

Lecture Notes on Data Engineering
and Communications Technologies 72

Faisal Saeed
Fathey Mohammed
Abdulaziz Al-Nahari *Editors*



Innovative Systems for Intelligent Health Informatics

Data Science, Health Informatics,
Intelligent Systems, Smart Computing

 Springer

Lecture Notes on Data Engineering and Communications Technologies

Volume 72

Series Editor

Fatos Xhafa, Technical University of Catalonia, Barcelona, Spain

The aim of the book series is to present cutting edge engineering approaches to data technologies and communications. It will publish latest advances on the engineering task of building and deploying distributed, scalable and reliable data infrastructures and communication systems.

The series will have a prominent applied focus on data technologies and communications with aim to promote the bridging from fundamental research on data science and networking to data engineering and communications that lead to industry products, business knowledge and standardisation.

Indexed by SCOPUS, INSPEC, EI Compendex.

All books published in the series are submitted for consideration in Web of Science.

More information about this series at <http://www.springer.com/series/15362>

Faisal Saeed · Fathey Mohammed ·
Abdulaziz Al-Nahari
Editors

Innovative Systems for Intelligent Health Informatics

Data Science, Health Informatics,
Intelligent Systems, Smart Computing

 Springer

Editors

Faisal Saeed
College of Computer Science
and Engineering
Taibah University
Medina, Saudi Arabia

Fathey Mohammed
School of Computing,
Information Systems Department
Universiti Utara Malaysia
Sintok, Malaysia

Abdulaziz Al-Nahari
Sanaa'a Community College
Sana'a, Yemen

ISSN 2367-4512

ISSN 2367-4520 (electronic)

Lecture Notes on Data Engineering and Communications Technologies

ISBN 978-3-030-70712-5

ISBN 978-3-030-70713-2 (eBook)

<https://doi.org/10.1007/978-3-030-70713-2>

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2021

This work is subject to copyright. All rights are solely and exclusively licensed 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 Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

We are honored to welcome you to the 5th International Conference of Reliable Information and Communication Technology 2020 (IRICT2020) that was conducted online on December 21–22, 2020, and organized by the Yemeni Scientists Research Group (YSRG), Information Service Systems and Innovation Research Group (ISSIRG) in Universiti Teknologi Malaysia (Malaysia), Data Science Research Group in College of Computer Science and Engineering at Taibah University (Kingdom of Saudi Arabia), School of Science and Technology in Nottingham Trent (UK), College of Engineering, IT, and Environment at Charles Darwin University (Australia) and Association for Information Systems—Malaysia Chapter (MyAIS).

IRICT2020 is a forum for the presentation of technological advances in the field of information and communication technology. The main theme of the conference is “Innovative Systems for Intelligent Health Informatics.”

Many researchers have been attracted to submit 140 papers to IRICT2020 from 29 countries including Algeria, Australia, China, Egypt, Fiji, Germany, India, Indonesia, Iraq, Iran, Jordan, Malaysia, Morocco, Myanmar, Nigeria, Oman, Pakistan, Saudi Arabia, Singapore, Somalia, South Africa, Sri Lanka, Sudan, Sweden, Taiwan, Tunisia, UK, USA and Yemen. Of those 140 submissions, 111 submissions have been selected to be included in this book.

The book presents several research topics which include health informatics, bioinformatics, information retrieval, artificial intelligence, machine learning, data science, big data analytics, business intelligence, Internet of things (IoT), information security, intelligent communication systems, information systems theories and applications, computational vision and robotics technology, software engineering and multimedia applications and services.

We would like to express our appreciations to all authors and the keynote speakers for sharing their expertise with us. And we would like to thank the organizing committee for their great efforts in managing the conference. In addition,

we would like to thank the technical committee for reviewing all the submitted papers; Prof. Dr. Janusz Kacprzyk, AISC series editor, Prof. Dr. Fatos Xhafa, book series editor; and Dr. Thomas Ditzinger from Springer.

Finally, we thank all the participants of IRICT2020 and hope to see you all again in the next conference.

