

PROCEEDINGS OF SPIE

# ***AI and Optical Data Sciences***

**Bahram Jalali**  
**Ken-ichi Kitayama**  
*Editors*

**4–5 February 2020**  
**San Francisco, California, United States**

*Sponsored and Published by*  
SPIE

**Volume 11299**

Proceedings of SPIE 0277-786X, V. 11299

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 *AI and Optical Data Sciences*, edited by Bahram Jalali, Ken-ichi Kitayama, Proceedings of SPIE Vol. 11299 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

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

ISBN: 9781510633612  
ISBN: 9781510633629 (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](http://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](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. 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](http://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

v	<i>Authors</i>
vii	<i>Conference Committee</i>

---

## AR/VR SCIENCES I

---

11299 04	<b>Notes on the design of free-form optics [11299-3]</b>
----------	--

---

## RESERVOIR COMPUTING

---

11299 08	<b>Time delay reservoir computing with VCSEL (Keynote Paper) [11299-7]</b>
11299 09	<b>Optical reservoir computer using speckle in a multimode waveguide [11299-8]</b>
11299 0A	<b>Time-multiplexed photonic reservoir computing [11299-9]</b>

---

## PHOTONIC HARDWARE ACCELERATORS

---

11299 0H	<b>A scalable optical neural network architecture using coherent detection [11299-16]</b>
----------	---

---

## OPTICAL COMPUTING

---

11299 0J	<b>Synchronously-pumped OPO coherent Ising machine: benchmarking and prospects [11299-18]</b>
----------	---

---

## COMPUTATIONAL IMAGING

---

11299 0N	<b>Origins and mitigations of some automotive pulsed lidar artifacts [11299-22]</b>
11299 0P	<b>Optical-coherence-tomography-based algorithm for handwriting forensic analysis [11299-24]</b>

**POSTER SESSION**

---

- 11299 10     **Electronic polarization-division demultiplexing based on artificial neural networks in optical communication systems [11299-35]**
- 11299 15     **Computational-complexity comparison of time- and frequency-domain artificial neural networks for optical nonlinearity compensation [11299-40]**
- 11299 16     **Overfitting of artificial-neural-network-based nonlinear equalizer for multilevel signals in optical communication systems [11299-41]**
- 11299 17     **An ANN-based embedded hardware for gas leak detection using a SWIR imaging system [11299-42]**