# **Communications** in Computer and Information Science

1306

#### **Editorial Board Members**

Joaquim Filipe 10

Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh

Indian Statistical Institute, Kolkata, India

Raquel Oliveira Prates

Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil

Lizhu Zhou

Tsinghua University, Beijing, China

More information about this series at http://www.springer.com/series/7899

Tran Khanh Dang · Josef Küng · Makoto Takizawa · Tai M. Chung (Eds.)

# Future Data and Security Engineering

Big Data, Security and Privacy, Smart City and Industry 4.0 Applications

7th International Conference, FDSE 2020 Quy Nhon, Vietnam, November 25–27, 2020 Proceedings



Editors

Tran Khanh Dang 

Ho Chi Minh City University of Technology
Ho Chi Minh City, Vietnam

Makoto Takizawa Hosei University Tokyo, Japan Josef Küng

Johannes Kepler University of Linz

Linz, Austria

Tai M. Chung

Sungkyunkwan University Suwon, Korea (Republic of)

ISSN 1865-0929 ISSN 1865-0937 (electronic) Communications in Computer and Information Science ISBN 978-981-33-4369-6 ISBN 978-981-33-4370-2 (eBook) https://doi.org/10.1007/978-981-33-4370-2

#### © Springer Nature Singapore Pte Ltd. 2020

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

#### **Preface**

In LNCS 12466 and CCIS 1306 volumes we present the accepted contributions for the 7th International Conference on Future Data and Security Engineering (FDSE 2020). The conference took place during November 25–27, 2020, in an entirely virtual mode (Quy Nhon University, Binh Dinh Province, Vietnam). The proceedings of FDSE are published in the LNCS series by Springer. Besides DBLP and other major indexing systems, the FDSE proceedings have also been indexed by Scopus and listed in Conference Proceeding Citation Index (CPCI) of Thomson Reuters.

The annual FDSE conference is a premier forum designed for researchers, scientists, and practitioners interested in state-of-the-art and state-of-the-practice activities in data, information, knowledge, and security engineering to explore cutting-edge ideas, to present and exchange their research results and advanced data-intensive applications, as well as to discuss emerging issues on data, information, knowledge, and security engineering. At the annual FDSE, the researchers and practitioners are not only able to share research solutions to problems of today's data and security engineering themes, but are also able to identify new issues and directions for future related research and development work.

The two-round call for papers resulted in the submission of 161 papers. A rigorous peer-review process was applied to all of them. This resulted in 24 accepted papers (acceptance rate: 14.9%) and 2 keynote speeches for LNCS 12466, and 37 accepted papers (including 8 short papers, acceptance rate: 23%) for CCIS 1306, which were presented online at the conference. Every paper was reviewed by at least three members of the International Program Committee, who were carefully chosen based on their knowledge and competence. This careful process resulted in the high quality of the contributions published in these two volumes. The accepted papers were grouped into the following sessions:

- Advances in Big Data Query Processing and Optimization (LNCS)
- Advanced Studies in Machine Learning for Security (LNCS)
- Big Data Analytics and Distributed Systems (LNCS and CCIS)
- Blockchain and Applications (LNCS)
- Security Issues in Big Data (LNCS)
- Data Analytics and Healthcare Systems (CCIS)
- Machine Learning based Big Data Processing (CCIS)
- Security and Privacy Engineering (CCIS)
- Industry 4.0 and Smart City: Data Analytics and Security (LNCS and CCIS)
- Emerging Data Management Systems and Applications (LNCS and CCIS)

In addition to the papers selected by the Program Committee, five internationally recognized scholars delivered keynote speeches:

- Prof. Johann Eder, Alpen-Adria-Universität Klagenfurt, Austria
- Prof. Dirk Draheim, Tallinn University of Technology, Estonia

#### Preface

- Prof. Tai M. Chung, Sungkyunkwan University, South Korea
- Prof. Sun Jun, Singapore Management University, Singapore
- Prof. Jian Yang, Macquarie University, Australia

The success of FDSE 2020 was the result of the efforts of many people, to whom we would like to express our gratitude. First, we would like to thank all authors who submitted papers to FDSE 2020, especially the invited speakers for the keynotes. We would also like to thank the members of the committees and external reviewers for their timely reviewing and lively participation in the subsequent discussion in order to select such high-quality papers published in these two volumes. Last but not least, we thank Prof. Do Ngoc My and the Organizing Committee members from Quy Nhon University, for their great hospitality and support of FDSE 2020.

