ALI MOGHIMI

Digital Agriculture Lab
Department of Biological and Agricultural Engineering
University of California, Davis
One Shields Ave, Davis, CA 95616

(612) 323-2299
amoghimi@ucdavis.edu
https://alimoghimi.net/

EDUCATION

Ph.D. **Bioproducts and Biosystems Science, Engineering and Management** *Feb 2019*

Ph.D. Minor **Computer Science and Engineering**

University of Minnesota - Twin Cities

Dissertation: Integrating hyperspectral imaging and artificial intelligence to develop automated frameworks for high-throughput phenotyping in wheat [Link]

M.Sc. **Mechanics of Agricultural Machinery** *July 2008*

Ferdowsi University of Mashhad - Mashhad, Iran

Thesis: Nondestructive measurements of quality characteristics of kiwifruit using Visible/NIR spectroscopy

B.Sc. **Agricultural Machinery** *Sep 2004*

Bahonar University of Kerman - Kerman, Iran

RESEARCH & PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate *March 2019 - present*

Digital Agriculture Lab, Department of Biological and Agricultural Engineering
University of California, Davis

Project 1: Integrating multi-type UAV-based RGB, LiDAR, and hyperspectral datasets for canopy profile mapping and yield prediction of almond trees [Link]

Project 2: Developing predictive models for nitrogen status in vineyard using artificial intelligence (machine learning/deep learning) and aerial imagery [Link]

Project 3: Developed a python-based batch analysis framework for radiometric calibration and stacking of UAV-based multispectral imagery [Link]

Project 4: Improved drought stress detection in turfgrass through filtering pixel-level data [Link]

Project 5: Developed/evaluated a low-maintenance spray back stop system to reduce spray drift without limiting the spray and air delivery [Link]

Graduate Research Assistant *2015-2019*

Agricultural Robotics Lab, Department of Bioproducts and Biosystems Engineering
University of Minnesota – Twin Cities

Project 1: Developed hyperspectral imaging and machine learning to assess salt stress tolerance in wheat

Project 2: Developed an ensemble feature selection pipeline to select informative spectral bands for plant phenotyping

Project 3: Identified informative spectral bands using machine learning techniques to detect Fusarium head blight in wheat

Project 4: Developed a deep neural network model to analyze aerial hyperspectral imagery for high-throughput yield phenotyping in wheat

Project 5: Developed a deep autoencoder network for unsupervised feature learning from aerial hyperspectral images

Research Assistant *2012-2014*

Research Center for Agricultural Machinery
Ferdowsi University of Mashhad

Project 1: Developed a robo-vision algorithm for a harvesting robot and designed a gripper

Project 2: Developed a solar dryer and evaluated the performance

Research Assistant *2009-2011*

Khorasan-Razavi Agricultural & Natural Resources Research Center

Project: Developed a computational model to assess rheological properties of food materials and their behavior during harvesting, handling, packaging, and storage (cherries, potato, and pomegranate)

Graduate Research Assistant *2006-2008*

Department of Biosystems Engineering
Ferdowsi University of Mashhad

Project: Developed chemometrics for nondestructive evaluation of quality characteristics in kiwifruit using Visible/NIR spectroscopy

PROFESSIONAL SKILLS

Technical	Remote sensing; UAV-based sensing (RGB, multispectral, and hyperspectral imaging; LiDAR); image processing; machine learning; deep learning; big data; feature selection; high-throughput plant phenotyping
Programming	Python; MATLAB; Git; GitHub; Robotino; Hugo
Data analysis	Keras; TensorFlow; Scikit-learn; WEKA; Pandas; MySQL; AWS (beginner)
Image analysis	OpenCV in Python; Image Processing Toolbox in MATLAB
Remote sensing/GIS	ERDAS Imagine; QGIS; eCognition; SpectranonPro; GDAL; Rasterio; GeoPandas MicroStation and Terrasolid (for analysis of 3D LiDAR data)

REFEREED JOURNAL ARTICLES

Moghimi, A., Yang, C., & Anderson, J.A. 2020. Aerial hyperspectral imagery and deep neural networks for high-throughput yield phenotyping in wheat. *Computers and Electronics in Agriculture*, 172, 105299. https://doi.org/10.1016/j.compag.2020.105299

Moghimi, A., Aghkhani, M.H., & Sazgarnia, A. 2019. Spectral feature selection from hyperspectral dataset to identify pistachio leaves infected by Psylla. Under review.

