

PROCEEDINGS OF SPIE

Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping X

**J. Alex Thomasson
Christoph Bauer**
Editors

**14–16 April 2025
Orlando, Florida, United States**

Sponsored and Published by
SPIE

Volume 13475

Proceedings of SPIE 0277-786X, V. 13475

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping X*, edited by J. Alex Thomasson, Christoph Bauer, Proc. of SPIE 13475, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510687394

ISBN: 9781510687400 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2025 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL
LIBRARY**

SPIDigitalLibrary.org

Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

v *Conference Committee*

ACCURATE UAV-BASED SENSING FOR PHENOTYPING AND PRECISION AGRICULTURE

- 13475 02 **Radiometric and modified RossThick-LiSparse BRDF correction for low-altitude UAV data at varying solar-sensor geometries for time-series analysis** [13475-1]
- 13475 03 **Longwave thermal infrared atmospheric correction using in situ scene elements: the multiple altitude technique revisited for small unmanned aircraft systems (sUAS) (Keynote Paper)** [13475-2]
- 13475 04 **Simulated real-time processing and machine learning on GNSS-R data for land-water segmentation in wetlands (Best Student Paper)** [13475-3]
- 13475 05 **Machine-learning techniques for the detection of powdery mildew in vineyards using aerial and ground imageries** [13475-34]
- 13475 06 **Automated tool for rapid data analysis of UAV-based remotely sensed data for field-based breeding programs (Best Student Paper - Runner Up)** [13475-5]

UAVS AND UGVs FOR PHENOTYPING AND PRECISION AGRICULTURE

- 13475 07 **Improving semantic segmentation through task adaptation for UAV hyperspectral agricultural imagery** [13475-6]
- 13475 08 **UAV-based sensing systems for agricultural optimization: focus on phenotyping and crop monitoring** [13475-7]
- 13475 09 **Chimaera: a tethered UAV enhancement to proximal sensing carts and UGVs** [13475-8]
- 13475 0A **Irradiance source comparison for FLD-based solar-induced fluorescence (SIF) retrieval using hyperspectral imagery (Best Student Paper - Runner Up)** [13475-9]

UGV-BASED SENSING FOR PHENOTYPING AND PRECISION AGRICULTURE I

- 13475 0C **Automated synthetic maize field for machine learning model development** [13475-11]
- 13475 0D **Corn stalk diameter estimation using deep learning** [13475-12]
- 13475 0E **Testing DRIP-GPS: a simulation study on real-time precision irrigation with GNSS-R** [13475-13]

UGV-BASED SENSING FOR PHENOTYPING AND PRECISION AGRICULTURE II

- 13475 OH **Investigating feature types for automated multiclass citrus peel disease detection** [13475-16]
- 13475 OI **Initial prototyping of a low-cost unoccupied ground vehicle platform for crop problem risk and severity mapping in agricultural fields** [13475-17]

UGV-BASED SENSING FOR PHENOTYPING AND PRECISION AGRICULTURE III

- 13475 OL **Harvest-Bot: precision harvesting of pepper (*Capsicum annuum* L.) varieties in a greenhouse** [13475-19]
- 13475 OP **PhenAI-Bot: precision 3D crop phenotyping of pepper (*Capsicum annuum* L.) varieties in a greenhouse** [13475-23]

APPLICATIONS OF UAV-BASED SENSING FOR PHENOTYPING AND PRECISION AGRICULTURE

- 13475 OQ **Comparative analysis of feature selection techniques to identify a set of optimal features for crop yield estimation using UAS-based multisensor data** [13475-24]
- 13475 OR **Leveraging stacked generalization for peanut maturity mapping using aerial multispectral imagery and growing degree days** [13475-25]
- 13475 OS **Machine learning models to detect strawberry plant health from UAVs for real-time applications** [13475-26]
- 13475 OT **Faba bean crop plant identification using aerial multispectral imagery and convolutional neural network-based deep learning models** [13475-27]

POSTER SESSION

- 13475 OU **Branched broomrape detection in tomato farms using satellite imagery and time-series analysis** [13475-30]
- 13475 OV **Leaf spectral reflectance prediction using multihead attention neural networks** [13475-32]