TANZEEL UR REHMAN, Ph.D.

Assistant Professor
Department of Biosystems Engineering
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Education

Ph.D., Agricultural & Biological Engineering, Purdue University — 2017 – 2022

Dissertation: *Predictive Models Transfer for Improved Hyperspectral Phenotyping in Greenhouse and Field Conditions*

M.S., Agricultural Sciences, Dalhousie University, Canada — 2015 – 2017

Thesis: *Development of a Machine Vision Based Weed (Goldenrod) Detection System for Spot-Application of Herbicides in Wild Blueberry Cropping System*

B.S., Agricultural Engineering, University of Agriculture, Faisalabad, Pakistan — 2009 – 2013

Professional Experience

Assistant Professor, Department of Biosystems Engineering, Auburn University — 2022 – Present

Graduate Research Assistant, Purdue University — 2017 – 2022

Graduate Scholar, Dalhousie University, Canada — 2015 – 2017

Lecturer, University of Agriculture, Faisalabad, Pakistan — 2014 – 2015

Research Interests

- *Smart Horticulture*: Developing and deploying innovative sensing tools, computer vision techniques, robust data mining algorithms, high precision smart control systems, robotics and automation methods to minimize the labor cost, management implications and enhance production resilience. Possible applications include fruit, vegetable, nursery, landscape and greenhouse production systems.
- *Controlled Environment Agriculture*: Selection, development and integration of multi-modal sensing suite to collect the data related to spatial, temporal and compositional heterogeneity of microclimate and plant stress signals. The extracted data can be used to

study the complex interaction of microclimate, growth media, and outdoor environmental conditions and their impact on plant health for early detection and intervention to achieve better outcomes in crop production.

- *AI-enabled decision Analysis:* Robust, data-centric machine learning/deep learning pipelines to systematically analyze the heterogeneous multi-modal, multi-temporal, multi-resolution and multi-scale big data for unleashing the horticultural/agricultural production potentials.

Publications

Peer-Reviewed Manuscripts

1. Khan, M. U., ur Rehman, M. M., Sultan, M., **Rehman, T. U.**, Sajjad, U., Yousaf, M., & Asif, M. (2022). Key prospects and major development of hydrogen and bioethanol production. *International Journal of Hydrogen Energy*, *47*(62), 26265. https://doi.org/10.1016/j.ijhydene.2022.06.224
2. **Rehman, T. U.**, Zhang, L., Ma, D., & Jin, J. (2022). Common Latent Space Exploration for Calibration Transfer across Hyperspectral Imaging-Based Phenotyping Systems. *Remote Sensing*, *14*(2), 319. https://doi.org/10.3390/rs14020319
3. Ma, D., **Rehman, T. U.**, Zhang, L., Maki, H., Tuinstra, M. R., & Jin, J. (2021). Modeling of Environmental Impacts on Aerial Hyperspectral Images for Corn Plant Phenotyping. *Remote Sensing*, *13*(13), 2520. https://doi.org/10.3390/rs13132520
4. Ma, D., **Rehman, T. U.**, Zhang, L., Maki, H., Tuinstra, M. R., & Jin, J. (2021). Modeling of diurnal changing patterns in airborne crop remote sensing images. *Remote Sensing*, *13*(9), 1719. https://doi.org/10.3390/rs13091719
5. **Rehman, T. U.**, Ma, D., Wang, L., Zhang, L., & Jin, J. (2020). Predictive spectral analysis using an end-to-end deep model from hyperspectral images for high-throughput plant phenotyping. *Computers and Electronics in Agriculture*, *177*, 105713. https://doi.org/10.1016/j.compag.2020.105713
6. **Rehman, T. U.**, Zhang, L., Ma, D., Wang, L., & Jin, J. (2020). Calibration transfer across multiple hyperspectral imaging-based plant phenotyping systems: I–Spectral space adjustment. *Computers and Electronics in Agriculture*, *176*, 105685. https://doi.org/10.1016/j.compag.2020.105685
7. **Rehman, T. U.**, Zhang, L., Wang, L., Ma, D., Maki, H., Sánchez-Gallego, J. A., Mickelbart, M. V., & Jin, J. (2020). Automated leaf movement tracking in time-lapse imaging for plant phenotyping. *Computers and Electronics in Agriculture*, *175*, 105623. https://doi.org/10.1016/j.compag.2020.105623
8. Wang, L., Jin, J., Song, Z., Wang, J., Zhang, L., **Rehman, T. U.**, Ma, D., Carpenter, N., & Tuinstra, M. R. (2020). LeafSpec: An accurate and portable hyperspectral corn leaf imager. *Computers and Electronics in Agriculture*, *169*, 105209. https://doi.org/10.1016/j.compag.2019.105209
9. Wang, L., Duan, Y., Zhang, L., **Rehman, T. U.**, Ma, D., & Jin, J. (2020). Precise Estimation of NDVI with a Simple NIR Sensitive RGB Camera and Machine Learning Methods for Corn Plants. *Sensors*, *20*(11), 3208. https://doi.org/10.3390/s20113208

