PROCEEDINGS OF SPIE

# *International Conference on Computer Network Security and Software Engineering (CNSSE 2022)*

**Wenshun Sheng**
**Yongquan Yan**
*Editors*

**25–27 February 2022**
**Zhuhai, China**

*Organized by*
Guangzhou Computer Society
Guangzhou Association for Science and Technology

*Sponsored*
AEIC Academic Exchange Information Center

*Published by*
SPIE

**Volume 12290**

Proceedings of SPIE 0277-786X, V. 12290


International Conference on Computer Network Security and Software Engineering (CNSSE 2022), edited by Wenshun Sheng, Yongquan Yan, Proc. of SPIE Vol. 12290, 1229001 · © 2022 SPIE
0277-786X · doi: 10.1117/12.2655727

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 SPIEDigitalLibrary.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 *International Conference on Computer Network Security and Software Engineering (CNSSE 2022)*, edited by Wenshun Sheng, Yongquan Yan, Proc. of SPIE 12290, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510655980
ISBN: 9781510655997 (electronic)

Published by
**SPIE**
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time)
SPIE.org


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
SPIEDigitalLibrary.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

**BIG DATA ALGORITHMS AND SOFTWARE ENGINEERING SIGNAL PROCESSING**

# Conference Committees

*General Conference Chair*

**Zhiyong Zhang**, Henan University of Science and Technology (China)

*Technical Program Committee Chair*

**Philippe Fournier-Viger**, Harbin Institute of Technology (China)

*Publication Chair*

**Qujiang Lei**, University of Chinese Academy of Sciences (China)

*Local Committee Chairs*

**Ji Wang,** Ningbo University (China)
**Carlos Becker Westphall**, Federal University of Santa Catarina (Brazil)

*Academic Committees*

**Zongxi Li,** Xi'an Jiaotong University (China)
**Jalil Piran,** Sejong University (Korea, Republic of)
**Jian Cao,** Air Force Engineering University (China)
**Lei Zhang,** Henan University (China)
**Nirmalya Thakur,** University of Cincinnati (United States)

*Program Committees*

**Fangfang Jian**, Henan University of Science and Technology (China)
**Yongquan Yan**, Shanxi University of Finance and Economics (China)
**Wenshun Sheng**, Nanjing Tech University (China)
**Junwen Chen**, China Petroleum Engineering and Construction Corporation, Southwest Branch (China)
**Cheng Jin**, New United Group Company Ltd. (China)

*Technical Program Committees*

**Anhui Liang**, Guangdong University of Technology (China)
**Kevin Cohen**, University of Colorado Boulder (United States)
**Marcin Paprzycki**, Systems Research Institute (Poland)
**Maria Ganzha**, Warsaw University of Technology (Poland)
**Ying-Ren Chien**, National Ilan University (China)
**Vladimir G. Chigrinov**, Foshan University (China)
**Mamoun Alazab,** Charles Darwin University (Australia)

**Mahmoud AlShawabkeh**, Guangxi Normal University for Nationalities (China)
**Mohamed A. Sullabi**, Libyan Academy-Misurata Branch (Libya)
**Paul Blondel**, Université Picardie Jules Vernes (France)