Qiu, R., Yang, C., **Moghimi, A.**, Zhang, M., & Steffenson, B. 2019. Detection of *Fusarium* head blight in wheat using a deep neural network and color imaging. *Remote Sensing*. https://www.mdpi.com/2072-4292/11/22/2658

Moghimi, A., Yang, C., & Marchetto, P. M. 2018. Ensemble Feature Selection for Plant Phenotyping: A Journey from Hyperspectral to Multispectral Imaging. *IEEE Access*, 6, 56870-56884. https://doi.org/10.1109/ACCESS.2018.2872801

Moghimi, A., Yang, C., Miller, M. E., Kianian, S. F., & Marchetto, P. M. 2018. A Novel Approach to Assess Salt Stress Tolerance in Wheat Using Hyperspectral Imaging. *Frontiers in Plant Science*, 9, 1182. https://doi.org/10.3389/fpls.2018.01182

Moghimi, A., Aghkhani, M.H., & Golzarian, M.R. 2015. Designing of Computer Vision Algorithm to Detect Sweet Peppers for Robotic Harvesting Under Natural Light. *Journal of Agricultural Machinery* (in Persian). http://doi.org/10.22067/jam.v5i1.23528

Aghkhani, M.H., Abbaspour-Fard, M.H., Bayati, M.R., Mortezapour, H., Saedi, I., & **Moghimi, A.** 2013. Performance analysis of a solar dryer equipped with a recycling air system and desiccant chamber. *Journal of Agricultural Machinery* (in Persian). https://jame.um.ac.ir/index.php/jame/article/view/25164

Moghimi, A., Saiedirad, M.H., & Ganji Moghadam, E. 2011. Interpretation of viscoelastic behaviour of sweet cherries (Prunus avium L.) using rheological models. *International Journal of Food Science & Technology*, 46, 855-861. https://doi.org/10.1111/j.1365-2621.2011.02563.x

Moghimi, A., Aghkhani, M.H., Sazgarnia, A., & Sarmad, M. 2010. Vis/NIR spectroscopy and chemometrics for the prediction of soluble solids content and acidity (pH) of kiwifruit. *Journal of Biosystems Engineering*, 106, 205-302. https://doi.org/10.1016/j.biosystemseng.2010.04.002

Moghimi, A., Aghkhani, M.H., Sazgarnia, A., & Abbaspour-Fard, M.H. 2009. Improvement of NIR transmission mode for internal quality assessment of fruit using different orientations. *Journal of Food Process Engineering*, 34, 1759-1774. https://doi.org/10.1111/j.1745-4530.2009.00547.x

---

CONFERENCE PROCEEDINGS

Moghimi, A., Pourreza, A., & Zuniga-Ramirez, G. 2020. Radiometric calibration of airborne spectral data for plant phenotyping: a journey from raw images to reflectance images. *Phenome Conference.* Tucson, AZ. (accepted for oral presentation).

Cheung, K., Pourreza, A., **Moghimi, A.**, & Zuniga-Ramirez, G. 2020. Calibration of photogrammetry-based canopy profile mapping using dense, sUAS-based LiDAR data in almond orchards. *SPIE Conference on Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping V*. Anaheim, CA. (accepted for oral presentation).