10. Zhang, L., Wang, L., Wang, J., Song, Z., **Rehman, T. U.**, Bureetes, T., Ma, D., Chen, Z., Neeno S., & Jin, J. (2019). Leaf Scanner: A portable and low-cost multispectral corn leaf scanning device for precise phenotyping. *Computers and Electronics in Agriculture*, *167*, 105069. https://doi.org/10.1016/j.compag.2019.105069
11. Khan, M. U., & **Rehman, T. U.** (2019). Early trends, current status and future prospects of farm mechanization in Asia. *Agricultural Engineering International: CIGR Journal*, *21*(3), 76-87.
12. Ma, D., Carpenter, N., Maki, H., **Rehman, T. U.**, Tuinstra, M. R., & Jin, J. (2019). Greenhouse environment modeling and simulation for microclimate control. *Computers and electronics in agriculture*, *162*, 134-142. https://doi.org/10.1016/j.compag.2019.04.013
13. **Rehman, T. U.**, Zaman, Q. U., Chang, Y. K., Schumann, A. W., & Corscadden, K. W. (2019). Development and field evaluation of a machine vision based in-season weed detection system for wild blueberry. *Computers and Electronics in Agriculture*, *162*, 1-13. https://doi.org/10.1016/j.compag.2019.03.023
14. Zhang, L., Maki, H., Ma, D., Sánchez-Gallego, J. A., Mickelbart, M. V., Wang, L., **Rehman, T. U.**, & Jin, J. (2019). Optimized angles of the swing hyperspectral imaging system for single corn plant. *Computers and electronics in agriculture*, *156*, 349-359. https://doi.org/10.1016/j.compag.2018.11.030
15. **Rehman, T. U.**, Mahmud, M. S., Chang, Y. K., Jin, J., & Shin, J. (2019). Current and future applications of statistical machine learning algorithms for agricultural machine vision systems. *Computers and electronics in agriculture*, *156*, 585-605. https://doi.org/10.1016/j.compag.2018.12.006
16. **Rehman, T. U.**, Zaman, Q. U., Chang, Y. K., Schumann, A. W., Corscadden, K. W., & Esau, T. J. (2018). Optimising the parameters influencing performance and weed (goldenrod) identification accuracy of colour co-occurrence matrices. *Biosystems Engineering*, *170*, 85-95. https://doi.org/10.1016/j.biosystemseng.2018.04.002
17. Chang, Y. K., Zaman, Q. U., **Rehman, T. U.**, Farooque, A. A., Esau, T., & Jameel, M. W. (2017). A real-time ultrasonic system to measure wild blueberry plant height during harvesting. *Biosystems engineering*, *157*, 35-44. https://doi.org/10.1016/j.biosystemseng.2017.02.004
18. **Rehman, T. U.**, Khan, M. U., Tayyab, M., Akram, M. W., & Faheem, M. (2016). Current status and overview of farm mechanization in Pakistan–A review. *Agricultural Engineering International: CIGR Journal*, *18*(2), 83-93.
19. Ghafoor, A., **Rehman, T. U.**, Munir, A., Ahmad, M., & Iqbal, M. (2016). Current status and overview of renewable energy potential in Pakistan for continuous energy sustainability. *Renewable and Sustainable Energy Reviews*, *60*, 1332-1342. https://doi.org/10.1016/j.rser.2016.03.020

Submitted Manuscripts

1. **Rehman, T. U.**, Zhang, L., Ma, D., & Jin, J. Deep adversarial domain adaptation for calibration transfer among plant phenotyping systems. *Biosystems Engineering (Under review*).
2. Zhang, L., Jin, J., Wang, L., **Rehman, T. U.**, Ma, D., & Gee, T. M. Eliminating crop leaf

angle impacts on plant reflectance using fusion of hyperspectral images and 3D point clouds. *Computers and Electronics in Agriculture (Under review*).

