NATHAN LOUIS

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EDUCATION

University of Michigan, Ann Arbor, MI — March 2024
Ph.D., Electrical and Computer Engineering
Advisor: Dr. Jason J. Corso

University of Michigan, Ann Arbor, MI — May 2020
M.S., Electrical and Computer Engineering
Research Area: Computer Vision

Kennesaw State University, Marietta, GA — July 2017
B.S., Electrical Engineering

SKILLS AND INTERESTS

Research Interests	AI & Deep learning, Pose estimation and tracking, Biomechanics applications Estimating human dynamics and skill from video
Skills	Python, PyTorch, MatLab programming
Platforms	OS X, Windows, Ubuntu

RESEARCH AND WORK EXPERIENCE

Research Engineer — March 2024 - Present
Div 18 - Southwest Research Institute — *San Antonio, TX*

- I lead and contribute to projects that design computer vision and AI solutions for various biomechanics-related problems.
- I have worked on projects related to multi-person multi-camera tracking, tissue segmentation from CT scans, estimating injury probability from running kinematics and CT scans, and approximating joint angles of human motion using differentiable simulation.

Graduate Research Intern — May 2021 - March 2024
Div 18 - Southwest Research Institute — *San Antonio, TX*

- I developed deep learning solutions to address problems in the biomechanics domain.
- I have worked on projects related to person and hand pose tracking, ground reaction force prediction from video and super resolution from low resolution CT-SCAN bone images.

Graduate Research Assistant — September 2017 - March 2024
COG Lab - University of Michigan — *Ann Arbor, MI*

- I identified problems in computer vision literature, developed new ideas, and designed experiments to publish in conference and journal articles.
- I have completed and published works related to tracking hand poses in the surgical domain, estimating external forces of human motion, evaluating quality of 3D poses using physics simulation, and classifying technical skills of resident and expert surgeons from tracked hand movement.

Summer Undergraduate Research in Engineering/Sciences — May 2016 - Aug 2016
Georgia Institute of Technology — *Atlanta, GA*

- I completed a research project with Dr. Patricio Vela, as part of an NSF REU summer program, titled *Improving the Computer Vision Pipeline Through the Application of a Damped Gradient Energy.*
- This was a process that aimed to reduce the amount of information necessary to produce feature vectors for some computer vision algorithms that utilize gradients. I presented our findings at the SURE symposium.

Louis Stokes Alliance For Minority Participation Summer Research May 2013 - August 2013
Kennesaw State University *Marietta, GA*

- I completed a project with Dr. Dan Lo titled *Smart Sensor Design & Development* as part of an NSF program.
- My team and I designed an embedded system to read data from sensors and transmit it over Bluetooth to an Android device. The sensors used were medical device sensors and a dust sensor, and visually displayed data in graphical or numerical form. We presented this at the PSLSAMP fall symposium.

PUBLICATIONS

N Louis, M Khoshlessan, JJ Corso. *Measuring Physical Plausibility of 3D Human Poses Using Physics Simulation.* British Machine Vision Conference, 2024.

LL Frazer, **N Louis**, W Zbijewski, J Vaishnav, K Clark, DP Nicolella. *Super-resolution of clinical CT: Revealing microarchitecture in whole bone clinical CT image data.* Bone 185, 2024: 117115.

N Louis, JJ Corso, TN Templin, TD Eliason, DP Nicolella. *Learning to Estimate External Forces of Human Motion in Video.* ACM International Conference on Multimedia, 2022

N Louis, L Zhou, SJ Yule, RD Dias, M Manojlovich, FD Pagani, DS Likosky, JJ Corso. *Temporally Guided Articulated Hand Pose Tracking in Surgical Videos.* International Journal of Computer Assisted Radiology and Surgery, 2022.

MR Ganesh, E Hofesmann, **N Louis**, JJ Corso. *ViP: Video Platform for PyTorch.* arXiv preprint, 2019.

L Zhou, **N Louis**, JJ Corso. *Weakly-Supervised Video Object Grounding from Text by Loss Weighting and Object Interaction.* British Machine Vision Conference, 2018.

