Samuel Ehrenstein

saeh.me | github.com/qscgy/ | sam.ehrenstein@gmail.com

Interests

AI + Health, Medical Imaging, 3D Computer Vision, Computational Geometry, Machine Learning, Motion Planning, Real-Time Vision

Education

Ph.D. in Computer Science — Aug 2021-present

University of North Carolina at Chapel Hill — Chapel Hill, NC

Advisor: Stephen M. Pizer

M.Sc. in Computer Science — Aug 2021-May 2023

University of North Carolina at Chapel Hill – Chapel Hill, NC

Advisor: Stephen M. Pizer

B.A. in Physics and Computer Science — Aug 2017-May 2021

Case Western Reserve University — Cleveland, OH

Specialization: Internet of Things + Medical Image Synthesis

Experience

COMP 116 Instructor – August 2025-Present

University of North Carolina at Chapel Hill — Chapel Hill, NC

- Taught scientific programming to a class of 112 non-CS majors as the instructor of record.
- Developed a syllabus and lesson plans tailored to the needs of students in life sciences, statistics, and economics.
- Managed a team of 6 TAs to ensure consistent availability of support to students.

Planning Engineer Intern – May 2025-Aug 2025

Kodiak Robotics – Mountain View, CA

Supervisor: Roya Sabbagh Novin - Implemented an advanced approach to motion planning that enabled a self-driving truck to detect and pull over for overtaking traffic on unpaved roads. - Increased lateral clearance when pulled over by an average of 0.6 meters, thus contributing to a safer product. - Performed extensive unit testing and simulation on a large-scale codebase, ensuring code reliability and robustness.

Graduate Research Assistant — Aug 2021-Present

University of North Carolina at Chapel Hill — Chapel Hill, NC

Advisor: Stephen M. Pizer

- Developed a novel approach to visual navigation, combining deep learning and computational geometry, in order to enable placement of an endoscope with an accuracy of 3 cm.
- Collaborated with a team to devise and implement a novel, Vision Transformer-based method of monocular depth estimation in the irregular domain of medical endoscopy, achieving competitive or superior performance against existing methods.
- Developed a trainable image-processing pipeline to detect texture-invariant geometric features in endoscopic video, outperforming the state of the art by 30 percentage points on overall accuracy. Optimized this approach to be able to process 110 frames per second.
- Used Qt and VTK to continue development of an interactive post-processing tool for 3D reconstructions.
- Performed extensive testing and debugging on a shared codebase.

Skills

Design: User interface design, Information visualization, Solidworks, Fusion 360, Canva, Illustrator

Programming: Python (NumPy, SciPy, Pandas, Matplotlib, PyTorch, Pytorch3D, OpenCV, Altair, Open3D), Java, C++, MATLAB (Deep Learning Toolbox), Bash, SQL

Testing/Simulation: GoogleTest, Applied Intuition Object Sim (formerly Simian), Elastic Kibana

Graduate Coursework

3D Generative Models, Bioinformatics, Computational Perception, Cryptography, Generative Modeling, Image Processing, Information Visualization, Machine Learning, Neural Rendering, Object Statistics, Shape Representation and Statistics, Vision Transformers

Projects

Shape Viewer — 2024-present

Tool for visualizing the geometric properties of 3D shapes

- Used PyVista, Sympy, and Numpy to to create a cross-platform educational app for visualizing the geometric properties of surfaces.
- This project is an attempt to make an updated, cross-platform version of Shapemonger, an old Windows application that was the only option availabe to visualize surface properties important in differential geometry.
- Features include:
  - visualization of local and global shape properties
  - plotting of Gauss maps and asymptotic spherical maps
  - a customizable plotting system
  - a library of example shape plots highlighting key concepts in differential geometry
- The code is available at https://github.com/qscgy/shape-viewer.

Outreach & Academic Service

UNC Computer Science Student Association — 2022-present

President — 2023-2024

- Budgeted university funds and coordinated with caterers and facilities services to host biweekly tea times, 4 offsite dinners and 4 lunches for 60 people each, and one family-friendly evening social for 100 people.
- In spring 2024, held 150% more department social events than in any of the previous four semesters.
- Advocated for the views and interests of students during the faculty hiring process as a voting member of the departmental faculty senate.
- Successfully advocated for a cost-of-living increase to graduate student stipends.

FIRST Robotics Competition Team 449

Mentor – 2017-2024

- Taught high school students fundamental skills in mechanical engineering, programming, and system design, leading to 3 world championship appearances in the 5 full competition seasons during this time period.

Publications & Patents

Ehrenstein, S., McGill, S., Rosenman, J., and Pizer, S. (In review, 2025). Geometric and Photometric Features for Navigation in Colonoscopy.

Paruchuri, A., **Ehrenstein, S.**, Wang, S., Fried, I., Pizer, S.M., Niethammer, M., and Sengupta, R. (2024). Leveraging Near-Field Lighting for Monocular Depth Estimation from Endoscopy Videos. European Conference on Computer Vision 2024. Milan, Italy. *arXiv:2403.17915*.

S. Ehrenstein, S.M. Pizer, S. Sengupta, S. Wang, Y. Zhang, J.-M. Frahm (2024). Methods, Systems, and Computer Readable Media for Colonoscopic Blind Spot Detection PCT/US2024/018732. Patent pending.

Ehrenstein, S., McGill, S., Rosenman, J., and Pizer, S. (2023). Scribble-Supervised Semantic Segmentation for Haustral Fold Detection [Lecture]. Presented at Computer Assisted Radiology and Surgery Congress 2023. Munich, Germany.

Zhang, Y., Frahm, J. M., **Ehrenstein, S.**, McGill, S. K., Rosenman, J. G., Wang, S., and Pizer, S. M. (2021). ColDE: A Depth Estimation Framework for Colonoscopy Reconstruction. *arXiv preprint arXiv:2111.10371*.

Ehrenstein, S., Abenojar, E., Perera, R., Exner, A., and Bayat, M. (2021). Rank-Assisted Deep Residual Reconstruction Network for Non-Contrast Ultrasound Imaging of Blood Microvessels. IEEE International Ultrasonics Symposium (IUS). Virtual.

Ehrenstein, S., and Bayat, M. (2021). Deep Learning For Accessible Non-Contrast Ultrasound Imaging of Blood Microvessels. NVIDIA GPU Technology Conference (GTC). Virtual.