Book Chapters

1. Chang, Y. K., & **Rehman, T. U.** (2017). Current and future applications of cost-effective smart cameras in agriculture. In *Robotics and Mechatronics for Agriculture* (pp. 75-120). CRC Press.
2. Jin, J., **Rehman, T. U.**, & Zhang, Q. (2022). Advances in optical analysis for crop phenotyping. In *Advances in Plant Phenotyping for More Sustainable Crop Production* (pp. 61-97). Burleigh Dodds Science Publishing Ltd.

Presentations

Oral Presentations

1. **Rehman, T. U.** & Jin, J. (2019). Development of an automated multi-sensor system for high-throughput plant phenotyping in greenhouse environment. *ASABE Annual International Meeting, Boston, USA*. July 7-10, 2019.
2. **Rehman, T. U.**, Zaman, Q. U., Schumann A. W., & Chang, Y. K. (2016). Algorithm development for weed detection using digital image processing techniques. *CSBE-SCGAB Annual General Meeting, Halifax, Canada*. July 3-6, 2016.

Poster Presentations

1. **Rehman, T. U.**, Zaman, Q. U., Schumann A. W., & Farooque, A. A. (2017). A machine vision based in-season weed detection system for spot application of herbicides. *CSBE-SCGAB Annual General Meeting, Manitoba, Canada*. August 6-10, 2017.
2. **Rehman, T. U.**, Zaman, Q. U., Schumann A. W., & Chang, Y. K. (2016). Development of an algorithm for Goldenrod detection using digital image processing techniques. *ASABE Annual International Meeting, Orlando, USA*. July 17-20, 2016.

Teaching

Guest Lecturer, Purdue University, USA Fall 2021

Course: Plant Phenotyping Technologies

Graduate Teaching Assistant, Dalhousie University, Canada Spring 2016

Course: Computer Science

Lecturer, University of Agriculture, Pakistan 2014 – 2015

Courses: Machine Design, Farm Power (I.C. Engines), Farm Mechanization, Farm Machinery and Earth Moving Equipment

Honors and Awards

Outstanding Graduate Student Research Award, Agricultural and Biological Engineering, Purdue University, USA (USD 2000).	2021
Nova Scotia Innovation and Research Graduate Scholarship-M.Sc., Government of Nova Scotia, Canada. (CAD 10,000).	2016-2017
Competitive Scholarship for Research in Wild Blueberry Industry, Department of Agriculture, Aquaculture and Fisheries, New Brunswick, Canada (CAD 22,500).	2016-2017
Nova Scotia Innovation and Research Graduate Scholarship-M.Sc., Government of Nova Scotia, Canada. (CAD 10,000).	2015-2016
International Graduate Student Entrance Scholarship award, Dalhousie University, Canada (CAD 6,000).	2015-2016
Gordon B. Kinsman Memorial Graduate Scholarship, Dalhousie University, Canada (CAD 1,500).	2015-2016
Travel Grant, Faculty of Graduate Studies, Dalhousie University, Canada (CAD, 500).	2016
Two Gold Medals (Class of 2013), Agricultural Engineering, University of Agriculture, Pakistan (*awarded annually to 1st student in Agricultural Engineering undergraduate program. Total strength = 140*).	2014
Outstanding Undergraduate Student (Class of 2013), Agricultural Engineering, University of Agriculture, Pakistan.	2013
Dean's List (all semesters), Agricultural Engineering, University of Agriculture, Pakistan.	2009-2013

Professional Associations

- American Society of Agriculture and Biological Engineers
- American Society for Horticultural Science
- Canadian Society of Biological Engineers
- Pakistan Society of Agricultural Engineers