

Winona Richey Nice, PhD

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<https://wrichey.github.io>

RESEARCH INTERESTS

Computer-Assisted Surgical Navigation • Image Guidance • Computer Vision

EDUCATION

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| 2017-2022 | Doctor of Philosophy, <i>Biomedical Engineering</i> ,
Vanderbilt University, Nashville, TN |
| 2013- 2017 | Bachelor of Science, <i>Biomedical Engineering and Computer Science</i> ,
Tulane University, New Orleans, LA |

EXPERIENCE

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| 2022 – Present | <i>PolarisAR</i> , Senior Staff Research Engineer
Dallas, TX (Remote) <ul style="list-style-type: none">• Contribute to the design, implementation, and testing for a total knee arthroplasty surgical guidance platform in augmented reality• Lead investigations evaluating clinical need, technical feasibility, and risk/reward ratios to advise executive team and investor board on funding next projects and company acquisitions• Lead surgeon collaborations to generate research publications, assess system accuracy in cadaveric and clinical environments, and channel observations into continuous product improvements• Independently developed tests and analysis tools to characterize point-based and planar tracking accuracy. Authored test reports resulting in FDA clearance without additional information requests |
| 2017 - 2022 | <i>Biomedical Modeling Lab</i> , with Dr. Michael Miga;
Vanderbilt University, Nashville, TN <ul style="list-style-type: none">• Dissertation Title: “<i>A System for Image Guided Breast Conserving Surgery: Leveraging Computer Vision</i>”• Characterized supine breast deformations using a custom guidance system for data acquisition and visualization in breast surgery• Established a model-based breast deformation correction approach using preoperative MR images and sparse intraoperative data• Developed a framework to monitor soft tissue deformations with automatic computer vision tracking of inked skin fiducials |
| 2016 - 2017 | <i>Biomedical Engineering Lab</i> , with Dr. Doug Chrisey;
Tulane University, New Orleans, LA <ul style="list-style-type: none">• Thesis Title: “<i>Matrix assisted pulsed laser evaporation direct write (MAPLE-DW) automated transfer validation: a machine learning approach</i>”• Designed experiments and software for detection of 3D bioprinting cell transfers using image processing and machine learning |
| 2016 | <i>NSF REU: Center for Research in Computer Vision</i> , with Dr. Ulas Bagci;
University of Central Florida, Orlando, FL |

- Implemented hand crafted features, combined with deep learning features for lung nodule detection in CT scans

