

# Nishchal Sapkota

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## Education

### University of Notre Dame (UND)

*Ph.D. in Computer Science and Engineering*

*M.S. in Computer Science and Engineering*

*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)

*B.S. in Computer Science | B.S. in Mathematics – Honors, summa cum laude (GPA: 3.91)*

*Thesis: Probabilistic Analysis of Revenues in Online Games*

Hattiesburg, MS

08/2020

## 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 (*Paper in progress*).
- 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. [9][10] [11]
- Proposed data-efficient universal 3D segmentation models with 11% performance improvement on out-of-distribution data.[1][3][8]
- Developed 3 novel methods leveraging foundation models for medical image analysis and cancer survival prediction. [2][5][6]
- Built a multimodal learning framework for automated sperm analysis handling label ambiguity [4] and a shape-aware segmentation method using implicit neural representations improving data efficiency by 30%. [7]
- Collaborated with multiple biology labs, hospitals, and anthropology departments to address medical and biological research challenges using AI-powered tools, resulting in several publications. [1][3][4][8]
- 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. [12]
- Analyzed online games using Markov Chain to maximize revenues for both players and the providers. [13]
- 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, Neural Networks, 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

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

## Teaching Experiences

<b>The University of Notre Dame</b>	Notre Dame, IN
Graduate Teaching Assistant	08/2020 – 12/2025
<ul style="list-style-type: none"><li>• <b>Design &amp; Analysis of Algorithms; Complexity &amp; Algorithms; Mobile App. Design; Discrete Mathematics</b></li><li>• Prepared lecture slides, graded submissions, created answer keys, and held office hours.</li></ul>	
STEM Project Leader   Warrior-Scholar Project	06/2023, 06/2024
<ul style="list-style-type: none"><li>• <b>Medical Image Analysis</b>: Designed and conducted a Bootcamp to prepare veterans for undergraduate research.</li><li>• <b>Introduction to Data Science</b>: Conducted a Bootcamp to prepare veterans for undergraduate coding classes.</li></ul>	

## Publications

- [1] **N. Sapkota**, Y. Zhang, Z. Zhao, M. J. Gomez, Y. Hsi, J. A. Wilson, K. Kawasaki, G. Holmes, M. Wu, E. W. Jabs, J. T. Richtsmeier, S. Perrine, and D. Z. Chen. UniCoN: Universal conditional networks for multi-age embryonic cartilage segmentation with sparsely annotated data. *Nature Scientific Reports*, 2024
- [2] 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
- [3] **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
- [4] **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
- [5] 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
- [6] 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
- [7] 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
- [8] 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<sup>3Y367C/+</sup> mouse model of achondroplasia. *Anatomical Record*, 2023
- [9] 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
- [10] 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
- [11] 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
- [12] **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
- [13] **N. Sapkota** and BSW Schröder. Probabilistic analysis of revenues in online games. *University of Southern Mississippi*, 2020

## 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*