Nishchal Sapkota

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Personal Website Google Scholar GitHub

EDUCATION

The 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* 05/2020
Dual Major: **Computer Science** and **Mathematics**
Thesis: *Probabilistic Analysis of Revenues in Online Games*

RESEARCH EXPERIENCES

The University of Notre Dame Notre Dame, IN
Graduate Researcher | Python, PyTorch, TensorFlow, Bash, Matlab 08/2020 - Present

- Currently developing a diffusion-based super-resolution framework for unpaired infrared photothermal heterodyne images, aimed at overcoming the Abbe diffraction limit and mitigating scanning-resultant background artifacts.
- Proposed 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 approaches achieving state-of-the-art segmentation performances. [9][10][11]
- Mentored one high school student and three undergraduate students on machine learning projects, leading to several publications and successful placements in industry.
- 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]

The University of Southern Mississippi Hattiesburg, MS
Undergraduate Researcher | Python, R, Matlab 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]

SOFTWARE/MACHINE LEARNING ENGINEERING PROJECTS

Distributed Peer-to-peer Messaging App | Python, Socket Programming, Catalog Server UND 2021

- 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. USM 2020

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

Our Safe Neighborhood | Google Cloud NLP, NLTK, React, JavaScript, Flask CalHacks 6.0 @ UC Berkeley 2019

- 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 AND RELEVANT CONCEPTS

Programming: Python, R, C++, Matlab, SQL
ML Packages: PyTorch, Tensorflow, Scikit-Learn, SciPy, OpenCV, Pandas, NumPy, Matplotlib, WandB
ML Concepts: Deep Learning, Computer Vision, Neural Networks, CNN, GAN, Transformers, NLP, LLM, Auto Encoders, Foundation Models, Self-supervised Learning, Generative AI, Multimodal Learning, INR, Diffusion Models
Tools: Jupyter, LaTeX, Fiji, 3D Slicer, Adobe Illustrator, Git, Microsoft Office Packages
Math Concepts: Data Analysis, Numerical Methods, Real Analysis, Modern Algebra, Number Theory, Statistics

PUBLICATIONS

[1] **Nishchal Sapkota**, Yejia Zhang, Susan M M Perrine, Yuhan Hsi, Sirui Li, Meng Wu, Greg Holmes, Abdul Abdulai, Ethylin Jabs, Joan T. Richtsmeier, and Danny Z Chen. UniCoN: Universal conditional networks for multi-age embryonic cartilage segmentation with sparsely annotated data. *Submitted to Nature Scientific Reports*, 2024

[2] Yejia Zhang, Hanqing Chao, Zhongwei Qiu, **Nishchal Sapkota**, Pengfei Gu, Danny Z Chen, Ke Yan, Dakai Jin, and Le Lu. IHCSurv: effective immunohistochemistry priors for multi-stain cancer survival analysis in gigapixel whole slide images. *MICCAI*, 2024

[3] **Nishchal Sapkota**, Yejia Zhang, Susan M M Perrine, Yuhan Hsi, Sirui Li, Meng Wu, Greg Holmes, Abdul Abdulai, Ethylin Jabs, Joan T. Richtsmeier, and Danny Z Chen. ConUNETR: A conditional transformer network for 3D Micro-CT embryonic cartilage segmentation. *IEEE ISBI*, 2024 **[Oral]**

[4] **Nishchal Sapkota**, Yejia Zhang, Sirui Li, Peixian Liang, Zhuo Zhao, and Danny Z Chen. SHMC-Net: A mask-guided feature fusion network for sperm head morphology classification. *IEEE ISBI*, 2024

[5] Hongxiao Wang, Yang Yang, Zhuo Zhao, Pengfei Gu, **Nishchal Sapkota**, and Danny Z Chen. Path-GPTOmic: A balanced multi-modal learning framework for survival outcome prediction. *IEEE ISBI*, 2024 **[Oral]**

[6] Pengfei Gu, Zihan Zhao, Hongxiao Wang, Yaopeng Peng, Yizhe Zhang, **Nishchal Sapkota**, and Danny Z Chen. Boosting medical image classification with segmentation foundation model. *IEEE ISBI*, 2024 **[Oral]**

[7] Yejia Zhang, Pengfei Gu, **Nishchal Sapkota**, Yaopeng Peng, Hao Zheng, and Danny Z Chen. Swipe: Efficient and robust medical image segmentation with implicit patch embeddings. *MICCAI*, 2023

[8] Susan M Motch Perrine, **Nishchal Sapkota**, Kazuhiko Kawasaki, Yejia Zhang, Danny Z Chen, Mizuho Kawasaki, Emily Durham, Yann Heuze, Laurence Legeai-Mallet, and Joan T Richtsmeier. Embryonic cranial cartilage defects in the fgfr3y367c/+ mouse model of achondroplasia. *Anatomical Record*, 2023

[9] Yejia Zhang, Pengfei Gu, **Nishchal Sapkota**, Hao Zheng, Peixian Liang, and Danny Z Chen. A point in the right direction: Vector prediction for spatially-aware self-supervised volumetric representation learning. *IEEE ISBI*, 2022

[10] Yejia Zhang, **Nishchal Sapkota**, Pengfei Gu, Y. Peng, Hao Zheng, and Danny Z Chen. Keep your friends close & enemies farther: Debiasing contrastive learning with spatial priors in 3d radiology images. In *IEEE BIBM*, 2022

[11] Yejia Zhang, Xinrong Hu, **Nishchal Sapkota**, Yiyu Shi, and Danny Z Chen. Unsupervised feature clustering improves contrastive representation learning for medical image segmentation. In *IEEE BIBM*, 2022

[12] **Nishchal 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] **Nishchal Sapkota** and Bernd SW Schröeder. Probabilistic analysis of revenues in online games. *University of Southern Mississippi*, 2020

TEACHING EXPERIENCES

The University of Notre Dame — Notre Dame, IN

Graduate Teaching Assistant

- Complexity and Algorithms (CSE 60111) — Spring 2023 & Spring 2024
- Mobile Application Design (CSE 40333) — Spring 2021
- Discrete Mathematics (CSE 20110) — Fall 2020

STEM Project Leader | Warrior-Scholar Project

- Medical Image Analysis — Summer 2024
- Introduction to Data Science — Summer 2023

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) — UND 2024
GSG 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 Rea Cross Endowed Chair in Mathematics ($10,500) — USM 2017-2020
Danny R. Carter Endowed Scholarship ($4,000) — USM 2017, 2019
First Place, Mathematics Comprehensive Exam (MFT) — USM 2019
Second Runner Up: Best Undergraduate Paper — MAA Meeting 2019
Eagle SPUR grant, Drapeau Center for Undergraduate Research ($2,000) — USM 2019
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