Moghimi, A., Pourreza, A., Cheung, K., Zuniga-Ramirez, G., Batista da Silva, B., Niederholzer, F., & Larbi, P. 2019. Development of a low-maintenance system to reduce spray drift without limiting the spray and air delivery in almond orchards. *Almond Board Conference.* Sacramento, CA.

Cheung, K., Pourreza, A., **Moghimi, A.**, Zuniga-Ramirez, G., Lampinen, B., & Shackel, K. 2019. Development of an unmanned aerial vehicle (UAV)-based canopy profile mapping technique to replace the mobile platform lightbar. *Almond Board Conference.* Sacramento, CA.

Pourreza, A., **Moghimi, A.,** Zuniga-Ramirez, G., Williams, L., & Fidelibus, M. 2019. Estimating nitrogen status of table grapes through aerial multispectral imaging. *Sustainable Agriculture & Food Systems*, Berlin, Germany. (oral presentation.)

Moghimi, A., Yang, C., Anderson, J.A., & Reynolds, S.K. 2019. Deep autoencoder to reduce dimensionality of hyperspectral images collected by UAV flying over experimental plots. *ASABE*, Boston, MA. (oral presentation.)

Moghimi, A., Yang, C., Anderson, J.A., & Reynolds, S.K. 2019. Selecting informative spectral bands using machine learning techniques to detect Fusarium head blight in wheat. *ASABE*, Boston, MA. (oral presentation.) https://elibrary.asabe.org/abstract.asp?aid=50476

Moghimi, A., Yang, C., Anderson, J.A., & Reynolds, S.K. 2018. Aerial Imagery for Yield Prediction of Experimental Wheat Plots. *ASABE*, Detroit, MI. (oral presentation.)

Moghimi, A., Yang, C., Miller, M. E., & Kianian, S. 2017. Hyperspectral imaging to identify salt-tolerant wheat lines. *SPIE Conference on Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping II*, Anaheim, CA. (oral presentation.) https://doi.org/10.1117/12.2262388

Moghimi, A., Aghkhani, M.H., Golzarian, M.R., Rohani, A., & Yang, C. 2015. A Robo-vision Algorithm for Automatic Harvesting of Green Bell Pepper. *ASABE*, New Orleans, LA. (oral presentation.) https://elibrary.asabe.org/abstract.asp?aid=46320

Moghimi, A., Aghkhani, M.H., & Golzarian, M.R. 2014. Grippers' Design Factors Determined by Integration of Computer Vision System and Mechanical Tests. *The 8th National congress on Biosystems Engineering and Mechanization*, Mashhad, Iran.

Saiedirad, M.H., Zarif Neshat, S., & **Moghimi, A**. 2011. Evaluation of Pomegranate Resistance against the Imposed Forces during Harvest. *National Congress on Agricultural Loss*, Tehran, Iran.

Zarif Neshat, S., Saiedirad, M.H., & **Moghimi, A**. 2011. Effect of Harvest Time, Soil Moisture and Varieties on Mechanical Damage of Potato. *National Congress on Agricultural Loss*, Tehran, Iran.

Moghimi, A., & Saiedirad, M.H. 2010. Viscoelastic Behavior of Cherries under Constant Strain. *The 6th National congress on Agricultural Machinery Engineering and Mechanization*, Tehran, Iran.

Moghimi, A., Aghkhani, M.H., Sazgarnia, A., & Sarmad, M. 2008. Application of Near-infrared Spectroscopy in Determination of Internal Quality of Apple, Orange and Kiwifruit in a Nondestructive Way. *The 18th National congress on Food Technology*, Mashhad, Iran.

GRANT WRITING EXPERIENCE

- **California Olive Committee** *Oct 2019*

Canopy profile mapping for yield prediction and nutrient management in olive. Amount requested ~$59,000. I was one of the Co-PIs.

- **Almond Board of California** *May 2019*

Development of a UAV-based canopy profile mapping technique to replace the mobile platform lightbar. Amount requested and funded ~$69,000. I was one of the Co-PIs.