Organization

IRICT2020 Organizing Committee

Honorary Co-chairs

Rose Alinda Alias	Association for Information Systems—Malaysian Chapter, Head of the Information Service Systems and Innovation Research Group (ISSIRG) in Universiti Teknologi Malaysia
Ahmad Lotfi	Computing and Technology School of Science and Technology, Nottingham Trent University, UK
Abdullah Alsaeedi	College of Computer Science and Engineering, Taibah University, Kingdom of Saudi Arabia

Conference General Chair

Faisal Saeed	Yemeni Scientists Research Group (YSRG), Head of Data Science Research Group in Taibah University, Kingdom of Saudi Arabia
--------------	--

Program Committee Chair

Fathey Mohammed	Universiti Utara Malaysia (UUM), Malaysia
-----------------	---

General Secretary

Nadhmi Gazem	Taibah University, Kingdom of Saudi Arabia
--------------	--

Technical Committee Chairs

Faisal Saeed	Taibah University, Kingdom of Saudi Arabia
Tawfik Al-Hadhrami	Nottingham Trent University, UK
Mamoun Alazab	Charles Darwin University, Australia

Publications Committee

Fathey Mohammed	Universiti Utara Malaysia
Abdulaziz Al-Nahari	Sanaá Community College

Publicity Committee

Abdullah Aysh Dahawi	Universiti Teknologi Malaysia
Maged Naeser	Universiti Teknologi Malaysia
Mohammed Omar	Universiti Teknologi PETRONAS
Awadh Al-Shatari	
Ali Ahmed Ali Salem	Universiti Tun Hussein Onn Malaysia

IT and Multimedia Committee

Fuad Abdeljalil Al-shamiri	Universiti Teknologi Malaysia
Mohammed Alsarem	Taibah University, KSA
Amer Alsaket	Sitecore, Malaysia
Sulaiman	Taibah University, KSA
Mohammed Abdulrahman	

Treasure Committee

Abdullah Aysh Dahawi	Universiti Teknologi Malaysia
----------------------	-------------------------------

Logistic Committee Chair

Wahid Al-Twaiti	Universiti Teknologi Malaysia (UTM)
-----------------	-------------------------------------

Registration

Sameer Hasan Albakri	Universiti Teknologi Malaysia (UTM)
----------------------	-------------------------------------

International Technical Committee

Abdelhadi Raihani	Hassan II University of Casablanca, Morocco
Abdelhamid Emara	Taibah University, KSA
Abdelkahir Ait Abdelouahad	Chouaib Doukkali University, Morocco
Abdualmajed Ahmed Ghaleb	Al-Khulaidi Sana'a University, Yemen
Abdullah Almogahed	Universiti Utara Malaysia, Malaysia
Abdullah B. Nasser	University Malaysia Pahang, Malaysia
Abdulrahman Alsewari	University Malaysia Pahang, Malaysia
Abubakar Elsafi	University of Jeddah, KSA
Aby Mathews Maluvelil	Independent Researcher, Canada
Ahmad Fadhil Yusof	Universiti Teknologi Malaysia, Malaysia
Ahmed Awad	King Abdulaziz University, KSA
Ahmed Majid	University of Information Technology and Communications, Iraq
Ahmed Mutahar	Management and Science University, Malaysia
Ahmed Rakha	Al-Azhar University, Egypt
Ahmed Talal	Al-Iraqia University, Iraq
Alaa Alomoush	Universiti Malaysia Pahang, Malaysia
Alaa Fareed Abdulateef	Universiti Utara Malaysia, Malaysia
Ali Ahmed	King Abdulaziz University, KSA
Ameen Ba Homaid	University Malaysia Pahang, Malaysia
Aminu Aminu Mu'Azu	Umaru Musa Yar'adua University Katsina, Nigeria
Amr Tolba	King Saud University, KSA
Amr Yassin	Ibb University, Yemen
Anton Satria Prabuwono	King Abdulaziz University, KSA
Arwa Aleryani	Independent Researcher, Canada
Auday Hashim	University of Mosul, Iraq
Saeed Al-Wattar	
Bakar Ba Qatyan	Universiti Utara Malaysia, Malaysia
Bander Al-Rimy	UNITAR, Malaysia
Bassam Al-Hameli	University Malaysia Pahang, Malaysia
Bouchaib Cherradi	Hassan II University, Morocco
Mohammed	Universiti Utara Malaysia, Malaysia
Gamal Alsamman	
Haitham Alali	Emirates College of Technology, UAE
Ehsan Othman	Ovgu Magdeburg, Germany
Eissa Alshari	Ibb University, Yemen
Fadhil Hujainah	University Malaysia Pahang, Malaysia
Faisal Saeed	Taibah University, KSA
Fathey Mohammed	Universiti Utara Malaysia, Malaysia
Fatma Al-Balushi	Independent Researcher, Oman
Feras Zen Alden	Universiti Utara Malaysia, Malaysia
Fuad Ghaleb	Universiti Teknologi Malaysia, Malaysia