PUBLICATIONS

1. H. J. Cooper, A. Young, J. B. Brenza, M. E. King, **W. L. Richey**, "Accuracy of a novel mixed reality surgical platform for total knee arthroplasty," Arthroplasty (Accepted).
2. M. J. Ringel, **W. L. Richey**, J. S. Heiselman, A. Stabile, I. M. Meszoely, and M. I. Miga, "Image Guidance System for Breast Conserving Surgery with Integrated Stereo Camera Monitoring and Deformable Correction," in Medical Imaging 2024: Image-Guided Procedures, Robotic Interventions, and Modeling, 2024. SPIE.
3. M. J. Ringel, **W. L. Richey**, J. S. Heiselman, I. M. Meszoely, and M. I. Miga, "Incorporating heterogeneity and anisotropy for surgical applications in breast deformation modeling," Clinical Biomechanics, vol. 104, p. 105927, 2023.
4. M. J. Ringel, J. S. Heiselman, **W. L. Richey**, I. M. Meszoely, and M. I. Miga, "Regularized Kelvinlet Functions to Model Linear Elasticity for Image-to-Physical Registration of the Breast," in International Conference on Medical Image Computing and Computer-Assisted Intervention, 2023: Springer, pp. 344-353.
5. A. Espinosa, M. J. Ringel, J. S. Heiselman, K. Pereira, F. Servin, **W. L. Richey**, I. Meszoely, and M. I. Miga, "Modeling retraction for breast conserving surgery guidance," in Medical Imaging 2023: Image-Guided Procedures, Robotic Interventions, and Modeling, 2023, vol. 12466: SPIE, pp. 535-540.
6. M. I. Miga, M. Luo, J. Tierney, **W. L. Richey**, J. S. Heiselman, and R. C. Thompson, "Accounting for brain shift during image-guided tumor resection surgeries: an intraoperative feasibility study," in Medical Imaging 2023: Image-Guided Procedures, Robotic Interventions, and Modeling, 2023, vol. 12466: SPIE, pp. 265-275.
7. W. Stabile, M. J. Ringel, **W. L. Richey**, J. S. Heiselman, I. Meszoely, and M. I. Miga, "Stereovision registration using a tracked checkerboard calibration object for a breast surgery image guidance system," in Medical Imaging 2023: Image-Guided Procedures, Robotic Interventions, and Modeling, 2023, vol. 12466: SPIE, pp. 541-548.
8. Xiang, J. S. Heiselman, **W. L. Richey**, W. R. Jarnagin, and M. I. Miga, "Comparison study of intraoperative surface acquisition methods for surgical navigation," in Medical Imaging 2023: Image-Guided Procedures, Robotic Interventions, and Modeling, 2023, vol. 12466: SPIE, pp. 162-168.
9. **W. L. Richey**, J. S. Heiselman, M. J. Ringel, I. M. Meszoely, and M. I. Miga, "Soft tissue monitoring of the surgical field: detection and tracking of breast surface deformations," IEEE Transactions in Biomedical Engineering, 2023.
10. **W. L. Richey**, J. S. Heiselman, M. J. Ringel, I. M. Meszoely, and M. I. Miga, "Computational Imaging to Compensate for Soft-Tissue Deformations in Image-Guided Breast Conserving Surgery," IEEE Transactions in Biomedical Engineering, vol. 69, no. 12, pp. 3760-3771, 2022.
11. **W. L. Richey**, J. Heiselman, M. Ringel, I. M. Meszoely, and M. I. Miga, "Tumor deformation correction for an image guidance system in breast conserving surgery," in Medical Imaging 2022: Image-Guided Procedures, Robotic Interventions, and Modeling, 2022, vol. 12034: SPIE, pp. 122-128.
12. M. J. Ringel, **W. L. Richey**, J. S. Heiselman, M. Luo, I. M. Meszoely, and M. I. Miga, "Supine magnetic resonance image registration for breast surgery: insights on material mechanics," Journal of Medical Imaging, vol. 9, no. 6, pp. 065001-065001, 2022.

13. **W. L. Richey**, J. S. Heiselman, M. Luo, I. M. Meszoely, and M. I. Miga, "Impact of deformation on a supine-positioned image guided breast surgery approach," *International Journal of Computer Assisted Radiology and Surgery*, vol. 16, no. 11, p. 2055—2066, 2021.
14. J. S. Heiselman, **W. L. Richey**, S. L. Taylor, and M. I. Miga, "Improving accuracy of image-to-physical laparoscopic liver registration via reconstruction of intrahepatic pressure changes from abdominal insufflation," in *Medical Imaging 2021: Image-Guided Procedures, Robotic Interventions, and Modeling*, 2021, vol. 11598: SPIE, p. 115980W.
15. **W. L. Richey**, J. Heiselman, M. Luo, I. M. Meszoely, and M. I. Miga, "Textual fiducial detection in breast conserving surgery for a near-real time image guidance system," in *Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling*, 2020, vol. 11315: SPIE p. 113151L.
16. **W. L. Richey**, M. Luo, S. E. Goodale, L. W. Clements, I. M. Meszoely, and M. I. Miga, "A system for automatic monitoring of surgical instruments and dynamic, non-rigid surface deformations in breast cancer surgery," in *Medical Imaging 2018: Image-Guided Procedures, Robotic Interventions, and Modeling*, 2018, vol. 10576: SPIE, p. 105761H.
17. N. Khosravan, **W. L. Richey**, and U. Bagci, "How Deep Can Hand-Crafted Features Be?," in *40th IEEE International Engineering in Medicine and Biology Conference (EMBC)*, 2018.
18. S. C. Sklare, **W. L. Richey**, B. T. Vinson, and D. B. Chrisey, "Directed self-assembly software for single cell deposition," *International Journal of Bioprinting*, vol. 3, no. 2, 2017.

