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: ***Deep Learning, Computer Vision, Self-supervised Learning, AI for Healthcare***

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

Industry Experiences

IBM — Research Triangle Park – Durham, NC
Sr. Data Science & AI PhD Intern — *05/2025 – 08/2025*

- Modeled user decision patterns from web clickstream sequences using both linear (N-gram Markov models) and non-linear (Transformer/Mamba-based) architectures to predict conversion outcomes.
- Engineered predictive models on session-level behavior to identify high-intent users and potential buyers with improved precision.
- Collaborated cross-functionally to translate model insights into actionable marketing interventions, driving campaign optimization and measurable uplift in engagement.

Mayo Clinic — Rochester, MN
Computational Pathology and AI Intern — *01/2025 – 05/2025*

- Developed multi-modal foundation models leveraging self-supervised methods, integrating unstructured pathology imaging and structured patient data for advanced diagnostics and personalized patient care in healthcare.
- 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.

Research Experiences

The University of Notre Dame — Notre Dame, IN
Graduate Researcher — *08/2020 – Present*

- Currently working on surgical video segmentation for AI-assisted surgery and diffusion-based super-resolution framework .
- 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][4][8]
- Mentored 1 high school and 3 undergraduate students in machine learning, resulting in 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) **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 – 05/2023*

- **Complexity & Algorithms** (CSE 60111), **Mobile App. Design** (CSE 40333), **Discrete Mathematics** (CSE 20110)
- 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**, 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$^{3Y367C/+}$ 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 Schröeder. 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) – *Published author, applying to PhD programs*
- **Maria Jose Gomez** (High School Intern, 2024) – *Published author, applying to undergraduate programs*