Hamzah Alaidaros	Al-Ahgaff University, Yemen
Hanan Aldowah	Universiti Sains Malaysia, Malaysia
Hapini Bin Awang	Universiti Utara Malaysia, Malaysia
Hassan Silkan	Université Chouaib Doukkali, Morocco
Hesham Alghodhaifi	University of Michigan, USA
Hiba Zuhair	Al-Nahrain University, Iraq
Hussein Abualrejal	Universiti Utara Malaysia, Malaysia
Insaf Bellamine	Chouaib Doukkali University, Morocco
Insaf Bellamine	FSDM Fès, Morocco
Jawad Alkhateeb	Taibah University, KSA
Kamal Alhendawi	Al-Quds Open University, Palestine
Khairul Shafee, Kalid	Universiti Teknologi PETRONAS, Malaysia
Khaleel Bader Bataineh	Amman Arab University, Jordan
Khalili Tajeddine	Hassan II University of Casablanca, Morocco
Marwa Alhadi	Sana'a University, Yemen
Masud Hasan	Taibah University, KSA
Mohamad Ghozali Hassan	Universiti Utara Malaysia, Malaysia
Mohamed Abdel Fattah	Taibah University, KSA
Mohamed Elhamahmy	Egypt
Mohammed A. Al-Sharafi	University Malaysia Pahang, Malaysia
Mohammed Al-Mhiqani	Universiti Teknikal Malaysia Melaka, Malaysia
Mohammed Alsarem	Taibah University, KSA
Mohammed Azrag	University Malaysia Pahang, Malaysia
Mohammed Nahid	Hassan II University, Casablanca, Morocco
Mostafa Al-Emran	Buraimi University College, Oman
Motasem Al Smadi	Jordan University of Science and Technology, Jordan
Mustafa Ali Abuzaraida	Universiti Utara Malaysia, Malaysia
Mustafa Noori	Middle Technical University, Iraq
Nabil Al-Kumaim	Universiti Teknikal Malaysia Melaka, Malaysia
Nadhmi Gazem	Taibah University, KSA
Naseebah Maqtary	University of Science and Technology, Yemen
Nejood Hashim Al-Walidi	Cairo University, Egypt
Noor Akma	Universiti Malaysia Pahang, Malaysia
Omar Dakkak	UNIKA, Turkey
Omar Zahour	Hassan II University of Casablanca, Morocco
Osama Sayaydeh	University Malaysia Pahang, Malaysia
Qasim Alajmi	A' Sharqiyah University, Oman
Raed Aldhubhani	University of Hafr Al Batin, KSA
Ragheed Esmaeel	University of Mosul, Iraq
Rajesh Kaluri	Vellore Institute of Technology, India
Salah Abdelmageid	Taibah University, KSA
Salwa Belaqziz	Ibn Zohr University, Morocco
Samar Ghazal	Universiti Sains Malaysia, Malaysia
Samar Salem Ahmed	International Islamic University, Malaysia

Sharaf J. Malebary	King Abdulaziz University, KSA
Sinan Salih	Dijlah University College, Iraq
Soufiane Hamida	Hassan II University of Casablanca, Morocco
Susan Abdulameer	Universiti Utara Malaysia, Malaysia
Syifak Izhar Hisham	Universiti Malaysia Pahang, Malaysia
Tawfik Al-Hadhrami	Nottingham Trent University, UK
Waleed A. Hammood	Universiti Malaysia Pahang, Malaysia
Waleed Ali	King Abdulaziz University, KSA
Waleed Alomoush	Imam Abdulrahman bin Faisal University, KSA
Waseem Alromimah	Taibah University, KSA
Wasef Mater	University of Petra, Jordan
Yaqoub Sulaiman	King Abdulaziz University, KSA
Yousef Fazea	Universiti Utara Malaysia, Malaysia
Yousif Abdullah AlRashidi	Al Yamamah University, KSA
Yousif Aftan Abdullah	University of Baghdad, Iraq
Yousif Munadhil Ibrahim	Universiti Utara Malaysia, Malaysia
Zainab Senan	Universiti Utara Malaysia, Malaysia

Contents

Intelligent Health Informatics

Comparative Study of SMOTE and Bootstrapping Performance Based on Predication Methods	3
Abdulaziz Aborujilah, Rasheed Mohammad Nassr, Tawfik Al-Hadhrami, Mohd Nizam Husen, Nor Azlina Ali, Abdulaleem Al- Othmani, and Mustapha Hamdi	
UPLX: Blockchain Platform for Integrated Health Data Management	10
Omar Musa, Lim Shu Yun, and Reza Ismail	
Convolutional Neural Networks for Automatic Detection of Colon Adenocarcinoma Based on Histopathological Images	19
Yakooop Qasim, Habeb Al-Sameai, Osamah Ali, and Abdulelah Hassan	
Intelligent Health Informatics with Personalisation in Weather-Based Healthcare Using Machine Learning	29
Radiyah Haque, Sin-Ban Ho, Ian Chai, Chin-Wei Teoh, Adina Abdullah, Chuie-Hong Tan, and Khairi Shazwan Dollmat	
A CNN-Based Model for Early Melanoma Detection	41
Amer Sallam, Abdulfattah E. Ba Alawi, and Ahmed Y. A. Saeed	
SMARTS D4D Application Module for Dietary Adherence Self-monitoring Among Hemodialysis Patients	52
Hafzan Yusoff, Nur Intan Raihana Ruhaiyem, and Mohd Hakim Zakaria	
Improved Multi-label Medical Text Classification Using Features Cooperation	61
Rim Chaib, Nabihah Azizi, Nawel Zemmal, Didier Schwab, and Samir Brahim Belhaouari	