- **Specialty Crop Research Initiative (SCRI) – USDA** *May 2019*

Building Resilience into Pistachio Production Systems. Amount requested but not funded ~$4,000,000. I was one of the Co-PIs.

- **USDA-ARS U.S. Wheat and Barley Scab Initiative (Funding No. 58-5062-8-018)** *Sep 2017*

Airborne hyperspectral imaging-based field high-throughput phenotyping system for assessing scab severity. Amount requested and funded ~$140,000. I wrote the first draft and was invited to present it to the steering committee of USWBSI.

RELATED COURSEWORK (GRADUATE LEVEL)

University of Minnesota	Intro to machine learning; Intro to data mining; Computer vision; Matrix theory; Intro to precision agriculture; Remote Sensing of natural resources & environment
Ferdowsi University of Mashhad	Image processing; Applications of remote sensing; Space photogrammetry; Managements of remote sensing data; Instrumentation

---

INVITED PRESENTATIONS

- **Canopy profile mapping for yield prediction and nutrient management** *Nov 2019*

California Olive Committee proposal review meeting, *Modesto, California.*

- **Artificial intelligence in agriculture: applications and limitations** *Oct 2019*

Dean's Advisory Council Meeting, College of Agricultural and Environmental Sciences, *University of California, Davis.*

- **Artificial intelligence and hyperspectral imaging for high-throughput plant phenotyping** *Sep 2019*

IEEE Agricultural Robotics and Automation. *Live stream webinar on YouTube and Zoom* (https://www.youtube.com/watch?v=zyQpKUFGo6U&t=8s).

- **Integrating hyperspectral imaging and deep learning for high-throughput yield phenotyping in wheat** *Apr 2019*

Seminar EBS290, *University of California, Davis* (https://twitter.com/DigitalAg_ucd/status/1112780484734382085).

- **Analysis of aerial hyperspectral images for high-throughput yield phenotyping: A deep learning approach** *Nov 2018*
  Phenomics Tech Talks, *University of Minnesota - Twin Cities.*

- **Selecting sensitive bands from hyperspectral images for plant phenotyping using machine learning algorithms** *Apr 2018*
  Precision Agriculture Center, *University of Minnesota - Twin Cities* (http://precisionag.umn.edu/selecting-sensitive-bands-hyperspectral-images-plant-phenotyping-using-machine-learning-algorithms).

- **Development of a high throughput phenotyping platform for assessing Fusarium head blight severity in wheat and barley using RGB/hyper-spectral imaging** *Apr 2017*
  US Wheat and Barley Scab Initiative (USWBSI) meeting. *Crowne Plaza Aire, Bloomington, Minnesota.*

- **Remote sensing for high throughput phenotyping** (Guest Lecturer) *Winter 2017*
  Topics in Applied Plant Sciences (HORT/AGRO 8280), *University of Minnesota - Twin Cities.*

- **Non-contact sensing technologies for precision agriculture** (Guest Lecturer) *Spring 2015*
  Introduction to Precision Agriculture (SOIL 4111), *University of Minnesota - Twin Cities.*

TEACHING AND MENTORING EXPERIENCE

Mentor of graduate students
University of California, Davis

- Graduate student from the department of Biological & Agriculture Engineering working on drought injury detection in turfgrass using aerial multispectral imagery. *Apr 2019 - present*
- Graduate student from the department of Electrical and Computer Engineering working on identifying informative spectral bands for detecting nutrient deficiency in vineyard. *Sep 2019 - present*
- Graduate student from the Electrical & Computer Engineering Department working on development of machine learning models to detect stress caused by soil-borne pathogens in walnut. *Apr - Jun 2019*

Mentor of 10 interns *Summer 2019*
University of California, Davis

- Advised them on various projects
  - Spike detection in wheat using convolutional neural network
  - Designing/fabricating an inflatable spray backstop prototype
  - Pre- and post-processing of aerial images
- Taught them remote sensing course
- Arranged and led a two-day data collection boot camp for collecting aerial imagery and LiDAR at Kearney Agricultural Research and Extension Center, Parlier, CA

Mentor of a UROP student (Undergraduate Research Opportunities Program) *Summer 2016*
University of Minnesota

Research title: investigating the capability of hyperspectral imaging for the estimation of wheat leaf rust disease

- Advised her on how to do literature review and write a report. Developed a MATLAB code for pre-processing of images, segmentation of leaves from background, and feature extraction.

