Akshay Paruchuri

akshay@cs.unc.edu | akshayparuchuri.com/ | yahskapar | akshayparuchuri

Summary

My research interests are at the intersection of computer vision, computer graphics, and machine learning. I'm interested in improving 3D, multi-modal (vision and language), and generative computer vision techniques for a variety of applications including, but not limited to, healthcare, augmented and virtual reality, and robotics. I also deeply care about and enjoy building systems in the aforementioned application areas, with a desire to make such systems as effective and accessible as possible in both academia and industry. Currently, I'm a PhD student in the Department of Computer Science at the University of North Carolina at Chapel Hill, where I'm advised by Roni Sengupta. I'm currently seeking internship opportunities in the summer of 2024.

Education

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

Ph.D. in Computer Science — *Aug 2021 - Present*

- Research Areas: Computer Vision, Computer Graphics, Machine Learning
- Advisor: Roni Sengupta

North Carolina State University — *Raleigh, NC, USA*

B.S. in Electrical and Computer Engineering — *Aug 2014 - Dec 2019*

- Graduated with Honors
- Research Areas: Embedded Systems, Wearable Sensors

Experience

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

Graduate Research Assistant (Advisor: Roni Sengupta) — *Aug 2022 - Present*

- Researching and developing a system that combines photometric stereo and SLAM for dynamic 3D reconstruction and localization within the context of 3D endoscopy procedures
- Researching and designing a deep fake advertisement prototyping pipeline to be used in experiments toward better healthcare outcomes using personalized, deep fake advertisements. The pipeline currently contains numerous components to produce personalized, reasonably photo-realistic deep fakes, including text and image-guided generation of both imagery and audio
- Explored and conducted research at the intersection of computer vision, computer graphics, and machine learning with the challenging task of robust, camera-based vital signs detection. In particular, I focused on addressing three sources of potential measurement error with remote photoplethysmography (rPPG) - 1) motion, 2) dynamic lighting, and 3) diverse skin types

Kitware — *Carrboro, NC*

Research and Development Intern (Manager: Brian Clipp) — *Apr 2023 - Jul 2023*

- Worked toward faster object detection, tracking, and ultimately semantic state understanding using 3D vision techniques such as Structure from Motion (SfM) and large foundation models such as the Segment Anything Model (SAM)
- Surveyed and investigated numerous ideas at the intersection of person re-identification and human activity recognition, including multi-modal (text and language) person search that sought to expand an existing state-of-the-art person re-identification dataset, MEVID, with high quality text attributes
- Explored and documented performance improvements using training data augmentations as a part of a system for human activity recognition using 2D skeleton poses extracted from far-field videos

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

Graduate Research Assistant (Advisors: Henry Fuchs and Danielle Szafir) — *Aug 2021 - Aug 2022*

- Developed code in Python and C++ as extensions to an existing human body 3D reconstruction pipeline in order to work toward physically plausible 3D reconstruction of human bodies
- Conducted experiments involving 3D reconstruction of the human body targeted for telepresence applications that involve a clinician and a patient involved in physical therapy
- Co-directed and helped write an NSF Smart and Connected Health (SCH) proposal related to augmented reality systems for the management of Parkinson's disease symptoms. The NSF proposal eventually got funded as an NIH proposal (Project #: 1R01HD111074-01), starting in Fall 2022.

Nike *Beaverton, OR*

Embedded Systems Engineer (Manager: Vikram Malhotra) *Jan 2020 - Jul 2021*

- Developed hardware, algorithms, and software toward novel, wearable consumer devices for experiences involving physical fitness

Nike *Beaverton, OR*

Embedded Systems Engineering Intern (Manager: Vikram Malhotra) *May 2019 - Aug 2019*

- Prototyped a feature-rich, non-form factor PCB to characterize power consumption in unique contexts and developed software toward meaningful gesture recognition using adaptive, self-lacing shoes

Active Robotic Sensing Lab (ARoS), NC State *Raleigh, NC*

Undergraduate Research Assistant (Advisor: Dr. Edgar Lobaton) *Jan 2019 - May 2019*

- Re-designed hardware and conducted experiments toward an autonomous robot for foraminifera identification

Integrated Bionic MicroSystems Laboratory (iBionicS), NC State *Raleigh, NC*

Undergraduate Research Assistant (Advisor: Dr. Alper Bozkurt) *Aug 2018 - Jan 2019*

- Investigated application of non-contact electrodes to perform electrocardiogram and bio-impedance measurements on canines involved in animal assisted therapies

Publications

4 Xin Liu, **Akshay Paruchuri***, Girish Narayanswamy*, Xiaoyu Zhang, Yuzhe Zhang, Yuntao Wang, Roni Sengupta, Shwetak Patel, and Daniel McDuff. rPPG-Toolbox: Deep Remote PPG Toolbox. *arXiv preprint arXiv:2210.00716*. (Accepted to NeurIPS 2023 - Datasets and Benchmarks Track).