TECHNICAL PRESENTATIONS

Measuring Physical Plausibility of 3D Human Poses Using Physics Simulation November 2024
British Machine Vision Conference *Glasgow, Scotland*

- Oral and poster presentation at the main conference

Learning to Estimate External Forces of Human Motion in Video October 2022
ACM Multimedia Conference *Lisbon, Portugal*

- Poster presentation at the main conference

The Use of AI & Computer Vision to Assess Human Performance July 2020
Brigham and Women's Health Hospital, Harvard University *Virtual*

- Invited talk by The Human Factors and Cognitive Engineering Lab as part of their STRATUS research seminar series.

Weakly-Supervised Video Obj. Grounding from Text by Loss Weighting and Obj. Inter. Fall 2018
University of Michigan *Ann Arbor, MI*

- Presented at the Engineering Graduate Symposium in October 2018
- Presented at the Michigan AI Symposium in November 2018

RELEVANT PROJECTS

Improving Human Force Prediction via Cycle-Consistency 2023
COG Lab - University of Michigan *Ann Arbor, MI*

- We aim to relax the quantity of supervised data needed for prediction of Ground Reaction Forces from 3D human poses. Given the vast amount of multi-view and motion capture data that exists, we seek to use a cycle-consistency training regime as a way to bootstrap limited amounts of supervised data with "label-free" 3D poses through self-reconstruction.

Explorative 3D Reconstruction 2020
EECS 598 - University of Michigan *Ann Arbor, MI*

· In this work, we explore the problem of multi-view 3D mesh reconstruction with a limited set of viewpoints. Analogous to an intelligent agent, we learn to select the next best view by predicting the regions of high uncertainty using low-cost silhouette reconstruction from a set of canonical viewpoints.

ViP: Video Platform for PyTorch 2019
COG Lab - University of Michigan *Ann Arbor, MI*

· We developed a deep learning-based framework we call the Video Platform for PyTorch (ViP). We designed it as a way to rapidly prototype and benchmark computer vision models in the video domain.

Learning Motion Models for Robust Visual Object Tracking 2019
COG Lab - University of Michigan *Ann Arbor, MI*

· I investigated using state estimation theory in combination with a deep learning framework to produce robust tracking coordinate positions. I used a Siamese CNN to encode my observations followed by a recurrent neural network that can approximate a motion model and covariance estimates for Kalman filter updates.

Weakly-Supervised Video Object Grounding from Text by Loss Weighting and Object Interaction 2018
COG Lab - University of Michigan *Ann Arbor, MI*

· We studied weakly-supervised video object grounding: given a video segment and a corresponding descriptive sentence, the goal is to localize objects that are mentioned from the sentence in the video. Our model is evaluated on the newly- collected benchmark YouCook2-BoundingBox and show improvements over competitive baselines.

VOLUNTEER SERVICE

AI4ALL July 2019
University of Michigan *Ann Arbor, MI*

· AI4ALL is a nonprofit with a focus on increasing diversity and inclusion in the field of Artificial Intelligence. During a two-week period and for 30+ high school students, I taught linear and non-linear regression techniques, Python coding basics, and guided a team into completing a group project.

STEMulation March 2019
University of Michigan *Ann Arbor, MI*

· Graduate Society of Black Engineers and Scientists invited high school students to campus to learn about college, engineering, and to participate in fun engineering/science activities. I participated as one of the volunteers in the planning and execution of this event.

College of Engineering Xplore Workshop June 2018
Lights, Pinholes, and Cameras *Ann Arbor, MI*

· Engineering workshops held for middle school students over two days. I presented on the importance of light and lenses from rudimentary to complex vision systems. The students all took home hand crafted pinhole cameras.

PSLSAMP Outreach Fall 2015
Marietta Middle School *Marietta, GA*

· Twice a week, I worked as a classroom assistant and helped students complete various science projects.

AWARDS AND ACHIEVEMENTS

Excellence in ECE Honor Roll Fall 2021

Recipient, Rackham Merit Fellowship Fall 2017

Dean's List, School of Engineering	Fall 2012 - Spring 2017
Awarded PSLSAMP Stipend	Spring 2013, Fall 2013, Spring 2014, Spring 2015, Fall 2015
Recipient, Shaw Industries Scholarship:	Fall 2013, Spring 2014