

Amy Tabb

<https://amytabb.com>
Latest version of this CV

March 29, 2020

EDUCATION

Purdue University <i>Ph.D. Electrical and Computer Engineering</i>	West Lafayette, Indiana USA <i>Dec. 2014</i>
Purdue University <i>M.S. Electrical and Computer Engineering</i>	West Lafayette, Indiana USA <i>Dec. 2012</i>
Duke University <i>M.A., Musicology (Performance Practice)</i>	Durham, North Carolina, USA <i>May 2003</i>
Sweet Briar College <i>B.A., Mathematics/Computer Science and Music</i> <i>summa cum laude</i>	Sweet Briar, Virginia, USA <i>May. 2001</i>
University of York, England, Mathematics and Music, 1999-2000	

PROFESSIONAL AFFILIATIONS

Research Agricultural Engineer (a PI role) <i>USDA-ARS-AFRS</i>	Kearneysville, West Virginia USA <i>2013-present</i>
Adjunct Assistant Research Professor <i>Marquette University, Department of Electrical and Computer Engineering</i>	Milwaukee, Wisconsin USA <i>2019-present</i>
Student trainee in engineering <i>USDA-ARS-AFRS</i>	Kearneysville, West Virginia USA <i>2004-2013</i>
Engineering Technician <i>USDA-ARS-AFRS and USDA-ARS-NCCCWA</i>	Kearneysville and Leetown, West Virginia, USA <i>2003-2004</i>

HONORS AND AWARDS

IEEE Senior Member, November 2019

COMPETITIVE GRANTS AWARDED

- [1] Quantifying invasive insect movement within and across landscapes using laser detection technology and unmanned aerial systems. PIs **A. Tabb**, H. Medeiros, T. Leskey, K. Rice, R. Morrison III, J. Tooker. NIFA AFRI Foundational Program, Agricultural Systems and Technology. **\$474,621**. 2018-2022.
- [2] Bloom intensity estimation using your smartphone: Machine learning algorithms for species-independent visual recognition of flowers. PIs H. Medeiros and **A. Tabb**. State Horticultural Association of Pennsylvania Research Committee. **\$20,200**. 2017-2018.
- [3] Elucidating the gene networks controlling branch angle and the directional growth of lateral meristems in trees. PIs K. Xu, C. Dardick, **A. Tabb**. NSF Plant Genome Research Program. **\$1,556,406**. 2014-2017 (additional time in no-cost extension).
- [4] Improving the fruit quality of Pennsylvania apples with precision pruning. PIs J. Schupp and T. Baugher. Pennsylvania Department of Agriculture. (Collaborator receiving funds). **\$40,000**. 2014.

 COMPETITIVE GRANT PROPOSALS AWARDED, COLLABORATOR

The regulation of lateral shoot orientation in plants by the novel gene WEEP. PIs C. Hollender, F. Telewski. (Collaborator not receiving funds). NIFA AFRI Foundational Program. \$475,000.

Publications are listed with the authoritative DOIs as well as public access links, when available. Students mentored via M.S. or Ph.D. committees are indicated in italics.