Image Modeling Through Augmented Reality for Skin Allergies Recognition	72
Nur Intan Raihana Ruhaiyem and Nur Amalina Mazlan	
Hybridisation of Optimised Support Vector Machine and Artificial Neural Network for Diabetic Retinopathy Classification	80
Nur Izzati Ab Kader, Umi Kalsom Yusof, and Maziani Sabudin	
A Habit-Change Support Web-Based System with Big Data Analytical Features for Hospitals (Doctive)	91
Cheryll Anne Augustine and Pantea Keikhosrokiani	
An Architecture for Intelligent Diagnosing Diabetic Types and Complications Based on Symptoms	102
Gunasekar Thangarasu, P. D. D. Dominic, and Kayalvizhi Subramanian	
An Advanced Encryption Cryptographically-Based Securing Applicative Protocols MQTT and CoAP to Optimize Medical-IOT Supervising Platforms	111
Sanaa El Aidi, Abderrahim Bajit, Anass Barodi, Habiba Chaoui, and Ahmed Tamtaoui	
Pulmonary Nodule Classification Based on Three Convolutional Neural Networks Models	122
Enoumayri Elhoussaine and Belaqziz Salwa	
A Comparative Study on Liver Tumor Detection Using CT Images	129
Abdulfattah E. Ba Alawi, Ahmed Y. A. Saeed, Borhan M. N. Radman, and Burhan T. Alzekri	
Brain Tumor Diagnosis System Based on RM Images: A Comparative Study	138
Ahmed Y. A. Saeed, Abdulfattah E. Ba Alawi, and Borhan M. N. Radman	
Diagnosis of COVID-19 Disease Using Convolutional Neural Network Models Based Transfer Learning	148
Hicham Moujahid, Bouchaib Cherradi, Mohammed Al-Sarem, and Lhoussain Bahatti	
Early Diagnosos of Parkinson’s Using Dimensionality Reduction Techniques	160
Tariq Saeed Mian	
Detection of Cardiovascular Disease Using Ensemble Machine Learning Techniques	176
Fizza Kashif and Umi Kalsom Yusof	

Health Information Management

**Hospital Information System for Motivating Patient Loyalty:
A Systematic Literature Review 189**

Saleh Nasser Rashid Alismaili, Mohana Shanmugam,
Hairol Adenan Kasim, and Pritheega Magalingam

Context Ontology for Smart Healthcare Systems 199

Salisu Garba, Radziah Mohamad, and Nor Azizah Saadon

**A Modified UTAUT Model for Hospital Information Systems
Geared Towards Motivating Patient Loyalty 207**

Saleh Nasser Rashid Alismaili, Mohana Shanmugam,
Hairol Adenan Kasim, and Pritheega Magalingam

**Teamwork Communication in Healthcare: An Instrument
(Questionnaire) Validation Process 217**

Wasef Matar and Monther Aldwair

**Potential Benefits of Social Media to Healthcare: A Systematic
Literature Review 230**

Ghada Ahmad Abdelguiom and Noorminshah A. Iahad

**Exploring the Influence of Human-Centered Design on User
Experience in Health Informatics Sector: A Systematic Review 242**

Lina Fatini Azmi and Norasnita Ahmad

**An Emotional-Persuasive Habit-Change Support Mobile
Application for Heart Disease Patients (BeHabit) 252**

Bhavani Devi Ravichandran and Pantea Keikhosrokiani

**A Systematic Review of the Integration of Motivational
and Behavioural Theories in Game-Based Health Interventions. 263**

Abdulsalam S. Mustafa, Nor’ashikin Ali, and Jaspaljeet Singh Dhillon

**Adopting React Personal Health Record (PHR) System in Yemen
HealthCare Institutions 279**

Ziad Saif Alrobieh, Dhaiaa Faisal Alshamy, and Maged Nasser

Artificial Intelligence and Soft Computing

**Application of Shuffled Frog-Leaping Algorithm for Optimal
Software Project Scheduling and Staffing 293**

Ahmed O. Ameen, Hamed A. Mojeed, Abdulazeez T. Bolariwa,
Abdullateef O. Balogun, Modinat A. Mabayoje,
Fatima E. Usman-Hamzah, and Muyideen Abdulraheem

