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
Master of Science in Computer Science and Engineering 08/2024
Research Areas: Deep Learning, Computer Vision, Medical Image Analysis

The University of Southern Mississippi (USM) Hattiesburg, MS
Bachelor of Science with Honors (GPA: 3.91), *summa cum laude* 05/2020
Dual Major: **Computer Science** and **Mathematics**

RESEARCH EXPERIENCES

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

- Developing data efficient universal conditional training schemes for both CNN and Transformer-based segmentation models to leverage similarity and dissimilarity in the dataset increasing the performance by up to 9%. [1]
- Proposed a novel transformer-based segmentation model for 3D images utilizing a conditional training scheme to learn from dissimilar datasets outperforming CNNs and Transformer models by up to 19% on zero-shot transfer. [3][8]
- Designed a state-of-the-art classification framework with a novel feature fusion scheme for sperm head morphology analysis by handling ambiguity in noisy labels and beating the known methods by up to 8%. [4]
- Introduced shape-aware segmentation 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]
- Proposed different novel methods leveraging foundation models (based on SAM and GPT) for medical image classification and cancer survival outcome prediction. [5][6]

The University of Southern Mississippi Hattiesburg, MS
Undergraduate Researcher | Python, R, Matlab 08/2017 - 05/2020

- Modeled a 3 species' predator-prey dynamic food chain model by introducing hunting cooperation in the middle predator and studying its long-term behavior. [12]
- Analysed revenues in online games using Markov Chain's transition matrix and its stationary form to estimate the per-game and the maximum revenues for players and the provider. [13]

SOFTWARE/MACHINE LEARNING ENGINEERING PROJECTS

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

- A secure, inexpensive, and central-server free peer-to-peer messaging interface with functionalities such as connecting to online users, creating group chats, real-time notifications, and persistent access to chat histories.

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 location of the crime, its type, and its severity using NLP tools.

TECHNICAL SKILLS AND RELEVANT CONCEPTS

Programming: Python, R, C++, Matlab, SQL
ML Packages: Pytorch, Numpy, Scikit-Learn, SciPy, OpenCV, Pandas, Tensorflow, Matplotlib, WandB
Tools: Jupyter, LaTeX, Fiji, 3D Slicer, Adobe Illustrator
ML Concepts: Artificial Intelligence, Machine Learning, Computer Vision, Neural Networks, CNNs, GANs, Transformers, Natural Language Processing (NLP), Self-supervised Learning, Generative AI, Auto Encoders, Distributed Systems
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. Universal conditional training schemes for 3d micro-ct embryonic cartilage segmentation. *Submitting 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, Yaopeng 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**, Rimsha Bhatta, Phillip Dabney, and Zhifu 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 [Undergraduate Thesis]

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