 JOURNAL PUBLICATIONS

- [1] *M. J. Feldmann*, M. A. Hardigan, R. A. Famula, C. M. López, **A. Tabb**, G. S. Cole, S. J. Knapp, “Multi-Dimensional Machine Learning Approaches for Fruit Shape Recognition and Phenotyping in Strawberry,” *GigaScience* [accepted]. available from bioRxiv, p. 736397, Aug. 2019. [10.1101/736397](https://doi.org/10.1101/736397)
- [2] L.J. Nixon, **A. Tabb**, W. M. Morrison, K. Rice, E. G. Brockerhoff, T.C. Leskey, S. Goldson, M. Rostás, “Volatile release, mobility, and mortality of diapausing *Halyomorpha halys* during simulated shipping movements and temperature changes,” *J Pest Sci* (2019). [10.1007/s10340-019-01084-x](https://doi.org/10.1007/s10340-019-01084-x) and [RG \(private request\)](#).
- [3] *P. A. Dias*, **A. Tabb** and H. Medeiros, “Multispecies Fruit Flower Detection Using a Refined Semantic Segmentation Network,” in *IEEE Robotics and Automation Letters*, vol. 3, no. 4, pp. 3003–3010, Oct. 2018. [10.1109/LRA.2018.2849498](https://doi.org/10.1109/LRA.2018.2849498) and [arXiv 1809:10080 \[cs.CV\]](https://arxiv.org/abs/1809.10080).
- [4] C. A. Hollender, P. Thierry, **A. Tabb**, T. Hadiarto, C. Srinivasan, W. Wang, Z. Liu, R. Scorza, and C. Dardick, “Loss of a highly conserved sterile alpha motif domain gene (WEEP) results in pendulous branch growth in peach trees,” *Proceedings of the National Academy of Sciences*, vol. 115, no. 20, pp. E4690–E4699, 2018. [10.1073/pnas.1704515115](https://doi.org/10.1073/pnas.1704515115) [Open Access].
- [5] C. A. Hollender, J. M. Waite, **A. Tabb**, D. Raines, S. Chinnithambi, and C. Dardick, “Alteration of TAC1 expression in *Prunus* species leads to pleiotropic shoot phenotypes,” *Horticulture Research*, vol. 5, no. 1, p. 26, May 2018. [10.1038/s41438-018-0034-1](https://doi.org/10.1038/s41438-018-0034-1) [Open Access.]
- [6] *P. A. Dias*, **A. Tabb**, and H. Medeiros, “Apple flower detection using deep convolutional networks,” *Computers in Industry*, vol. 99, pp. 17–28, Aug. 2018. [10.1016/j.compind.2018.03.010](https://doi.org/10.1016/j.compind.2018.03.010) and [arXiv:1809.06357 \[cs.CV\]](https://arxiv.org/abs/1809.06357).
- [7] **A. Tabb** and H. Medeiros, “Automatic segmentation of trees in dynamic outdoor environments,” *Computers in Industry*, vol. 98, pp. 90–99, Jun. 2018. [10.1016/j.compind.2018.03.002](https://doi.org/10.1016/j.compind.2018.03.002) and [arXiv:1702.07611 \[cs.CV\]](https://arxiv.org/abs/1702.07611).
- [8] **A. Tabb** and K. M. Ahmad Yousef, “Solving the robot-world hand-eye(s) calibration problem with iterative methods,” *Machine Vision and Applications*, vol. 28, no. 5, pp. 569–590, Aug. 2017. [10.1007/s00138-017-0841-7](https://doi.org/10.1007/s00138-017-0841-7) and [arXiv:1907.12425 \[cs.RO\]](https://arxiv.org/abs/1907.12425).
- [9] D. L. Peterson, **A. Tabb**, T.A. Baugher, K. Lewis, D.M. Glenn, “Dry Bin Filler for Apples,” *Applied Engineering in Agriculture*, vol. 26, no. 4, p. 541, 2010. [10.13031/2013.32057](https://doi.org/10.13031/2013.32057) and [USDA NAL](#).
- [10] B.S. Bennedsen, D.L. Peterson, and **A. Tabb**, “Identifying Apple Surface Defects Using Principal Components Analysis and Artificial Neural Networks,” *Transactions of the ASABE*, vol. 50, no. 6, p. 2257, 2007. *Transactions of the ASABE*, 50(6): 2257–2265. [10.13031/2013.24078](https://doi.org/10.13031/2013.24078) and [USDA NAL](#).
- [11] B.S. Bennedsen, D.L. Peterson, **A. Tabb**, “Identifying defects in images of rotating apples,” *Computers and Electronics in Agriculture*, vol. 48, no. 2, pp. 92–102, Aug. 2005. [10.1016/j.compag.2005.01.003](https://doi.org/10.1016/j.compag.2005.01.003) and [USDA NAL](#).

BOOK CHAPTERS

- [12] Q. Zhang, M. Karkee, **A. Tabb**, “The use of agricultural robots in orchard management.” in *Robotics and automation for improving agriculture*. John Billingsley, Ed. Burleigh Dodds Science Publishing, 2019, pp. 187–214. [10.19103/AS.2019.0056.14](https://doi.org/10.19103/AS.2019.0056.14) and [arXiv:1907.13114](https://arxiv.org/abs/1907.13114) [cs.RO].

