

PROCEEDINGS OF SPIE

# ***Sensing for Agriculture and Food Quality and Safety XVI***

**Moon S. Kim**  
**Byoung-Kwan Cho**  
*Editors*

**22–24 April 2024**  
**National Harbor, Maryland, United States**

*Sponsored and Published by*  
SPIE

**Volume 13060**

Proceedings of SPIE 0277-786X, V. 13060

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](http://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 *Sensing for Agriculture and Food Quality and Safety XVI*, edited by Moon S. Kim, Byoung-Kwan Cho, Proc. of SPIE 13060, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510674387

ISBN: 9781510674394 (electronic)

Published by

**SPIE**

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

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2024 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](http://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](http://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*

---

## **SESSION 1 NIR SPECTROSCOPY AND IMAGING**

---

13060 02 **Detection of woody breast condition in broiler breast fillets using light scattering imaging**  
[13060-4]

---

## **SESSION 2 SPECTRAL IMAGING: AI/ML APPLICATION**

---

13060 03 **Detection of citrus black spot fungus using fluorescence imaging and deep learning on leaf surface** [13060-7]

13060 04 **Localizing plant leaves using maximum anchor boxes in region proposal convolutional neural networks** [13060-8]

---

## **SESSION 3 PLANT HEALTH AND QUALITY MONITORING**

---

13060 05 **Non-destructive method for assessing fruit quality using modified depthwise separable convolutions on hyperspectral images** [13060-12]

---

## **SESSION 4 PATHOGEN AND CHEMICAL CONTAMINANT DETECTION**

---

13060 06 **Detection of E. coli concentration levels using CSI-D+ handheld with UV-C fluorescence imaging and deep learning on leaf surfaces** [13060-15]

13060 07 **Detection of bacteria contamination in milk through H<sub>2</sub> and CO<sub>2</sub> measurements by Raman gas spectroscopy** [13060-16]

13060 08 **Design of real-time pathogen monitoring device for sampled food products during shipment**  
[13060-18]

---

## **SESSION 5 QAT FOR FOOD QUALITY AND SAFETY**

---

13060 09 **Authentication of gluten-free flour by Fourier-transform infrared spectroscopic technique**  
[13060-22]

13060 0A **Design of a portable fluorescence imaging platform for on-site detection target analyte by loop-mediated isothermal amplification** [13060-23]

---

**POSTER SESSION**

---

- 13060 0B **Non-destructive detection of TVC in pork by machine learning techniques based on spectral information** [13060-25]
- 13060 0C **Rapid determination of Ractopamine by SERS coupled with size-tunable Au-Ag alloy** [13060-26]
- 13060 0D **Rapid quantitative detection of Ractopamine using Raman scattering features combining with deep learning** [13060-27]
- 13060 0E **SERS characterization and concentration prediction of Salmonella in pork** [13060-28]
- 13060 0F **Seafood quality, adulteration, and traceability technology integrated with blockchain supply chain** [13060-33]
- 13060 0G **Determination of optimal harvest timing for field-grown apple fruits using hyperspectral imaging technology** [13060-38]
- 13060 0H **Detection and confirmation of Salmonella Typhimurium by smartphone-enabled optomechanical platform** [13060-43]

---

**DIGITAL POSTER SESSION**

---

- 13060 0I **Terahertz sensing through the lens of the Kalman filter: a bibliometric exploration** [13060-31]
- 13060 0J **Advanced crop monitoring: incorporating the Kalman filter into modern agriculture** [13060-32]