Nicholas Konz
Applied Machine Learning Researcher

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ABOUT ME

I am a machine learning researcher with experience in applied ML problems, whose Ph.D. research specializes in medical image analysis. Proficient at ML research that covers a broad spectrum from application-focused to foundational, I am skilled with using deep learning to solve challenging problems on real-world data, as well as being interested in how foundational ML concepts behave differently and need to be adapted for medical image analysis and other applied computer vision domains. I'm also drawn to the intersection of machine learning and science: understanding deep learning through a scientific lens, and leveraging it for scientific modeling, discovery, and applications in science-adjacent domains, influenced by my background in physics.

WORK EXPERIENCE

JAN 2021 – DEC 2025 (FT)

Duke University, Durham, NC
Doctoral Researcher

Key skills: deep generative models, domain adaptation and image-to-image translation, anomaly detection, computer vision.
My Ph.D. research contributed a diverse range of novel ML methodologies and discoveries in medical image analysis:

1. I discovered and modeled key discrepancies in how neural networks learn and generalize differently from medical images compared to natural images. I contributed methodologies for the guided generation of medical images, including new models and evaluation metrics. I led diverse advancements in machine learning for breast imaging (*e.g.*, MRI and DBT), including in self-supervised anomaly detection, domain adaptation, and lesion detection.

2. I published multiple first-author papers in top machine learning and medical image analysis conferences (*e.g.*, ICLR, MIC-CAI, MIDL) and journals (*e.g.*, Medical Image Analysis) as a result of my research.

3. All of my research projects have a focus on the public release of usable and documented code, datasets, and other accompanying materials to benefit the research community, which have gained hundreds of stars on GitHub ⤢.

MAY 2023 – JULY 2023 (FT)

Pacific Northwest National Laboratory, Richland, WA
Data Scientist Intern

Key skills: adversarial ML, interpretability and data attribution for neural networks.
My research in ML robustness and interpretability resulted in a first-author oral paper presentation at the ATTRIB workshop at NeurIPS 2023 and a third-author paper at EMNLP 2023, in addition to various internal confidential projects.

AUG 2017 – DEC 2020 (PT)

EDUCATION

2021 – 2025	**Doctor of Philosophy** GPA: 3.88/4.00 Electrical and Computer Engineering *Duke University*
2016 – 2020	**Bachelor of Science** GPA: 3.91/4.00, HIGHEST HONORS Physics (B.S.) and Mathematics (B.A.) *UNC Chapel Hill*

TECHNICAL SKILLS

PROGRAMMING	Python (numpy, pandas, sklearn, etc.), PyTorch, C++/C, Bash, LaTeX, JavaScript, HTML
DEVOPS	Git, Open Source, Docker, Vim, C++-to-Python wrapping

PROFESSIONAL SKILLS

COMMUNICATION	Experienced speaker at international conferences and workshops. Skilled in distilling project ideas to peers, leadership, and collaborators.
WRITING	Accomplished in academic writing. Major contributor for several large grant proposals. Experienced reviewer in multiple leading conferences and journals.
LEADERSHIP	Experienced mentor and manager of peers, junior researchers and students in various projects.
PROJECT MANAGEMENT	Proficient in planning, organizing, and coordinating resources and tasks to achieve goals efficiently.

TEACHING/MENTORING EXPERIENCE

2022 – 2023 (PT)

Duke University, Durham, NC
Graduate Teaching Assistant

Teaching assistant for ECE 685D: Introduction to Deep Learning under Prof. Vahid Tarokh. Responsibilities included lecturing, teaching lab sections, leading projects, office hours, assignment and exam creation, and grading.

2017 – 2018 (PT)

UNC Chapel Hill, Chapel Hill, NC
Undergraduate Teaching Assistant

Teaching/learning assistant for MATH 528: Mathematical Methods for the Physical Sciences, MATH 233: Multivariable Calculus, and PHYS 119: Introductory Calculus-Based Electromagnetism.

UNC/Skynet Robotic Telescope Network
Research Assistant

UNC Chapel Hill, Chapel Hill, NC
Educator/Coordinator

Key skills: statistical algorithm development, open-source documentation and release, Monte Carlo methods.

My undergraduate research in statistical computational methods for astronomy was focused on developing a suite of algorithms ⤢ for robust outlier detection and uncertainty-aware model fitting, resulting in the release of public code packages, web interfaces, and accompanying publications.

Mentor for ERIRA ⤢, a yearly week-long intensive radio astronomy research program for early college students led by Prof. Daniel Reichart. Projects I lead involve machine learning for astronomy.

SELECTED PUBLICATIONS

N. Konz, M. A. Mazurowski. "The Effect of Intrinsic Dataset Properties on Generalization: Unraveling Learning Differences Between Natural and Medical Images". ***ICLR*, 2024**.

N. Konz, Y. Chen, H. Gu, H. Dong, M.A. Mazurowski. "Anatomically-Controllable Medical Image Generation with Segmentation-Guided Diffusion Models". ***MICCAI*, 2024**.

N. Konz, H. Dong, M.A. Mazurowski. "Unsupervised anomaly localization in high-resolution breast scans using deep pluralistic image completion". ***Medical Image Analysis*, 2023**.

N. Konz*, M. Buda*, et al. "A Competition, Benchmark, Code and Data for Using Artificial Intelligence to Detect Lesions in Digital Breast Tomosynthesis". ***JAMA Network Open*, 2023**.

N. Konz, H. Gu, H. Dong, M. A. Mazurowski. "The Intrinsic Manifolds of Radiological Images and their Role in Deep Learning". ***MICCAI*, 2022**.

Full list on Google Scholar ⤢.

REFERENCES

	Dr. Maciej Mazurowski
POSITION	Professor *(doctoral advisor)*
EMPLOYER	Duke University ⤢
EMAIL	maciej.mazurowski@duke.edu
	Dr. Vahid Tarokh
POSITION	Professor *(teaching assistantship)*
EMPLOYER	Duke University ⤢
EMAIL	vahid.tarokh@duke.edu
	Dr. Henry Kvinge
POSITION	Data Scientist, Professor *(internship mentor)*
EMPLOYER	Pacific Northwest National Laboratory ⤢ University of Washington ⤢
EMAIL	hjk3@uw.edu

RELEVANT COURSEWORK

Duke University:

MACHINE LEARNING/ COMPUTER SCIENCE	Deep Learning, Advanced Topics in Deep Learning, Probabilistic Machine Learning, Natural Language Processing, Generative Models, Adversarial Machine Learning, Engineering Deep Neural Networks, Vector Space Methods

UNC Chapel Hill:

COMPUTER SCIENCE	Numerical Techniques, Physical Modeling,
MATHEMATICS	Multivariable and Vector Calculus, Linear Algebra, Probability, Real Analysis, Ordinary Differential Equations, Partial Differential Equations, Complex Analysis, Mathematical Methods I & II
PHYSICS & ASTRONOMY	Classical Mechanics, Electromagnetism I & II, Quantum Mechanics I & II, Quantum Computing, Cosmology, Astrophysics, Thermodynamics/Statistical Mechanics, Experimental Techniques, Astronomical Data