

# electronic IMAGING 2021

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11–28 January 2021 • Online

PROCEEDINGS

## Food and Agricultural Imaging Systems 2021

Editors: **Mustafa Jaber**, NantOmics, LLC (United States),  
**Grigorios Tsagakatakis**, Institute of Computer Science, FORTH (Greece), and  
**Mohammed Yousef Hussien**, General Electric Global Research (United States)

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## Food and Agricultural Imaging Systems 2021

### Workshop overview

Guaranteeing food security, understanding the impact of climate change in agriculture, quantifying the impact of extreme weather events on food production, and automating the process of food quality control are a few topics where modern imaging technologies can provide much needed solutions. This workshop welcomes contributions on innovative imaging systems, computer vision, machine/deep learning research, and augmented reality focusing on applications in food and agriculture. Workshop topics consider how novel imaging technologies can address issues related to the impact of climate change, handling and fusion of remote sensing and in-situ data, crop yield prediction, intelligent farming, and livestock management among others. Topics related to food and beverage industry that include food recognition, calorie estimation, food waste management (among others) are included.

### Highlights

The workshop hosts a keynote presentation titled, "SPCTOR: Sensing policy controller and optimizer or multi-scale space and time observations for earth science." Keynote speaker Mahta Moghaddam is the William M. Hogue Professor of Electrical Engineering in the Ming Hsieh Department of Electrical and Computer Engineering at the University of Southern California Viterbi School of Engineering. Moghaddam has introduced innovative approaches and algorithms for quantitative interpretation of multichannel radar imagery based on analytical inverse scattering techniques applied to complex and random media. She has also developed quantitative approaches for multisensor data fusion by combining radar and optical remote sensing data for nonlinear estimation of vegetation and surface parameters. She has led the development of new radar instrument and measurement technologies for subsurface and subcanopy characterization. She has been a systems engineer for the Cassini Radar and the Science Chair of the JPL Team X (Advanced Mission Studies Team).

**Workshop Chairs:** Mustafa Jaber, NantOmics, LLC (United States); Grigorios Tsagkatakis, Institute of Computer Science, FORTH (Greece); and Mohammed Yousefhusien, General Electric Global Research (United States)

**Program Committee:** Jan van Aardt, Susan Farnand, and Andreas Savakis, Rochester Institute of Technology (United States), and Hari Tagat, Edmund Optics (United States)

*Paper authors listed as of 1 January 2021; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.*

# Food and Agricultural Imaging Systems 2021

MONDAY 18 JANUARY 2021

## IMAGING SYSTEMS & APPLICATIONS I

**Moderator:** Grigorios Tsagkatakis, Foundation for Research and Technology (FORTH) (Greece) / **Session Chair:** Mohammed Yousefhussein, General Electric Global Research (United States)  
13:15 – 14:15

13:15 FAIS-026  
**Recognition of manual forest work for time on task recording,** *Stefan Dilger, Fraunhofer-Institut für Sichere Informationstechnologie SIT (Germany)*

13:35 FAIS-027  
**Knowledge distillation from multispectral images for fish freshness estimation,** *Grigorios Tsagkatakis<sup>1</sup>, Stelios Roubakis<sup>1</sup>, Savas Nikolidakis<sup>2</sup>, Eleni Petra<sup>3</sup>, Athanasios Mantes<sup>3</sup>, Argyris Kapantagakis<sup>2</sup>, Kriton Grigorakis<sup>2</sup>, George Katselis<sup>4</sup>, Nikos Vlahos<sup>4</sup>, and Panagiotis Tsakalides<sup>1</sup>; <sup>1</sup>Foundation for Research and Technology (FORTH), <sup>2</sup>Elleniko Kentro Thalassion Ereunon, <sup>3</sup>Athens Ereunetiko Kentro, and <sup>4</sup>Panepistemio Peloponnesou Schole Oikonomias kai Technologias (Greece)*

## KEYNOTE: IMAGING SYSTEMS & APPLICATIONS II

**Session Chair:** Grigorios Tsagkatakis, Foundation for Research and Technology (FORTH) (Greece) / **Moderator:** Mohammed Yousefhussein, General Electric Global Research (United States)  
18:15 – 19:15

18:15 FAIS-030  
**Analysis of reflected metamer light effect on cheese palatability,** *Gaku Yamashita, Midori Tanaka, and Takahiko Horiuchi, Chiba University (Japan)*