**A Long Short Term Memory and a Discrete Wavelet Transform
to Predict the Stock Price 304**

Mu’tasem Jarrah and Naomie Salim

Effective Web Service Classification Using a Hybrid of Ontology Generation and Machine Learning Algorithm 314
Murtoza Monzur, Radziah Mohamad, and Nor Azizah Saadon

Binary Cuckoo Optimisation Algorithm and Information Theory for Filter-Based Feature Selection 324
Ali Muhammad Usman, Umi Kalsom Yusof, and Syibrah Naim

Optimized Text Classification Using Correlated Based Improved Genetic Algorithm 339
Thabit Sabbah

Multi-objective NPO Minimizing the Total Cost and CO₂ Emissions for a Stand-Alone Hybrid Energy System 351
Abbas Q. Mohammed, Kassim A. Al-Anbarri, and Rafid M. Hannun

A Real Time Flood Detection System Based on Machine Learning Algorithms 364
Abdirahman Osman Hashi, Abdullahi Ahmed Abdirahman, Mohamed Abdirahman Elmi, and Siti Zaiton Mohd Hashim

Extracting Semantic Concepts and Relations from Scientific Publications by Using Deep Learning 374
Fatima N. AL-Aswadi, Huah Yong Chan, and Keng Hoon Gan

Effectiveness of Convolutional Neural Network Models in Classifying Agricultural Threats 384
Sayem Rahman, Murtoza Monzur, and Nor Bahiah Ahmad

A Study on Emotion Identification from Music Lyrics 396
Affreen Ara and Raju Gopalakrishna

A Deep Neural Network Model with Multihop Self-attention Mechanism for Topic Segmentation of Texts 407
Fayçal Nouar and Hacene Belhadef

Data Science and Big Data Analytics

Big Data Interoperability Framework for Malaysian Public Open Data 421
Najhan Muhamad Ibrahim, Amir Aatieff Amir Hussin, Khairul Azmi Hassan, and Ciara Breathnach

The Digital Resources Objects Retrieval: Concepts and Figures 430
Wafa' Za'al Alma'aitah, Abdullah Zawawi Talib, and Mohd Azam Osman

A Review of Graph-Based Extractive Text Summarization Models 439
Abdulkadir Abubakar Bichi, Ruhaidah Samsudin, Rohayanti Hassan, and Khalil Almekhlafi

Review on Emotion Recognition Using EEG Signals Based on Brain-Computer Interface System 449
 Mona Algarni and Faisal Saeed

A New Multi-resource Deadlock Detection Algorithm Using Directed Graph Requests in Distributed Database Systems 462
 Khalid Al-Hussaini, Nabeel A. Al-Amdi, and Fuaad Hasan Abdulrazzak

Big Data Analytics Model for Preventing the Spread of COVID-19 During Hajj Using the Proposed Smart Hajj Application 475
 Ibtehal Nafea

Financial Time Series Forecasting Using Prophet 485
 Umi Kalsom Yusof, Mohd Nor Akmal Khalid, Abir Hussain, and Haziqah Shamsudin

Facial Recognition to Identify Emotions: An Application of Deep Learning 496
 Kenza Belhouchette

Text-Based Analysis to Detect Figure Plagiarism 505
 Taiseer Abdalla Elfadil Eisa, Naomie Salim, and Salha Alzahrani

A Virtual Exploration of al-Masjid al-Nabawi Using Leap Motion Controller 514
 Slim Kammoun and Hamza Ghandorh

Comparison of Data Analytic Techniques for a Spatial Opinion Mining in Literary Works: A Review Paper 523
 Sea Yun Ying, Pantea Keikhosrokiani, and Moussa Pourya Asl

Open Data in Prediction Using Machine Learning: A Systematic Review 536
 Norismiza Ismail and Umi Kalsom Yusof

Big Data Analytics Based Model for Red Chili Agriculture in Indonesia 554
 Junita Juwita Siregar and Arif Imam Suroso

A Fusion-Based Feature Selection Framework for Microarray Data Classification 565
 Talal Almutiri, Faisal Saeed, Manar Alassaf, and Essa Abdullah Hezzam

An Approach Based Natural Language Processing for DNA Sequences Encoding Using the Global Vectors for Word Representation 577
 Brahim Matougui, Hacene Belhadef, and Ilham Kitouni

