Nishchal Sapkota

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EDUCATION

The University of Notre Dame (UND) Notre Dame, IN
Ph.D. in Computer Science and Engineering, Current GPA: 3.50 08/2020 - 12/2025 (Expected)
Research Areas: Deep Learning, Computer Vision, Graph Models, Medical Image Analysis
Advisor: Dr. Danny Chen

The University of Southern Mississippi (USM) Hattiesburg, MS
Bachelor of Science with Honors, GPA: 3.91, *Summa Cum Laude* 08/2016 - 05/2020
Dual Major: **Computer Science** and **Mathematics**
Thesis: *Probabilistic Analysis of Revenues in Online Games*
Advisor: Dr. Bernd Schröeder and Dr. Zhifu Xie

EXPERIENCES

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

- Proposed a light-weight transformer-based universal segmentation model for effective cartilage segmentation through a conditional training scheme to learn from dissimilar datasets and generalize well on unseen data in less training data regime outperforming several well-known CNN and Transformer based Models by up to 19%. [1,4]
- Introduced state-of-the-art classification framework with a novel feature fusion scheme for sperm analysis that generates boundary-refined sperm masks and combines the morphology information from both image and mask to elevate classification by handling ambiguity in noisy labels and beating the known methods by up to 8%. [2]
- Helped in proposing shape-aware segmentation using implicit neural representations that improved data efficiency by 30%. [3]
- Contributed to the development of three self-supervised learning approaches which all achieved state-of-the-art segmentation performances. [5,6,7]
- Contributed to the development of a classification framework with a novel data augmentation technique that leverages the vision foundation model (SAM) to enhance medical image classification.

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

- Modeled a 3 species' predator-prey food chain by introducing hunting cooperation in the middle predator and studied its long-term behavior. [8]
- Analysed revenues in online games using Markov Chain's transition matrix and stationary form to estimate the per-game and the maximum revenues for players and the provider. [9]
- Studied the potential to develop computational methods to predict the potential toxicity of chemical compounds using feature engineering and dimension reduction algorithms.

ML/SOFTWARE ENGINEERING PROJECTS

The University of Notre Dame Notre Dame, IN
Distributed Peer-to-peer Messaging App | Python, Socket Programming, Catalog Server Fall 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.

The University of Southern Mississippi Hattiesburg, MS
Nenglish: A Language Translator App | React Native, Google Cloud Vision, AutoML Translation. Spring 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.

CalHacks 6.0, The University of California, Berkeley Berkeley, CA
Our Safe Neighborhood | Google Cloud NLP, NLTK, React, JavaScript, Flask Fall 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

SCHOLARSHIPS, GRANTS, HONORS AND ACHIEVEMENTS

CSE Select Fellowship Award (*1/40 incoming Ph.D students; yearly stipend worth* $\$40,000$ *for 5 years*) UND 2020
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/Wings grant, Drapeau Center for Undergraduate Research ($\$2000$) USM 2019
Honors Keystone Scholarship ($\$2000$) USM 2019
Finalist, Integration Bee MAA Meeting 2018
Nominated for College of Science and Technology's Outstanding Sophomore Award USM 2017
Burner Science and Technology Annual Scholarship ($\$800$) USM 2017
Wallace C. and Lynn L. Pye Endowed Scholarship ($\$800$) USM 2017

PUBLICATIONS

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

[2] 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 International Symposium on Biomedical Imaging (ISBI)*, 2024

[3] 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 International Symposium on Biomedical Imaging (ISBI)*, 2024

[4] 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. *Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, 2023

[5] 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

[6] 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. *The IEEE International Symposium on Biomedical Imaging (ISBI)*, 2022

[7] 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 *2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2022

[8] Yejia Zhang, Xinrong Hu, Nishchal Sapkota, Yiyu Shi, and Danny Z Chen. Unsupervised feature clustering improves contrastive representation learning for medical image segmentation. In *2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2022

[9] 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

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