Winona Richey, PhD

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Research Interests: Computer Assisted Surgical Navigation • Computer Vision • Machine Learning

EDUCATION

BSE, Biomedical Engineering and Computer Science Tulane University, New Orleans, LA, May 2017
PhD, Biomedical Engineering Vanderbilt University, Nashville, TN, April 2022

SKILLS

Python • MATLAB • Bash • Java • C/C++ • Unity • 3D Slicer • Qt • ParaView • ITK/VTK • CMake TensorFlow • OpenCV • GitHub • MR/CT/Ultrasound Image Processing • CAD (SolidWorks/Creo) Ultrasound N-Wire Calibration • Human Anatomy Cadaver Lab • Surgical Experience • Grant Writing

RESEARCH EXPERIENCE

- *Polaris AR*, Staff Research Engineer; Dallas, TX (Remote); 2022-Present
    - Contributing to the design, implementation, and testing for a total knee arthroplasty surgical guidance platform in augmented reality using Unity and C++
    - Independently conceived and implemented test protocols and analysis tools to characterize point and plane tracking accuracy, extending beyond ASTM Standard F2554-22. Authored test reports resulting in FDA clearance without additional information requests.
- *Biomedical Modeling Lab*, Dr. Michael Miga; Vanderbilt University, Nashville, TN; 2017-2022
  Image guided software system for breast surgical oncology
    - Designed and implemented meticulously planned IRB approved experiments, which generated a robust dataset that supported diverse research endeavors for over five years
    - Developed image guidance system for breast cancer resection in 3D Slicer (Python/Qt) deployed on human subjects, with iterative surgeon feedback
    - Leveraged biomechanical modeling to enhance intraoperative tumor localization; improved image-to-physical registration errors 50-65% compared to rigid alignments
    - Implemented tracked ultrasound N-wire calibration framework in a custom module complementing optically tracked NDI tools for surgical data acquisition via Plus Toolkit
  Computer vision framework
    - Created innovative surface acquisition method with FLIR (Point Grey) stereo cameras in OpenCV and MATLAB, using colored ink and hand-drawn letters on the breast surface
- *Biomedical Engineering Lab*, Dr. Doug Chrisey; Tulane University, New Orleans, LA; 2016-2017
    - Binary classification of 3D bioprinting cell transfers with support vector machines (SVM) and a neural network implemented in Python with TensorFlow
- *NSF sponsored REU: Center for Research in Computer Vision*, Dr. Ulas Bagci; University of Central Florida, Orlando, Florida; 2016
    - Lung nodule binary classifier via TensorFlow deep learning and hand-crafted features

AWARDS

- *Edward Ferguson Jr. Graduate Award ('22)*, Vanderbilt Graduate School
- *T32 Graduate Fellowship Award:* ('19 –'21),*Vanderbilt Institute of Surgery and Engineering*, NIH
- *1st Place Poster ('21), Finalist ('20): Vanderbilt Institute of Surgery and Engineering Symposium*
- *Honorable Mention ('17): NSF & Ford Foundation Graduate Research Fellowships*
- *Vanderbilt Engineering Graduate Fellowship ('17),* Vanderbilt University
- *Tulane 34 Award ('17)*, Tulane University
- *Leaders in Service Award ('17),* Tulane University
- *Presidential Scholarship ('13-'17),* Tulane University

LEADERSHIP AND SERVICE

- *Women of Vanderbilt Institute of Surgery and Engineering;*
    - Steering Committee ('17 –'22); Outreach ('17 –'18), President ('19 –'20),
- *High School Outreach Coordinator, Vanderbilt Biomedical Engineering Dept.;* 2017-2021