SEAN MULLAN

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EDUCATION

UNIVERSITY OF IOWA — Iowa City, IA
PhD., Biomedical Engineering — August 2019 – May 2023
Thesis: Deep Learning and Explainable AI in Medical Image Segmentation
Advisor: Professor Milan Sonka

UNIVERSITY OF IOWA — Iowa City, IA
MCS, Computer Science — August 2017 – May 2019

CARLETON COLLEGE — Northfield, MN
BA, Computer Science — August 2012 – May 2016
Concentration: Cognitive Science
Capstone Project: Genetic Programming for Stock Forecasting

AWARDS AND HONORS

Iowa Lung Imaging Training Program Fellow (NIH Grant T32-HL144451)

PROFESSIONAL EXPERIENCE

UNIVERSITY OF IOWA — Iowa City, IA
Graduate Research Assistant, Dept. of Biomedical Engineering — June 2018 – May 2023

- Designed and implemented novel deep learning models for medical image segmentation, as well as adapted pre-existing state-of-the-art models for specific tasks and modalities.
- Worked extensively with various imaging modalities, including CT, MR, OCT, and X-ray, to ensure accurate and effective segmentation across a diverse range of medical images.
- Led the design and execution of independent research projects in medical image segmentation and explainable AI.
- Collaborated with medical experts by providing customized machine learning solutions to address specific clinical research questions and projects.
- Designed and validated a novel visual explanation method for deep learning segmentation models, enabling bias assessment and more reliable model development.

UNIVERSITY OF IOWA — Iowa City, IA
Research Assistant, Dept. of Computer Science — June 2017 – August 2017

- Developed wearable technologies and related computer vision algorithms to enable running guidance for the visually impaired.
- Performed statistical, qualitative, and quantitative analysis of the developed technologies both in laboratory and field settings.
- Designed and implemented a machine learning pipeline for segmentation of diabetic foot ulcers.

- Developed an assisted annotation tool to enable the rapid annotation of a diabetic foot ulcer dataset containing thousands of cell-phone images.

QUALITY CONSULTING INC. Des Moines, IA
Test Automation Engineer September 2016 – May 2017

- Created successful test scripts to manage automated feature testing.
- Developed TypeScript and Protractor-based test suites and modules for end-to-end testing of DuPont Pioneer's Encirca web services.
- Collaborated as part of a development team to identify issues, share insights, and contribute to a streamlined continuous development pipeline.

RESEARCH INTERESTS

My current research interests focus on machine learning analysis applied to medical imaging and healthcare. I am particularly interested in developing robust models and explainability methods to enable understanding of the underlying function of these models so that they can be utilized for clinical applications.

TECHNICAL SKILLS

- Programming: Python / C++
- Medical Image Analysis: Segmentation, Classification, Registration
- Deep Learning: PyTorch, TensorFlow, Keras, Monai
- Deep Learning Architecture: nnU-Net, CNNs, Transformers
- Data Analysis: NumPy, SciPy, ITK, VTK
- Explainable AI: GradCAM, Integrated Gradients, Concept Vectors
- Data Visualization: Matplotlib, Seaborn
- Technical Writing

SELECTED PUBLICATIONS

[Complete List: orcid.org/0000-0003-4832-4453]

[1] Sean Mullan, & Milan Sonka (2023). Kernel-weighted contribution: a method of visual attribution for 3D deep learning segmentation in medical imaging. *Journal of Medical Imaging*, 10(05).

[2] S. Mullan, L. Zhang, H. Zhang, & M. Sonka. (2023). Deep learning medical image segmentation. In A. Frangi, J. Prince, & M. Sonka (Eds.), *Medical Image Analysis* (1st ed., pp. 475-500). Elsevier.

[3] Sean Mullan, Milan Sonka (2022). Visual attribution for deep learning segmentation in medical imaging. In *Medical Imaging 2022: Image Processing*. SPIE.

[4] Joseph T. Vecchi, Sean Mullan, Josue A. Lopez, Marlan R. Hansen, Milan Sonka, & Amy Lee (2021). NeuriteNet: A convolutional neural network for assessing morphological parameters of neurite growth. *Journal of Neuroscience Methods*, 363, 109349.

[5] S. Mullan, Z. Chen, M. Pazdernik, H. Zhang, A. Wahle, V. Melenovsky, J. Kautzner, V. Karmazin, H. Bedanova, A. Tomasek, E. Ozabalova, & M. Sonka (2019). Deep Learning Facilitates Automation of Wall Layer Quantification in Heart Transplant Coronary OCT. *The Journal of Heart and Lung Transplantation*, 38(4), S281.