18:35 FAIS-031  
**KEYNOTE: SPCTOR: Sensing policy controller and optimizer or multi-scale space and time observations for earth science,** *Mahta Moghaddam, University of Southern California (United States)*

*Keynote speaker Mahta Moghaddam is the William M. Hogue Professor of Electrical Engineering in the Ming Hsieh Department of Electrical and Computer Engineering at the University of Southern California Viterbi School of Engineering. Moghaddam has introduced innovative approaches and algorithms for quantitative interpretation of multichannel radar imagery based on analytical inverse scattering techniques applied to complex and random media. She has also developed quantitative approaches for multisensor data fusion by combining radar and optical remote sensing data for nonlinear estimation of vegetation and surface parameters. She has led the development of new radar instrument and measurement technologies for subsurface and subcanopy characterization. She has been a systems engineer for the Cassini Radar and the Science Chair of the JPL Team X (Advanced Mission Studies Team).*

## TUESDAY 19 JANUARY 2021

### PLENARY: DEEP INTERNAL LEARNING—DEEP LEARNING WITH ZERO EXAMPLES

**Session Chair:** Charles Bouman, Purdue University (United States)

10:00 – 11:10

#### Deep internal learning—Deep learning with zero examples

**Michal Irani**, *professor, Department of Computer Science and Applied Mathematics, Weizmann Institute of Science (Israel)*

*Michal Irani is a professor at the Weizmann Institute of Science. Her research interests include computer vision, AI, and deep learning. Irani's prizes and honors include the Maria Petrou Prize (2016), the Helmholtz "Test of Time Award" (2017), the Landau Prize in AI (2019), and the Rothschild Prize in Mathematics and Computer Science (2020). She also received the ECCV Best Paper Awards (2000 and 2002), and the Marr Prize Honorable Mention (2001 and 2005).*

## THURSDAY 21 JANUARY 2021

### PLENARY: THE DEVELOPMENT OF INTEGRAL COLOR IMAGE SENSORS AND CAMERAS

**Session Chair:** Jonathan B. Phillips, Google Inc. (United States)

10:00 – 11:10

#### The development of integral color image sensors and cameras

**Kenneth A. Parulski**, *expert consultant: mobile imaging (United States)*

*Kenneth Parulski is an expert consultant to mobile imaging companies and leads the development of ISO standards for digital photography. He joined Kodak in 1980 after graduating from MIT and retired in 2012 as research fellow and chief scientist in Kodak's digital photography division. His work has been recognized with a Technical Emmy and other major awards. Parulski is a SMPTE fellow and an inventor on more than 225 US patents.*

## MONDAY 25 JANUARY 2021

### PLENARY: MAKING INVISIBLE VISIBLE

**Session Chair:** Jonathan B. Phillips, Google Inc. (United States)

10:00 – 11:10

#### Making invisible visible

**Ramesh Raskar**, *associate professor, MIT Media Lab (United States)*

*Ramesh Raskar is an associate professor at MIT Media Lab and directs the Camera Culture research group. His focus is on AI and imaging for health and sustainability. They span research in physical (e.g., sensors, health-tech), digital (e.g., automated and privacy-aware machine learning), and global (e.g., geomaps, autonomous mobility) domains. He received the Lemelson Award (2016), ACM SIGGRAPH Achievement Award (2017), DARPA Young Faculty Award (2009), Alfred P. Sloan Research Fellowship (2009), TR100 Award from MIT Technology Review (2004), and Global Indus Technovator Award (2003). He has worked on special research projects at Google [X] and Facebook and co-founded/advised several companies.*

**WEDNESDAY 27 JANUARY 2021**

**PLENARY: REVEALING THE INVISIBLE TO MACHINES WITH NEUROMORPHIC VISION SYSTEMS: TECHNOLOGY AND APPLICATIONS OVERVIEW**

Session Chair: Radka Tezaur, Intel Corporation (United States)

10:00 – 11:10

**Revealing the invisible to machines with neuromorphic vision systems: Technology and applications overview**

**Luca Verre, CEO and co-founder, Prophesee (France)**

*Luca Verre is co-founder and CEO of Prophesee, the inventor of the world's most advanced neuromorphic vision systems. Verre is a World Economic Forum technology pioneer. His experience includes project and product management, marketing, and business development roles at Schneider Electric. Prior to Schneider Electric, Verre worked as a research assistant in photonics at the Imperial College of London. Verre holds a MSc in physics, electronic and industrial engineering from Politecnico di Milano and Ecole Centrale and an MBA from Institut Européen d'Administration des Affaires, INSEAD.*