REFEREED CONFERENCE PUBLICATIONS

- [13] *B. Stumph*, M. Hernandez Virto, H. Medeiros, **A. Tabb**, S. Wolford, K. Rice, T. Leskey, “Quantification of Dispersal Patterns of Invasive Insects with Unmanned Aerial Vehicles,” in 2019 IEEE International Conference on Robotics and Automation (ICRA), 2019. doi: [10.1109/ICRA.2019.8794116](https://doi.org/10.1109/ICRA.2019.8794116) and [arXiv:1903.00815](https://arxiv.org/abs/1903.00815) [cs.RO].
- [14] *P.A. Dias*, Z. Shen, **A. Tabb** and H. Medeiros, “FreeLabel: a publicly available annotation tool based on freehand traces,” in 2019 IEEE Winter Conference on Applications of Computer Vision (WACV).doi: [10.1109/WACV.2019.00010](https://doi.org/10.1109/WACV.2019.00010) and [arXiv:1902.06806](https://arxiv.org/abs/1902.06806) [cs.CV].
- [15] **A. Tabb** and H. Medeiros, “Fast and Robust Curve Skeletonization for Real-World Elongated Objects,” in 2018 IEEE Winter Conference on Applications of Computer Vision (WACV), 2018, pp. 1935–1943. [10.1109/WACV.2018.00214](https://doi.org/10.1109/WACV.2018.00214) and [arXiv:1702.07619](https://arxiv.org/abs/1702.07619) [cs.CV].
- [16] **A. Tabb**, K. E. Duncan and C. N. Topp, “Segmenting Root Systems in X-Ray Computed Tomography Images Using Level Sets,” in 2018 IEEE Winter Conference on Applications of Computer Vision (WACV), 2018, pp. 586–595. [10.1109/WACV.2018.00070](https://doi.org/10.1109/WACV.2018.00070) and [arXiv:1809.06398](https://arxiv.org/abs/1809.06398) [cs.CV].
- [17] **A. Tabb** and H. Medeiros, “A robotic vision system to measure tree traits,” 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vancouver, BC, 2017, pp. 6005-6012. [10.1109/IROS.2017.8206497](https://doi.org/10.1109/IROS.2017.8206497) and [arXiv:1707.05368](https://arxiv.org/abs/1707.05368) [cs.RO].
- [18] **A. Tabb** and K. Ahmad Yousef, “Parameterizations for reducing camera reprojection error for robot-world hand-eye calibration,” 2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Hamburg, 2015, pp. 3030-3037. [10.1109/IROS.2015.7353795](https://doi.org/10.1109/IROS.2015.7353795) and RG.
- [19] **A. Tabb** and J. Park, “Camera calibration correction in Shape from Inconsistent Silhouette,” in 2015 IEEE International Conference on Robotics and Automation (ICRA), 2015, pp. 4827–4834. [10.1109/ICRA.2015.7139870](https://doi.org/10.1109/ICRA.2015.7139870) and RG.
- [20] **A. Tabb**. 2013, “Shape from Silhouette Probability Maps: Reconstruction of Thin Objects in the Presence of Silhouette Extraction and Calibration Error,” in 2013 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2013, pp. 161–168. [10.1109/CVPR.2013.28](https://doi.org/10.1109/CVPR.2013.28) and CVF.
- [21] J. Park, **A. Tabb**, and A. C. Kak. 2006, “Hierarchical Data Structure for Real-Time Background Subtraction,” in 2006 International Conference on Image Processing (ICIP), 2006, pp. 1849–1852. <https://doi.org/10.1109/ICIP.2006.312840> and AT.

PREPRINTS

- [22] **A. Tabb**, H. Medeiros, *M. J. Feldmann*, and T. T. Santos, “Calibration of Asynchronous Camera Networks: CALICO,” Nov. 2019. [arXiv:1903.06811](https://arxiv.org/abs/1903.06811) [cs.CV].
- [23] **A. Tabb**, G.A. Holguín, and R Naegele, “Using cameras for precise measurement of two-dimensional plant features,” May 2019. [arXiv:1904.13187](https://arxiv.org/abs/1904.13187) [cs.CV].

EXTENDED ABSTRACTS

M. Feldmann, **A. Tabb**, and S. Knapp, "Cost-effective, high-throughput 3D reconstruction method for fruit phenotyping", in CVPPP 2019: workshop on Computer Vision Problems in Plant Phenotyping, 2019. (peer-reviewed) [IPP](#) and [poster](#), [AT](#)

NON-REFEREED CONFERENCE PUBLICATIONS

A. Tabb, D. Peterson, and J. Park, "Segmentation of Apple Fruit from Video via Background Modeling. ASABE Annual International Meeting," 2006. [10.13031/2013.20873](#) and [AT](#).