November 2020

Tran Khanh Dang Josef Küng Makoto Takizawa Tai M. Chung

## **Organization**

#### **Honorary Chair**

Do Ngoc My Quy Nhon University, Vietnam

#### **Program Committee Chairs**

Tran Khanh Dang Ho Chi Minh City University of Technology, Vietnam

Josef Küng Johannes Kepler University Linz, Austria

Makoto Takizawa Hosei University, Japan

Tai M. Chung Sungkyunkwan University, South Korea

#### **Steering Committee**

Dirk Draheim Tallinn University of Technology, Estonia

Dinh Nho Hao Institute of Mathematics, Vietnam Academy of Science

and Technology, Vietnam

Dieter Kranzlmüller Ludwig Maximilian University of Munich, Germany

Fabio Massacci University of Trento, Italy
Erich Neuhold University of Vienna, Austria
Silvio Ranise Fondazione Bruno Kessler, Italy

A Min Tjoa Technical University of Vienna, Austria Fukuda Kensuke National Institute of Informatics, Japan

## **Local Organizing Committee**

Do Ngoc My (Co-chair) Quy Nhon University, Vietnam

Tran Khanh Dang (Chair) Ho Chi Minh City University of Technology, Vietnam Ho Chi Minh City University of Technology, Vietnam

Josef Küng Johannes Kepler University Linz, Austria

Nguyen Tien Trung Quy Nhon University, Vietnam Tran Tri Dang RMIT University, Vietnam

Nguyen Le Hoang Ho Chi Minh City University of Technology, Vietnam Ta Manh Huy Ho Chi Minh City University of Technology, Vietnam

#### **Publicity Chairs**

Tran Minh Quang Ho Chi Minh City University of Technology, Vietnam

Nguyen Quoc Viet Hung Griffith University, Australia

Le Hong Trang Ho Chi Minh City University of Technology, Vietnam

Nam Ngo-Chan University of Trento, Italy

#### **Program Committee**

Artur Andrzejak Heidelberg University, Germany Pham The Bao Saigon University, Vietnam

Hyunseung Choo Sungkyunkwan University, South Korea

H. K. Dai Oklahoma State University, USA

Vitalian Danciu Ludwig Maximilian University of Munich, Germany

Nguyen Tuan Dang Saigon University, Vietnam
Tran Tri Dang RMIT University, Vietnam
Thanh-Nghi Do Can Tho University, Vietnam

Nguyen Van Doan Japan Advanced Institute of Science and Technology,

Japan

Johann Eder Alpen-Adria-Universität Klagenfurt, Austria

Jungho EomDaejeon University, South KoreaMichael FeldererUniversity of Innsbruck, AustriaFukuda KensukeNational Institute of Informatics, JapanAlban GabillonUniversity of French Polynesia, France

Verena Geist Software Competence Center Hagenberg, Austria

Osvaldo Gervasi University of Perugia, Italy

Manuel Clavel Vietnamese-German University, Vietnam Raju Halder Indian Institute of Technology Patna, India

Nguyen Huu Hoa Can Tho University, Vietnam

Tran Van Hoai Ho Chi Minh City University of Technology, Vietnam

Phan Duy Hung FPT University Hanoi, Vietnam Nguyen Viet Hung University of Trento, Italy

Trung-Hieu Huynh Industrial University of Ho Chi Minh City, Vietnam

Kien Huynh Stony Brook University, USA

Kha-Tu Huynh International University - VNU-HCM, Vietnam

Tomohiko Igasaki Kumamoto University, Japan

Koichiro Ishibashi The University of Electro-Communications, Japan

Eiji Kamioka Shibaura Institute of Technology, Japan M-Tahar Kechadi University College Dublin, Ireland Andrea Ko Corvinus University of Budapest, Hungary

