# Nishchal Sapkota

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🏠 [Personal Website](#)    𝔊 [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, AI for Healthcare, 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**
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

- ⮑ Developed data efficient encoder-agnostic universal segmentation models for 3D images to learn from dissimilar datasets outperforming the state-of-the-art by up to 11% on zero-shot transfer. [1] [3] [8]
- ⮑ Proposed a multimodal classification framework for automated sperm analysis and a shape-aware segmentation method using implicit neural representations improving data efficiency by 30%. [7]
- ⮑ 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]
- ⮑ 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 [6] and cancer survival outcome prediction. [2][5]

**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 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
**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. *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, 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

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|---|---|
| 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 |