OTHER PUBLICATIONS

A. Tabb, "Shape from Inconsistent Silhouette: Reconstruction of Objects in the Presence of Segmentation and Camera Calibration Error", Open Access Dissertations. 372, 2014. [Open Access Link](#)

SOFTWARE RELEASES

- [S1] **A. Tabb**, "Data and Code from: Using cameras for precise measurement of two-dimensional plant features: CASS," Zenodo, 2020. <http://doi.org/10.5281/zenodo.3677473>
- [S2] **A. Tabb** and *M. J. Feldmann*, "Data and Code from: Calibration of Asynchronous Camera Networks: CALICO," [Data set]. Zenodo. 2019. [10.5281/zenodo.3520866](https://doi.org/10.5281/zenodo.3520866)
- [S3] **A. Tabb**, K. E. Duncan, C. N. Topp, "Code and Data from: Segmenting Root Systems in X-Ray Computed Tomography Images Using Level Sets," [Data set]. Zenodo. 2019. [10.5281/zenodo.3333709](https://doi.org/10.5281/zenodo.3333709)
- [S4] **A. Tabb**, "Code from: Fast and robust curve skeletonization for real-world elongated objects," Ag Data Commons, 2017. [10.15482/USDA.ADC/1399689](https://doi.org/10.15482/USDA.ADC/1399689)
- [S5] **A. Tabb**, "Data from: Solving the Robot-World Hand-Eye(s) Calibration Problem with Iterative Methods," Ag Data Commons, 2017. [10.15482/USDA.ADC/1340592](https://doi.org/10.15482/USDA.ADC/1340592)

DATA RELEASES

- [D1] *P. A. Dias*, **A. Tabb**, H. Medeiros, "Multi-species fruit flower detection using a refined semantic segmentation network," Ag Data Commons, 2018. [10.15482/USDA.ADC/1423466](https://doi.org/10.15482/USDA.ADC/1423466)

INVITED TALKS

- [1] Quantifying canopy shape with computer vision. International Fruit Tree Association Meeting 2020, Grand Rapids, Michigan. February 10, 2020.
- [2] Reproducible plant measurements from consumer camera data with calibration. Interoperability and Federation Across Bioinformatic Platforms and Resources Workshop at Plant and Animal Genome (PAG) XXVIII, San Diego, California. January 11, 2020.
- [3] Communication across multidisciplinary lines for plant phenotyping research: an engineer's perspective. Plant Phenotypes Workshop at Plant and Animal Genome (PAG) XXVIII, San Diego, California. January 11, 2020.
- [4] Automation and phenotyping for tree fruit. E&J Gallo precision agriculture group. Modesto, California. September 10, 2019.
- [5] Autonomously generating shape estimates of plant parts across scales. Phenome 2019. Tucson, Arizona. February 7, 2019.
- [6] Transforming Pixels to Millimeters: Geometric Camera Calibration. Plantae webinar series, American Society of Plant Biologists. November 29, 2018. [\[Recording, resources\]](#)

-
- [7] Autonomous shape phenotyping of trees: strategies using computer vision and robotics. Michigan State University Horticulture Department. East Lansing, Michigan. September 13, 2018.
 - [8] Estimating plant shape in field settings. University of Minnesota Computer Science and Engineering colloquium. Minneapolis, Minnesota. September 10, 2018.
 - [9] Autonomous phenotyping: tree shape, flower detection, and root segmentation. Donald Danforth Plant Science Center seminar series. St. Louis, Missouri. May 16, 2018.
 - [10] Phenotyping tree shape in the field using computer vision and robotics. Phenome 2018 *Robotics* section. Tucson, Arizona. February 15, 2018.
 - [11] Computer vision and robotics in tree fruit production: an infinite supply of interesting yet complex and difficult problems. Chester F. Carlson Center for Imaging Science seminar series, Rochester Institute of Technology. Rochester, New York. November 16, 2016.
 - [12] A robotic system for three-dimensional tree architecture phenotyping. Cornell Fruit Field Day, Geneva, New York. July 20, 2016.
 - [13] Autonomously Determining the Shape of Trees for Structural Phenotyping and Pruning. IEEE Robotics and Automation Society technical committee on Agricultural Robotics and Automation webinar series, February 11, 2016.
 - [14] Engineering Computer Vision Tools for Entomology Research. Brown Marmorated Stink Bug Integrated Pest management working group meeting. December 2, 2015.
 - [15] Computer vision in tree fruit production. Marquette University Electrical and Computer Engineering lecture series. October 13, 2015.
 - [16] Parameterizations for Reducing Camera Reprojection Error for Robot-World Hand-Eye Calibration. National Institute of Standards and Technology, Metrology section. August 11, 2015.
 - [17] Steps forward in autonomous pruning. Penn State Fruit Research and Experiment Center, Field day. July 9, 2015.
 - [18] Three-dimensional modeling of dormant trees for robotic pruning. Specialty Crops Engineering Solutions workshop, Robotics Institute, Carnegie Mellon University, November 28, 2012.