Lecturer at Payame Noor University of Mashhad *2011-2014*

- Statics
- Strength of Materials
- Technical drawing and drafting
  - ❖ Responsible for teaching and grading of 20-30 undergraduate students

Lecturer at University of Applied Science and Technology *2009-2014*

- Mechanisms in Agricultural Machinery
- Post-harvest Technology
- Fundamentals of Physics
  - ❖ Responsible for teaching and grading of 30-40 undergraduate students

Teaching Assistant at Ferdowsi University of Mashhad *Fall 2008*

- Physical & Mechanical Properties of Agricultural Products
  - ❖ Responsible for lab sessions of 5-10 graduate students

HONORS AND AWARDS

BBE Graduate Fellowship *2018-2019*

- Stipend, tuition, and health benefits for 12 months

MnDRIVE Global Food Ventures Fellowship *2017-2018*

- Stipend for 12 months ($28,500)
- Grant for professional development activities ($1,000)
- Travel grant for World Food Prize / Borlaug Dialog conference

Food Systems Leadership Certificate (four one-week courses arranged by MnDRIVE)

- Food Safety and Defense in the Context of Global Food Security *May 2018*
- Global Food Systems Policy, Governance and Regulation *May 2018*
- Leadership to Address Global Grand Challenges - Focus on Food Systems *Jan 2018*
- Food Production Systems *Aug 2017*

Best Paper Award – Runner-up

- SPIE Conference on Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping II, Anaheim, CA. ($500) *2017*
- The 8th National Congress on Biosystems Engineering and Mechanization, Mashhad *2014*

Distinguished Graduate Student *2007*

- Department of Biosystems Engineering, Ferdowsi University of Mashhad

PROFESSIONAL MEMBERSHIPS

American Society of Agricultural and Biological Engineers (ASABE)

- ASABE - ITSC-312 Machine Vision Committee *2015 - present*
- ASABE - Unmanned Aerial Systems (MS-60) Committee *2015 - present*

Institute of Electrical and Electronics Engineers (IEEE)

- IEEE Geoscience and Remote Sensing Society *2019 - present*
- IEEE RAS Technical Committee on Agricultural Robotics and Automation *2019 - present*

ACADEMIC SERVICES

Journal Reviews

- IEEE Access – *IEEE*
- IEEE Transactions on Automation Science and Engineering – *IEEE*
- Remote Sensing – *MDPI*
- Plant Methods – *BMC*
- Computers and Electronics in Agriculture – *Elsevier*
- Journal of Food Science and Technology – *Springer*
- Journal of Food Chemistry – *Elsevier*
- International Journal of Food Properties – *Taylor & Francis*
- Agronomy – *MDPI*
- Biosystems Engineering - *Elsevier*
- Journal of Agricultural Machinery

Extension services

- Talked about 'Remote sensing applications in vineyard' for growers, El Dorado, CA *2019*
- Presented drones and sensors to growers, Open House at the Southern Research and Outreach Center, Waseca, MN *2016 & 2018*

Selected Volunteer Activities

- Member of planning committee for Production Agriculture Symposium - Minnesota *2018-2019*
- Member of conciliation board at Como Student Community Cooperative - Minnesota *2016-2017*
- Member of reception board at 8th National Congress on Biosystems Engineering and Mechanization – Iran *2014*

REFERENCES

Available upon request.