3 **Akshay Paruchuri**, Xin Liu, Yulu Pan, Shwetak Patel, Daniel McDuff, and Roni Sengupta. Motion Matters: Neural Motion Transfer for Better Camera Physiological Sensing. *arXiv preprint arXiv:2303.12059*. (Accepted to WACV 2024) **[Oral, Top 2.6%, 53 of 2042 submissions]**.

2 Qian Zhang, **Akshay Paruchuri**, Young-Woon Cha, Jia-Bin Huang, Jade Kandel, Howard Jiang, Adrian Ilie, Andrei State, Danielle Szafir, Daniel Szafir, and Henry Fuchs. Reconstruction of Human Body Pose and Appearance Using Body-Worn IMUs and a Nearby Camera View for Collaborative Egocentric Telepresence. *2023 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Shanghai, China, 2023, pp. 96-97, doi: 10.1109/VRW58643.2023.00025.

1 Angelos Angelopoulos, Austin Hale, Husam Shaik, **Akshay Paruchuri**, Ken Liu, Randal Tuggle, and Daniel Szafir. Drone Brush: Mixed Reality Drone Path Planning. *Late-Breaking Reports at the IEEE/ACM International Conference on Human-Robot Interaction (HRI 2022)*.

Skills

Design	Hardware prototyping (PCB layout, circuit modeling), User interface design (hardware and software)
Programming	Python (NumPy, PyTorch, PyTorch3D, and OpenCV), C , C++, MATLAB
Hardware	MCUs, FPGAs, Soldering, Hardware debuggers (SEGGER J-Link, ST-LINK), Oscilloscope, Logic analyzer, Spectrum analyzer, 3D printing

Courses

Machine Learning, Deep Learning, Computer Vision in our 3D World, Neural Rendering, Visual Recognition with Transformers, Topics in Parallel Computing, Mobile Health Systems, Human-Robot Interaction, and Information Visualization

Awards

ASSIST Center Undergraduate REU (Summer 2018, sponsored by RTNN)
ASSIST Center Undergraduate Research Fellowship (Fall 2018)
NC State ECE Department Undergraduate REU (Fall 2018)
NC State Dean's List (4.0 GPA in Spring 2019 and Fall 2019)

Presentations

Motion Matters: Neural Motion Transfer for Better Camera Physiological Sensing
Poster Presentation, International Conference on Computational Photography (Summer 2023)
Poster Presentation, UNC Data Science Day (Fall 2023)
Oral + Poster Presentation, IEEE/CVF Winter Conference on Applications of Computer Vision (WACV) (Winter 2024)
FORABOT: An Autonomous and Accessible System for Sorting Foraminifera
Poster Presentation, NC State Undergraduate Research and Creativity Symposium (Spring 2019)
Thermoelectric Properties of $CuBi_xSb_{1-x}Te_2$ Bulk Alloys
Technical Talk and Poster Presentation, National Nanotechnology Coordinated Infrastructure (NNCI) REU Convocation (Summer 2018)
Poster Presentation, NC State Undergraduate Research and Creativity Symposium (Summer 2018)
Poster Presentation, ASSIST Center Research Symposium (Summer 2018)

Mentoring

Mingxuan Li (UNC CS BS, Spring 2022)
Yulu Pan (UNC CS BS, Fall 2022-Spring 2023)
Bang Gong (UNC CS BS, Summer 2023-Present)
Peifeng (Hank) He (UNC CS BS, Fall 2023-Present)

Outreach & Academic Service

Outreach
UNC-CH Computer Science Student Association Officer, Summer 2023 - Present
UNC-CH Computer Science Student Association President, Fall 2022 - Summer 2023
UNC CS Fellowship Panel Organizer, Fall 2022
Decoding Graduate Programs in CS Panel Member, Fall 2022
UNC CS Middle School/High School Open House Volunteer, Spring 2023
UNC CS Vision Seminar Organizer, Spring 2023
Academic Service
IEEE VR 2023, Reviewer

Authorizations

U.S. Citizenship
Amateur Radio License (Granted by FCC, Call-sign: KN4IOS)