Communications in Computer and Information Science 1431

Editorial Board Members

Joaquim Filipe
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

Juan Carlos Figueroa-García ·
Yesid Díaz-Gutierrez ·
Elvis Eduardo Gaona-García ·
Alvaro David Orjuela-Cañón (Eds.)

Applied Computer Sciences in Engineering

8th Workshop on Engineering Applications, WEA 2021
Medellín, Colombia, October 6–8, 2021
Proceedings

Springer

Editors
Juan Carlos Figueroa-García
Universidad Distrital Francisco José de Caldas
Bogotá, Colombia

Elvis Eduardo Gaona-García
Universidad Distrital Francisco José de Caldas
Bogotá, Colombia

Yesid Díaz-Gutierrez
Universidad Santo Tomás de Aquino
Bogotá, Colombia

Alvaro David Orjuela-Cañón
Universidad del Rosario
Bogotá, Colombia

ISSN 1865-0929 ISSN 1865-0937 (electronic)
Communications in Computer and Information Science
ISBN 978-3-030-86701-0 ISBN 978-3-030-86702-7 (eBook)
https://doi.org/10.1007/978-3-030-86702-7

© Springer Nature Switzerland AG 2021
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 Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The eighth edition of the Workshop on Engineering Applications (WEA 2021) was focused on applications in computer science, computational intelligence, IoT, bioengineering, optimization, and simulation. WEA 2021 was one of the flagship events of the Faculty of Engineering of the Universidad Distrital Francisco José de Caldas and the Informatics Engineering program of the Universidad Santo Tomás de Aquino, Colombia.

WEA 2021 was held in hybrid mode due to the COVID-19 pandemic which has changed how conferences are organized. We received 127 submissions from authors in thirteen countries on diverse topics such as computer science, computational intelligence, IoT/networks, bioengineering, operations research/optimization, and simulation systems, among others. The peer review process of all submissions was rigorous, with all reviewers providing constructive comments, and as a result of their work 44 papers were accepted for oral presentation at WEA 2021. The Program Committee organized the papers into different sections to aid the presentation and increase the impact of this volume, published in Springer's Communications in Computer and Information Sciences (CCIS) series, whose main area is Applied Computer Sciences in Engineering.

The Faculty of Engineering of the Universidad Distrital Francisco José de Caldas and the Universidad Santo Tomás de Aquino made significant efforts to guarantee the success of the conference considering that 2021 was the second consecutive year of the COVID-19 pandemic and its global effects.

We would like to thank all members of the Program Committee and the reviewers for their commitment to help in the review process and for spreading our call for papers which was a hard task due to COVID-19. We would like to thank Alfred Hofmann and Jorge Nakahara from Springer for their helpful advice, guidance, and continuous support in publicizing the proceedings. Moreover, we would like to thank all the authors for supporting WEA 2021 as without all their high-quality submissions the conference would not have been possible. Finally, we are especially grateful to the IEEE Universidad Distrital Francisco José de Caldas Student branch, the Laboratory for Automation and Computational Intelligence (LAMIC) and GITUD research groups of the Universidad Distrital Francisco José de Caldas, and the GRINTIC research group of the Informatics Engineering program of the Universidad Santo Tomás de Aquino.

October 2021

Juan Carlos Figueroa-García
Yesid Díaz-Gutierrez
Alvaro David Orjuela-Cañón
Elvis Eduardo Gaona-García

Organization

General Chair

Juan Carlos Figueroa-García	Universidad Distrital Francisco José de Caldas, Colombia

Finance Chair/Treasurer

Julio Barón	Universidad Distrital Francisco José de Caldas, Colombia

Technical Chairs

Crisman Martinez	Universidad Santo Tomás de Aquino, Colombia
Alexandra Silva	Universidad Santo Tomás de Aquino, Colombia

Logistic Chairs

Fernando Antonio Güiza-Jerez	Universidad Santo Tomás de Aquino, Colombia
Yesid Díaz-Gutierrez	Corporación Unificada Nacional de Educación Superior, Colombia