AWARDS

2024	<i>Edison Award (Silver)</i> , Health Medical & Biotech, Innovative Surgical Solutions <ul style="list-style-type: none"> • Authored PolarisAR's winning submission in top 10% of applicants
2022	<i>Edward Ferguson Jr. Graduate Award</i> , \$5000, Vanderbilt Graduate School <ul style="list-style-type: none"> • For excellence in research
2021	<i>1st Place Poster Presentation: Vanderbilt Institute of Surgery and Engineering Symposium</i>
2019-2021	<i>T32 Graduate Fellowship Award: Vanderbilt Institute for Surgery and Engineering Training Program for Surgical and Interventional Engineering</i> , National Institutes of Health National Institute of Biomedical Imaging and Bioengineering T32EB021937
2020	<i>Poster Presentation Finalist: Vanderbilt Institute of Surgery and Engineering Symposium</i> , top 5 poster presentations
2018	<i>Honorable Mention: National Science Foundation Graduate Research Fellowship</i> , top 30%
2018	<i>Honorable Mention: Ford Foundation Graduate Research Fellowship</i> , top 30%
2017	<i>Vanderbilt Engineering Graduate Fellowship</i> , \$5000, Vanderbilt University
2017	<i>Tulane 34 Award</i> , Tulane University <ul style="list-style-type: none"> • For leadership, service and academic excellence; presented to 34 graduates across undergraduate, graduate, law, and medical schools
2017	<i>Leaders in Service Award</i> ; Tulane University <ul style="list-style-type: none"> • For improving the community through service-learning courses and student leadership
2013-2017	<i>Presidential Scholarship</i> , 50% of tuition, room and board; Tulane University

CONTRIBUTED TALKS

1. Tumor deformation correction for an image guidance system in breast conserving surgery. *SPIE Medical Imaging*. 2022
2. Textual fiducial detection in breast conserving surgery for a near-real time image guidance system. *SPIE Medical Imaging*. 2020
3. A Novel Guidance System for Breast Conserving Surgery. *Vanderbilt Ingram Cancer Center Breast Cancer Research Program Retreat*. 2020
4. Computer Vision Driven Image Guided Breast Conserving Surgery. *Research in Progress Seminar, Vanderbilt Institute of Surgery and Engineering*. 2020
5. Computer Vision Tracking in an Image Guidance System for Breast Cancer Lumpectomy. *Research in Progress Seminar, Vanderbilt Institute of Surgery and Engineering*. 2019
6. A system for automatic monitoring of surgical instruments and dynamic, non-rigid surface deformations in breast cancer surgery. *SPIE Medical Imaging*. 2018

LEADERSHIP and SERVICE

2017 - 2022	<i>Women of Vanderbilt Institute of Surgery and Engineering</i> ; Nashville, TN <ul style="list-style-type: none">• Planning Committee, 2017-2019; Founding President 2019-2020, Steering Committee 2020-2022• Started and formalized the group to foster community, discuss translational research, and promote the success of women in STEM• Coordinated monthly events including invited speakers, K-12 outreach, mentorship groups, and gender inequality discussions
2017 – 2022	<i>Glenclyff High School STEM Outreach</i> ; Nashville, TN <ul style="list-style-type: none">• Biomedical Engineering Graduate Student Alliance Outreach Chair, 2018-2019, 2020-2021; monthly lectures and hands-on activities• Developed and led events; introductions to Vanderbilt research areas and a discussion panel on college, research, and STEM
2017-2020	<i>Vanderbilt Center for Science Outreach, Tutor</i> <ul style="list-style-type: none">• Tutored computer science, chemistry and pre-calculus
2019	<i>Vanderbilt Biomedical Engineering Graduate Recruitment Coordinator</i> <ul style="list-style-type: none">• Organized the invitation weekend for prospective grad. students
2017-2018	<i>Vanderbilt Students Volunteering for Science, Team Leader</i> <ul style="list-style-type: none">• Led weekly science lectures and hands-on activities
2015-2017	<i>Tulane Center for Public Service, Leader of Service Learning Assistants</i> <ul style="list-style-type: none">• Provide logistical support to Senior Program Coordinator for service learning; manage mentoring and co-training of 27 service learning assistants; organize speakers/special events; aid in hiring• Coordinated communication between community partners, Tulane professors and service learning students; managed logistics and facilitated class discussions, reflections and workshops
2016-2017	<i>Tulane Academic Success Center, Tutoring Team Leader</i> <ul style="list-style-type: none">• Supervised team of 20 tutors; restructured team meetings to focus on teaching pedagogy; tutored chemistry, physics, calculus, and engineering courses (all levels offered)