Short-Term CO₂ Emissions Forecasting Using Multi-variable Grey Model and Artificial Bee Colony (ABC) Algorithm Approach 586
 Ani Shabri, Ruhaidah Samsudin, and Essa Abdullah Hezzam

IoT and Intelligent Communication Systems

A Reliable Single Prediction Data Reduction Approach for WSNs Based on Kalman Filter 601
 Zaid Yemeni, Haibin Wang, Waleed M. Ismael, Younis Ibrahim, and Peng Li

A Real-Time Groundwater Level Monitoring System Based on WSN, Taiz, Yemen 612
 Asma’a K. Akershi, Ziad S. Arobieh, and Reayidh A. Ahmed

Design and Simulation of Multiband Circular Microstrip Patch Antenna with CSRR for WLAN and WiMAX Applications. 623
 Abdulguddoos S. A. Gaid, Amer A. Sallam, Mohamed H. M. Qasem, Maged S. G. Abbas, and Amjad M. H. Aoun

Reference Architectures for the IoT: A Survey 635
 Raghdah Saemaldahr, Bijayita Thapa, Kristopher Maikoo, and Eduardo B. Fernandez

A Circular Multiband Microstrip Patch Antenna with DGS for WLAN/WiMAX/Bluetooth/UMTS/LTE 647
 Abdulguddoos S. A. Gaid, Amer A. Sallam, Mohamed H. M. Qasem, Maged S. G. Abbas, and Amjad M. H. Aoun

Anomaly Intrusion Detection Systems in IoT Using Deep Learning Techniques: A Survey 659
 Muaadh. A. Alsoufi, Shukor Razak, Maheyzah Md Siraj, Abdulalem Ali, Maged Nasser, and Salah Abdo

Security and Threats in the Internet of Things Based Smart Home 676
 Nor Fatimah Awang, Ahmad Fudhail Iyad Mohd Zainudin, Syahaneim Marzuki, Syed Nasir Alsagoff, Taniza Tajuddin, and Ahmad Dahari Jarno

Simulation and Control of Industrial Composition Process Over Wired and Wireless Networks 685
 Hakim Qaid Abdullah Abdulrab, Fawnizu Azmadi Hussin, Panneer Selvam Arun, Azlan Awang, and Idris Ismail

Performance Degradation of Multi-class Classification Model Due to Continuous Evolving Data Streams 696
 Abdul Sattar Palli, Jafreezal Jaafar, and Manzoor Ahmed Hashmani

Compact Wide-Bandwidth Microstrip Antenna for Millimeter Wave Applications 707
 Osaid Abdulrahman Saeed, Moheeb Ali Ameer, and Mansour Noman Ghaleb

Dual-Band Rectangular Microstrip Patch Antenna with CSRR for 28/38 GHz Bands Applications 717
 Abdulguddoos S. A. Gaid, Mohamed H. M. Qasem, Amer A. Sallam, and Ebrahim Q. M. Shayea

Dual Band Rectangular Microstrip Patch Antenna for 5G Millimeter-Wave Wireless Access and Backhaul Applications 728
 Abdulguddoos S. A. Gaid, Amer A. Sallam, Amjad M. H. Aoun, Ahmed A. A. Saeed, and Osama Y. A. Saeed

Design of Wireless Local Multimedia Communication Network (WLMmCN) Based on Android Application Without Internet Connection 739
 R. Q. Shaddad, F. A. Alqasemi, S. A. Alfaqih, M. F. Alsabahi, A. T. Fara, K. M. Nejad, and E. A. Albukhaiti

A Statistical Channel Propagation Analysis for 5G mmWave at 73 GHz in Urban Microcell 748
 Zaid Ahmed Shamsan

Advances in Information Security

Robot Networks and Their Impact on Cyber Security and Protection from Attacks: A Review 759
 Daniah Anwar Hasan and Linah Faisal Tasji

An Efficient Fog-Based Attack Detection Using Ensemble of MOA-WMA for Internet of Medical Things 774
 Shilan S. Hameed, Wan Haslina Hassan, and Liza Abdul Latiff

A New DNA Based Encryption Algorithm for Internet of Things 786
 Bassam Al-Shargabi and Mohammed Abbas Fadhil Al-Husainy

Watermarking Techniques for Mobile Application: A Review 796
 Aqilah Abd. Ghani, Syifak Izhar Hisham, Nur Alya Afikah Usop, and Nor Bakiah Abd Warif

Analysis and Evaluation of Template Based Methods Against Geometric Attacks: A Survey 807
 Tanya Koohpayeh Araghi, Ala Abdulsalam Alarood, and Sagheb Kohpayeh Araghi

Survey of File Carving Techniques 815
 Nor Ika Shahirah Ramli, Syifak Izhar Hisham, and Mohd Faizal Abd Razak