AGENCY/LOCATION PRESENTATIONS

- [1] Computer vision and robotics in fruit systems: automation strategies. USDA-ARS Grape Research Workshop. Portland, Oregon. November 29, 2017.
- [2] Computer vision and robotics in tree fruit production. Virginia Tech Orchard Twilight Meeting. August 29, 2017.
- [3] Computer vision and robotics in tree fruit production. Appalachian Fruit Research Station seminar series. July 26, 2017.
- [4] Robotic Imaging System for Orchard Automation. Young Growers Alliance Tour. June 7, 2016.

CONFERENCE PRESENTATIONS NOT REPRESENTED ELSEWHERE

- [1] **A. Tabb.** 2016. An autonomous measurement system for dormant trees. Cumberland-Shenandoah Fruit Worker's Conference.
- [2] **A. Tabb.** 2015. Reconstruction of dormant trees' shape for automated pruning and phenotyping. ASABE Annual International Meeting.
- [3] **A. Tabb.** 2014. Reconstruction of dormant trees' shape for automated pruning and phenotyping. Cumberland-Shenandoah Fruit Worker's Conference.

POSTERS

- [1] **A. Tabb**. Phenotyping tree shape in the field using computer vision and robotics. 2018. Data Crunching and New Analytics Section, Phenome 2018.
- [2] **A. Tabb**, K. Xu, C. Dardick. 2017. A phenotyping system for measuring shape features of trees. NSF Plant Genome Research Program, 20th annual awardee meeting.

FEATURES IN TRADE PRESS

- [1] Orchard Management Technology. Sharon Durham. December 2017. AgResearch.
- [2] Pruning Goes High-Tech. Christina Herrick. June 2, 2017. American Fruit Grower.
- [3] Kearneysville station research focuses on breeding yield, density into fruit trees. David Weinstock and Curt Harler. June 2017. Fruit Growers News.

RADIO INTERVIEWS

Automating harvest equipment. Guest of the Peggy Smedley show, an IoT internet radio show. May 29, 2018.

PROFESSIONAL AWARDS

2017: Nominee for the Eastern Panhandle Federal Employee Association Manager category award.

TEACHING EXPERIENCE

Students mentored (as a committee member)**Ph.D.**

Philippe Ambrozio Dias	ECE, Marquette University	2020 (expected)
Mitchell Feldmann	Plant Sciences, University of California-Davis	2020 (expected)

M.S.

Brian Stumph	ECE, Marquette University	2019
--------------	---------------------------	------

Undergraduates

Leighton Miller	ECE, West Virginia University	summer 2016
-----------------	-------------------------------	-------------

RELATED PROFESSIONAL SKILLS

Linux
 C/C++
 Matlab/Octave
 OpenCV
 OpenMP
 Wincaps (for Denso robots)
 Docker
 L^AT_EX
 Basic webpages with [Jekyll](#) and [WordPress](#)

SERVICE

Positions

- [1] Co-chair, [IEEE RAS Technical Committee on Agricultural Robotics and Automation](#).
September 2018-present. Organize and host international webinar series; edit webpage; communications, Twitter account [@AgRoboticsTC](#).
- [2] Executive Board member, [North American Plant Phenotyping Network \(NAPPN\)](#), 2020-2022.
Serve as part of future board from March 2019 - March 2020.

Workshops

Organizer, RSS 2020 workshop [Robots in the Wild: Challenges in Deploying Robust Autonomy for Robotic Exploration](#).

Editing

Associate Editor, IEEE International Conference on Robotics and Automation (ICRA) 2019
Guest Editor, special issue [“Robotics Perception in Adversarial Environments”](#) in Frontiers in Robotics in AI, 2019-2020.

Program committees

- [1] member, Phenome 2019
- [2] member, IEEE International Conference on Semantic Computing 2019
- [3] member, IEEE International Conference on Semantic Computing 2020
- [4] member, Mechatronics and Machine Vision in Practice 2019.

