

PROCEEDINGS OF SPIE

Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020

**Michael C. Dudzik
Stephen M. Jameson**
Editors

**27 April – 8 May 2020
Online Only, United States**

Sponsored and Published by
SPIE

Volume 11415

Proceedings of SPIE 0277-786X, V. 11415

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

Autonomous Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020,
edited by Michael C. Dudzik, Stephen M. Jameson, Proc. of SPIE Vol. 11415, 1141501
© 2020 SPIE · CCC code: 0277-786X/20/\$21 · doi: 10.1117/12.2572759

Proc. of SPIE Vol. 11415 1141501-1

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 Systems: Sensors, Processing, and Security for Vehicles and Infrastructure 2020*, edited by Michael C. Dudzik, Stephen M. Jameson, Proceedings of SPIE Vol. 11415 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510636071
ISBN: 9781510636088 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2020, Society of Photo-Optical Instrumentation Engineers.

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 copying fees. The Transactional Reporting Service base fee for this volume is \$21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online 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. The CCC fee code is 0277-786X/20/\$21.00.

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: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article 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

CYBERSECURITY AND COMMUNICATION ISSUES WITH NETWORKED AUTONOMOUS SYSTEMS I

- 11415 03 **Raman-assisted BOTDA performance improvement with the differential pulse-width pair technique and an artificial neural network based fitting algorithm [11415-2]**
- 11415 04 **Simulation-based model for surrogate safety measures analysis in automated vehicle-pedestrian conflict on an urban environment [11415-3]**
- 11415 05 **Multi point pure pursuit [11415-4]**
- 11415 06 **Securing global positioning systems in a blockchain using vehicle-to-everything communications [11415-5]**

APPLICATIONS FOR AUTONOMOUS SYSTEMS IN NATIONAL SECURITY AND EMERGENCY RESPONSE

- 11415 07 **Autonomy at the end of the Earth: an inclement weather autonomous driving data set (Invited Paper) [11415-6]**
- 11415 08 **Robot coordination in rescue missions [11415-7]**
- 11415 09 **Extending free-space mapping to unstructured, off-road environments [11415-8]**

JOINT SESSION WITH CONFERENCES 11415 AND 11425: AUTONOMOUS GROUND VEHICLES: SENSING, PROCESSING, AND SAFETY

- 11415 0B **The Mertens Unrolled Network (MU-Net): a high dynamic range fusion neural network for through the windshield driver recognition [11415-18]**
- 11415 0C **Monocular depth estimation for vision-based vehicles based on a self-supervised learning method [11415-12]**
- 11415 0D **Accuracy of echo detection using differentiation for compact LIDAR implementation [11415-13]**
- 11415 0E **C-SLAM: six degrees of freedom point cloud mapping for any environment [11415-14]**
- 11415 0F **Unreal as a simulation environment for off-road autonomy [11415-15]**
- 11415 0G **SVM-based sensor fusion for improved terrain classification [11415-16]**

11415 OH **Comparing machine learning and neural network-based approaches for sign detection and classification in autonomous vehicles [11415-17]**