Affecting Factors in Information Security Policy Compliance: Combine Organisational Factors and User Habits	826
Angraini, Rose Alinda Alias, and Okfalisa	
Mitigation of Data Security Threats in Iraqi Dam Management Systems: A Case Study of Fallujah Dam Management System.	837
Hussam J. Ali, Hiba Zuhair, and Talib M. Jawad	
Advances in Information Systems	
Development and Validation of a Classified Information Assurance Scale for Institutions of Higher Learning	857
Bello Ahmadu, Ab Razak Che Hussin, and Mahadi Bahari	
Sustainable e-Learning Framework: Expert Views	869
Aidrina Binti Mohamed Sofiadin	
Derivation of a Customer Loyalty Factors Based on Customers' Changing Habits in E-Commerce Platform	879
Mira Afrina, Samsuryadi, Ab Razak Che Hussin, and Suraya Miskon	
Analysis of Multimedia Elements Criteria Using AHP Method	891
Nadiyah Mohamad Sofian, Ahmad Sobri Hashim, and Aliza Sarlan	
The Development of a Criteria-Based Group Formation Systems for Student Group Work	903
Divya Gopal Mohan and Khairul Shafee Kalid	
Trusted Factors of Social Commerce Product Review Video	911
Humaira Hairudin, Halina Mohamed Dahlan, and Ahmad Fadhil Yusof	
Building Information Modelling Adoption: Systematic Literature Review.	920
Hafiz Muhammad Faisal Shehzad, Roliana Binti Ibrahim, Ahmad Fadhil Yusof, Khairul Anwar Mohamed Khaidzir, Omayma Husain Abbas Hassan, and Samah Abdelsalam Abdalla	
Adoption of Smart Cities Models in Developing Countries: Focusing in Strategy and Design in Sudan	933
Mohammed S. Adrees, Abdelrahman E. Karrar, and Waleed I. Osman	
Factors Affecting Customer Acceptance of Online Shopping Platforms in Malaysia: Conceptual Model and Preliminary Results.	945
Nabil Hasan Al-kumaim, Gan Wong Sow, and Fathey Mohammed	
Student Compliance Intention Model for Continued Usage of E-Learning in University	960
Ken Ditha Tania, Norris Syed Abdullah, Norasnita Ahmad, and Samsuryadi Sahmin	

Digital Information and Communication Overload Among Youths in Malaysia: A Preliminary Review 975
 Mohamad Ghozali Hassan, Muslim Diekola Akanmu, Hussein Mohammed Esmail Abualrejal, and Amal Abdulwahab Hasan Alamrani

The Effect of Using Social Networking Sites on Undergraduate Students’ Perception and Academic Performance at University of Taiz-Yemen 987
 Maged Rfeqallah, Rozilah Kasim, Faisal A. M. Ali, and Yahya Abdul Ghaffar

Building Information Modelling Adoption Model for Malaysian Architecture, Engineering and Construction Industry 999
 Hafiz Muhammad Faisal Shehzad, Roliana Binti Ibrahim, Ahmad Fadhil Yusof, Khairul Anwar Mohamed Khaidzir, Muhammad Mahboob Khurshid, and Farah Zeehan Othman

Digital Government Competency for Omani Public Sector Managers: A Conceptual Framework 1009
 Juma Al-Mahrezi, Nur Azaliah Abu Bakar, and Nilam Nur Amir Sjarif

Computational Vision and Robotics

Landmark Localization in Occluded Faces Using Deep Learning Approach 1023
 Zieb Rabie Alqahtani, Mohd Shahrizal Sunar, and Abdulaziz A. Alashbi

Contrast Image Quality Assessment Algorithm Based on Probability Density Functions Features 1030
 Ismail Taha Ahmed, Soong Der Chen, Norziana Jamil, and Baraa Tareq Hammad

The Impact of Data Augmentation on Accuracy of COVID-19 Detection Based on X-ray Images 1041
 Yakoop Qasim, Basheer Ahmed, Tawfeek Alhadad, Habeb Al-Sameai, and Osamah Ali

A Fusion Schema of Hand-Crafted Feature and Feature Learning for Kinship Verification 1050
 Mohammed Ali Almuashi, Siti Zaiton Mohd Hashim, Nooraini Yusoff, and Khairul Nizar Syazwan

Lossless Audio Steganographic Method Using Companding Technique 1064
 Ansam Osamah Abdulmajeed

Smart Traffic Light System Design Based on Single Shot MultiBox Detector (SSD) and Anylogic Simulation 1075
 E. R. Salim, A. B. Pantjawati, D. Kuswardhana, A. Saripudin,
 N. D. Jayanto, Nurhidayatulloh, and L. A. Pratama