Scientific committees

member, 12th European Conference on Precision Agriculture [2019]

Technical Committees

member, [Robots in the Wild: Challenges in Deploying Robust Autonomy for Robotic Exploration](#), a workshop of the Robotics: Science and Systems 2019 conference.

Peer review: Conferences

- [1] IEEE International Conference on Robotics and Automation (ICRA) 2016: 2015
- [2] IEEE International Conference on Robotics and Automation (ICRA) 2018: 2017
- [3] IEEE/RSJ International Conference on Intelligent Robots (IROS) 2018: 2018
- [4] IEEE/RSJ International Conference on Intelligent Robots (IROS) 2019: 2019
- [5] IEEE International Conference on Robotics and Automation (ICRA) 2020: 2019
- [6] IEEE/RSJ International Conference on Intelligent Robots (IROS) 2020: 2020

Peer review: Journals

- [1] Autonomous Robots, 2019
- [2] Biosystems Engineering: 2016
- [3] Computers and Electronics in Agriculture: 2011, 2012, 2013, 2014, 2019

-
- [4] Horticulture Research: 2018
 - [5] HortTechnology: 2013
 - [6] Intelligent Service Robotics: 2018
 - [7] IEEE Robotics and Automation Letters: 2018
 - [8] IEEE Sensors: 2017, 2018
 - [9] Journal of Field Robotics: 2016, 2018, 2019
 - [10] Journal of Food Measurement: 2013
 - [11] Measurement: 2017
 - [12] Plant Methods: 2019
 - [13] Precision Agriculture: 2017, 2018
 - [14] Remote Sensing (MDPI): 2019
 - [15] Sensors (MPDI): 2018
 - [16] Transactions of ASABE: 2011, 2012, 2013, 2014, 2016, 2018

Peer review: Grant panels

- [1] Binational Agricultural Research and Development Fund (BARD): 2014
- [2] USDA-NIFA AFRI Foundational program, panel member: 2015
- [3] USDA SBIR, ad hoc technical reviewer: 2016
- [4] Citrus Research Board, ad hoc scientific reviewer: 2018

Technical review: other

External reviewer, Ph.D. proposal, Wageningen University: 2019

Agency/Location Service

- [1] USDA-ARS-AFRS Management labor relations negotiating team, September 2015-May 2016
- [2] USDA-ARS North Atlantic Area Inform and Engage ad-hoc committee June-August 2014
- [3] USDA-ARS Northeast Area Inform and Engage committee, July 2015-present
- [4] Landscape committee chairperson, June 2015-June 2019
- [5] People's Garden management representative, January 2016-present

Community Involvement

- [1] Jefferson County 4-H Robotics Club mentor, September 2014-March 2016
- [2] Sweet Briar Women in STEM leader for Computer Science, July 2015-March 2016
- [3] Speaker for Leadership Jefferson, a program offered through the Chamber of Commerce, Agriculture module, October 2016, 2017, 2018, 2019. Presented research work to a general audience.
- [4] Give presentations of work from the engineering group to the public at USDA-ARS-AFRS, including, but not limited to: pre-K students, Boy Scouts, special ed. students, vocational agriculture/FFA students, homeschool students, community college students, local college students, agricultural industry representatives, visitors from New Zealand, and universities.
- [5] Panelist: sustainable agriculture at Sweet Briar College, April 23, 2019.
- [6] Panelist: Farms 2 Schools, WVU extension service, June 19, 2019.

Service, other

co-chair Visual Perception II session IEEE ICRA 2015

PROFESSIONAL MEMBERSHIPS

- [1] Member of USDA NIFA W1009: Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops multi-state regional project, 2008-2013.
- [2] Member of USDA NIFA W2009: Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops multi-state regional project, 2013-2018.
- [3] Member of USDA NIFA W3009: Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops multi-state regional project, 2018-2023.
- [4] American Society of Agricultural and Biological Engineers (ASABE), 2006 - 2018.
- [5] Institute of Electrical and Electronics Engineers (IEEE), 2011.
- [6] IEEE Computer Society, 2011.
- [7] IEEE Robotics and Automation Society, 2011.
- [8] IEEE RAS Technical Committee on Agricultural Robotics and Automation, 2015.
- [9] North American Plant Phenotyping Network, 2018.
- [10] Computer Vision Foundation, 2018