*, 2022

[16] Y. Zhang, X. Hu, **N. Sapkota**, Y. Shi, and D. Z. Chen. Unsupervised feature clustering improves contrastive representation learning for medical image segmentation. In *IEEE BIBM*, 2022

Students Mentored

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