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*

Experiences

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

- Currently working on real-time surgical video segmentation for AI-assisted surgery and diffusion-based super-resolution framework for unpaired infrared photothermal heterodyne images aimed at overcoming the Abbe diffraction limit.
- Proposed 3 different novel methods leveraging foundation models (based on SAM and GPT) for medical image classification [6] and cancer survival outcome prediction. [2][5]
- Developed data efficient encoder-agnostic universal 3D segmentation models that improved performance on out-of-distribution datasets by up to 11%, with less than a 2% increase in model complexity. [1] [3] [8]
- Proposed 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]
- Developed 3 self-supervised learning models achieving state-of-the-art segmentation performances. [9][10] [11]
- 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 student and 3 undergraduate students on machine learning projects, leading to several publications and successful placements in the industry.

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

- Developing multi-modal foundation models leveraging self-supervised methods integrating unstructured medical imaging and structured patient data for advanced diagnostics and personalized patient care in healthcare.
- Analyzing clinical and non-clinical data at scale to develop predictive healthcare models and managing its full data science lifecycle in collaboration with cross-functional teams.

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 maximum revenues for both players and the providers. [13]
- Predicted chemical compound toxicity using in-vitro computational methods and feature engineering.

Projects

Distributed Peer-to-peer Messaging App | *Python, Socket Programming, Catalog Server*

- Created a secure peer-to-peer decentralized messaging app with features like user connectivity, group chats, real-time notifications, and persistent chat histories, all without a central server.

Nenglish: A Language Translator App | *React Native, Google Cloud Vision, AutoML Translation.*

- Developed a mobile application that detects the contents from public signboards written in over 105 languages and translates to the user's choice of language.

BitCoin Price Prediction | *LSTM, AR, ARIMA*

- Developed a hybrid mathematical modeling and deep learning-based time series forecasting model to predict bitcoin prices with up to 91% accuracy.

Our Safe Neighborhood – CalHacks 6.0 @ UC Berkeley | *Google Cloud NLP, NLTK, React, JavaScript, Flask*

- Built a web application that scraps through the local news article and classifies the cities in the neighborhood as safe or unsafe by identifying the crime's location, type, and severity.

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: Artificial Intelligence, Machine Learning, Computer Vision, Neural Networks, CNN, LSTM, RNN, GAN, Transformers, NLP, LLM, Auto Encoders, Foundation Models, Self-supervised Learning, Generative AI, Multimodal Learning, Transfer Learning, INR, Diffusion Models, Time Series Forecasting, Mathematical Modeling, EDA, 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