Learning Scope of Python Coding Using Immersive Virtual Reality 1086
 Abdulrazak Yahya Saleh, Goh Suk Chin, Roselind Tei,
 Mohd Kamal Othman, Fitri Suraya Mohamad, and Chwen Jen Chen

Automatic Audio Replacement of Objectionable Content for Sri Lankan Locale 1101
 Gobiga Rajalingam, Janarthan Jeyachandran, M. S. M. Siriwardane,
 Tharshvini Pathmaseelan, R. K. N. D. Jayawardhane, and N. S. Weerakoon

A Comparison of CNN and Conventional Descriptors for Word Spotting Approach: Application to Handwritten Document Image Retrieval 1115
 Ryma Benabdelaiz, Djamel Gaceb, and Mohammed Haddad

Handwritten Arabic Character Recognition: Comparison of Conventional Machine Learning and Deep Learning Approaches 1127
 Faouci Soumia, Gaceb Djamel, and Mohammed Haddad

Document Image Edge Detection Based on a Local Hysteresis Thresholding and Automatic Setting Using PSO 1139
 Mohamed Benkhattou, Nibel Nadjeh, and Djamel Gaceb

Fast I2SDBSCAN Based on Integral Volume of 3D Histogram: Application to Color Layer Separation in Document Images 1151
 Zakia Kezzoula and Djamel Gaceb

Enhancing Daily Life Skills Learning for Children with ASD Through Augmented Reality 1164
 Rahma Bouaziz, Maimounah Alhejaili, Raneem Al-Saedi, Abrar Mihdhar,
 and Jawaher Alsarrani

Recent Computing and Software Engineering

SpaceScience App: Development of a Mobile Application for School Children 1177
 Wan Fatimah Wan Ahmad and Ain Fatihah Ahmad Harnaini

Research on Online Problem-Based Learning Among Undergraduate Students: A Systematic Review 1187
 Amira Saif and Irfan Umar

Derivation of Factors in Dealing Negative E-WOM for Maintaining Online Reputation 1198
Rizka Dhini Kurnia, Halina Mohamed Dahlan, and Samsuryadi

A Terms Interrelationship Approach to Query Expansion Based on Terms Selection 1209
Nuhu Yusuf, Mohd Amin Mohd Yunus, Norfaradilla Wahid, Mohd Najib Mohd Salleh, and Aida Mustapha

Multi-domain Business Intelligence Model for Educational Enterprise Resource Planning Systems 1218
Hisham Abdullah, Azman Taa, and Fathey Mohammed

Measuring Risk Mitigation Techniques in Agile Global Software Development 1225
Adila Firdaus Arbain, Muhammad Akil Rafeek, Zuriyaninatasa Podari, and Cik Feresa Mohd Foozy

Risk Mitigation Framework for Agile Global Software Development 1233
Zuriyaninatasa Podari, Adila Firdaus Arbain, Noraini Ibrahim, and Endah Sudarmilah

Re-verification of the Improved Software Project Monitoring Task Model of the Agile Kanban (i-KAM) 1247
Hamzah Alaidaros, Mazni Omar, Rohaida Romli, and Adnan Hussein

Author Index 1259

Watermarking techniques for mobile application: A review

Aqilah Abd. Ghani^a, Syifak Izhar Hisham^a, Nur Alya Afikah Usop^a & Nor Bakiah Abd Warif^b

^a Faculty of Computing, College of Computing and Applied Sciences, University Malaysia Pahang, Pekan, Pahang, 26600, Malaysia

^b Faculty of Computer Science and Information Technology, Universiti Tun Hussien Onn Malaysia, Parit Raja, Johor, 86400, Malaysia

ABSTRACT

This paper reviewed mobile applications schemes for image watermarking techniques used to secure user media files. Due to the increase in number of smartphones and Internet usage especially in today's life, cybercrime rate seems to be increasing too. Thus, an efficient and suitable watermarking scheme for mobile devices needs to be studied and developed. Digital watermarking is an example of a data hiding technique used by researchers. From the analysis, almost all schemes implement Android Operating System for different techniques and media file types. This paper provides an overview and comparison of various mobile applications for image watermarking techniques.

KEYWORDS

Data hiding; Mobile application; Review; Security; Watermarking

ACKNOWLEDGEMENTS

This research works is supported by a RACER grant entitled 'A New Embedding Algorithm using Hilbert-Peano Pattern in Enhancing Authentication Systems for Textual Documents' (RDU192623) RACER/1/2019/ICT04/UMP//2 supported by Ministry of Higher Education, and PGRS200369 supported by Universiti Malaysia Pahang.