Duc-Anh Le Center for Open Data in the Humanities, Tokyo, Japan Lam-Son Le Ho Chi Minh City University of Technology, Vietnam

Nhien-An Le-Khac University College Dublin, Ireland

Truong Thi Dieu Linh Hanoi University of Science and Technology, Vietnam

Cao Van Loi Le Quy Don Technical University, Vietnam

Hoang Duc Minh
Nguyen Thai-Nghe
Nam Ngo-Chan
National Physical Laboratory, UK
Can Tho University, Vietnam
University of Trento, Italy

Thanh Binh Nguyen Ho Chi Minh City University of Technology, Vietnam Binh Thanh Nguyen International Institute for Applied Systems Analysis,

Austria

Anh-Tuan Nguyen Ho Chi Minh City University of Foreign Languages

and Information Technology, Vietnam

Benjamin Nguyen Institut National des Sciences Appliqués Centre

Val de Loire, France

An Khuong Nguyen Ho Chi Minh City University of Technology, Vietnam

Khoa Nguyen CSIRO, Australia

Vu Thanh NguyenVan Hien University, VietnamTruong Toan NguyenCurtin University, AustraliaLuong The NhanAmadeus IT Group, France

Alex Norta Tallinn University of Technology, Estonia

Duu - Sheng Ong Multimedia University, Malaysia Eric Pardede La Trobe University, Australia Cong Duc Pham University of Pau, France

Vinh Pham Sungkyunkwan University, South Korea Nhat Hai Phan New Jersey Institute of Technology, USA

Thanh An Phan Institute of Mathematics, Vietnam Academy of Science

and Technology, Vietnam

Phu H. Phung University of Dayton, USA

Nguyen Van Sinh International University - VNU-HCM, Vietnam Erik Sonnleitner Johannes Kepler University Linz, Austria

Huynh Quyet Thang Hanoi University of Science and Technology, Vietnam

Nguyen Hoang Thuan RMIT University, Vietnam

Michel Toulouse Hanoi University of Science and Technology, Vietnam Thien Khai Tran Ho Chi Minh City University of Foreign Languages

and Information Technology, Vietnam Hong Bang International University, Vietnam

Ha-Manh Tran

Hong Bang International University, Vietnam

Ho Chi Minh City University of Technology, Vietnam

Tran Minh Triet HCMC University of Natural Sciences, Vietnam

Takeshi Tsuchiya Tokyo University of Science, Japan Le Pham Tuyen Kyunghee University, South Korea

Hoang Huu Viet Vinh University, Vietnam Edgar Weippl SBA Research, Austria

Wolfram Woess Johannes Kepler University Linz, Austria Honguk Woo Sungkyunkwan University, South Korea Sadok Ben Yahia Tallinn University of Technology, Estonia Szabó Zoltán Corvinus University of Budapest, Hungary

#### **External Reviewers**

Thu Le Thi Bao National Institute of Informatics, Japan Tran Manh Hung Sungkyunkwan University, South Korea Heidelberg University Cormony

Le Thi Kim Tuyen Heidelberg University, Germany

Trung Ha
University of Information Technology, Vietnam
Dan Ho Duc
Hieu Le
Ho Chi Minh City University of Technology, Vietnam
Ho Chi Minh City University of Technology, Vietnam
Industrial University of Ho Chi Minh City, Vietnam

Manh-Tuan Nguyen COFICO Company, Vietnam

Trung-Viet Nguyen Can Tho University of Technology, Vietnam

#### Organization

X

Thai-Minh Truong Chau D. M. Pham Tan Ha Mai Pham Thi Vuong Ho Chi Minh City University of Technology, Vietnam Zalo, Vietnam Ho Chi Minh City University of Technology, Vietnam Saigon University, Vietnam

# **Contents**

Big Data Analytics and Distributed Systems	
On the Potential of Numerical Association Rule Mining	3
Applying Peer-to-Peer Networks for Decentralized Customer-to-Customer Ecommerce Model	21
An Elastic Data Conversion Framework for Data Integration System	35
A Novel Model Using CDN, P2P, and IPFS for Content Delivery	51
Course Recommendation with Deep Learning Approach	63
Py_ape: Text Data Acquiring, Extracting, Cleaning and Schema Matching in Python	78
Security and Privacy Engineering	
Improving ModSecurity WAF with Machine Learning Methods	93
An Elastic Anonymization Framework for Open Data	108
A Computer Virus Detection Method Based on Information from PE Structure of Files Combined with Deep Learning Models  Vu Thanh Nguyen, Vu Thanh Hien, Le Dinh Tuan, Mai Viet Tiep, Nguyen Hoang Anh, and Pham Thi Vuong	120

Automatic Attendance System Based on Face Recognition Using HOG Features and Cosine Distance	130
Thanh-Hai Nguyen, Cong-Tinh Dao, Nguyen-Minh-Thao Phan, Thi-Ngoc-Cham Nguyen, Tan-Tai Phan, and Huynh-Ngoc Pham	150
Industry 4.0 and Smart City: Data Analytics and Security	
Ontology-Based Shrimp and Fish Diseases Diagnosis	151
Deep Learning-Based Methods for Plant Disease.  Vu Thanh Nguyen, Triet Quang Duong, Tuan Dinh Le, and Anh Thi Dieu Nguyen	166
Uberwasted App for Reporting and Collecting Waste Using Location Based and Deep Learning Technologies	178
A Flexible Internet of Things Architecture for Data Gathering and Monitoring System	189
Recognition and Quantity Estimation of Pastry Images Using Pre-training Deep Convolutional Networks	200
Forecasting Sensor Data Using Multivariate Time Series Deep Learning Nguyen Thai-Nghe and Nguyen Thanh-Hai	215
A Template-Based Approach for Generating Vietnamese References from Flat MR Dataset in Restaurant Domain	230
Data Analytics and Healthcare Systems	
A Synthetic Data Generation Model for Diabetic Foot Treatment Jayun Hyun, Seo Hu Lee, Ha Min Son, Ji-Ung Park, and Tai-Myoung Chung	249
An Approach for Skin Lesions Classification with a Shallow Convolutional Neural Network	265

Detection and Classification of Brain Hemorrhage Using Hounsfield Unit and Deep Learning Techniques	281
Anh-Cang Phan, Hung-Phi Cao, Thanh-Ngoan Trieu, and Thuong-Cang Phan	
Inflammatory Bowel Disease Classification Improvement with Metagenomic Data Binning Using Mean-Shift Clustering	294
Machine Learning-Based Big Data Processing	
Additional Learning on Object Detection: A Novel Approach in Pornography Classification	311
Proposing the Development of Dataset of Cartoon Character using DCGAN Model	325
Feature Selection Using Local Interpretable Model-Agnostic Explanations on Metagenomic Data	340
ORB for Detecting Copy-Move Regions with Scale and Rotation in Image Forensics	358
A Convex Optimization Based Method for Color Image Reconstruction Nguyen Thi Hong Anh, Nguyen Duy Viet Toan, and Le Hong Trang	373
<b>Emerging Data Management Systems and Applications</b>	
Cost Effective Control Plane Design for Service Assurance in Software Defined Service Function Chaining	387
Using Fuzzy Time Series Model Based on Hedge Algebras and Relationship Groups Following Time Points for Forecasting Time Series Nguyen Dinh Thuan and Hoang Tung	401
Finding Maximum Stable Matchings for the Student-Project Allocation Problem with Preferences Over Projects  Hoang Huu Viet, Le Van Tan, and Son Thanh Cao	411

#### xiv Contents

Short Papers: Security and Data Engineering	
Data Privacy in Its Three Forms – A Systematic Review	425
Incremental Learning for Classifying Vietnamese Herbal Plant	434
Using Topic Models to Label Documents for Classification	443
Genome-Wide Association Analysis for Oat Genetics Using Support Vector Machines	452
Develop High School Students Recommendation System Based on Ontology	461
Digital Signatures Using Hardware Security Modules for Electronic Bills in Vietnam: Open Problems and Research Directions	469
Automatic Vietnamese Passport Recognition on Android Phones	476
A Third-Party Intelligent System for Preventing Call Phishing and Message Scams.  Manh-Hung Tran, Trung Ha Le Hoai, and Hyunseung Choo	486

Author Index .....

493