Publication Chair

Germán Hernández-Pérez	Universidad Nacional de Colombia, Colombia

Program Chairs

Yesid Díaz-Gutierrez	Corporación Unificada Nacional de Educación Superior (CUN), Colombia
Lindsay Alvarez	Universidad Distrital Francisco José de Caldas, Colombia
Elvis Eduardo Gaona-García	Universidad Distrital Francisco José de Caldas, Colombia
Alvaro David Orjuela-Cañon	Universidad del Rosario, Colombia

Plenary Speakers

Ana Paula Barbosa-Póvoa	Universidade de Lisboa, Portugal
Antonio Plaza	University of Extremadura (UEX), Spain
Agapito Ledezma Espino	Carlos III University of Madrid, Spain
Roman Neruda	Charles University and Czech Academy of Sciences, Czech Republic

Program Committee

Adil Usman	Indian Institute of Technology, Mandi, India
Alexandra Silva	Universidad Santo Tomás de Aquino, Colombia
Adolfo Jaramillo-Matta	Universidad Distrital Francisco José de Caldas, Colombia
Alvaro David Orjuela-Cañon	Universidad del Rosario, Colombia
Andrés Ernesto Salguero	Universidad Antonio Nariño, Colombia
Andres Gaona	Universidad Distrital Francisco José de Caldas, Colombia
Carlos Franco-Franco	Universidad del Rosario, Colombia
Carlos Osorio-Ramírez	Universidad Nacional de Colombia, Colombia
Crisman Martinez	Universidad Santo Tomás de Aquino, Colombia
DeShuang Huang	Tongji University, China
Diana Ovalle	Universidad Distrital Francisco José de Caldas, Colombia
Eduyn López-Santana	Universidad Distrital Francisco Jose de Caldas, Colombia
Elvis Eduardo Gaona-García	Universidad Distrital Francisco José de Caldas, Colombia
Fabián Garay	ESINF, Colombia
Feizar Javier Rueda-Velazco	Universidad Distrital Francisco José de Caldas, Colombia
Fernando Antonio Güiza-Jerez	Universidad Santo Tomás de Aquino, Colombia
Francisco Ramis	Universidad del Bío-Bío, Chile
Germán Hernández-Pérez	Universidad Nacional de Colombia, Colombia
Gloria Jeanette Rincón	Universidad Cooperativa de Colombia, Colombia
Guadalupe González	Universidad Tecnológica de Panamá, Panama
Gustavo Puerto-Leguizamón	Universidad Distrital Francisco José de Caldas, Colombia
Gustavo Suárez	Universidad Pontificia Bolivariana, Colombia
Heriberto Román-Flores	Universidad de Tarapacá, Chile
I-Hsien Ting	National University of Kaohsiung, Taiwan
Jair Cervantes-Canales	Universidad Autónoma de México, Mexico
Jairo Soriano-Mendez	Universidad Distrital Francisco José de Caldas, Colombia
Javier Arturo Orjuela-Castro	Universidad Distrital Francisco José de Caldas, Colombia

J. J. Merelo	Universidad de Granada, Spain
Jose Luís Gonzalez-Velarde	Instituto Tecnológico de Monterrey, Mexico
José Luis Jiménez-Useche	National Colombian Army, Colombia
Jose Luis Villa	Universidad Tecnológica de Bolívar, Colombia
Juan Carlos Figueroa-García	Universidad Distrital Francisco José de Caldas, Colombia
Lindsay Alvarez	Universidad Distrital Francisco José de Caldas, Colombia
Mabel Frías	Universidad de las Villas "Marta Abreu", Cuba
Mario Enrique Duarte-Gonzalez	Universidad Antonio Nariño, Colombia
Martin Pilat	Charles University in Prague, Czech Republic
Martine Ceberio	University of Texas at El Paso, USA
Miguel Melgarejo	Universidad Distrital Francisco José de Caldas, Colombia
Nelson L. Diaz Aldana	Universidad Distrital Francisco José de Caldas, Colombia
Oswaldo Lopez Santos	Universidad de Ibagué, Colombia
Paulo Alonso Gaona	Universidad Distrital Francisco José de Caldas, Colombia
Rafael Bello-Pérez	Universidad de las Villas "Marta Abreu", Cuba
Roberto Ferro	Universidad Distrital Francisco José de Caldas, Colombia
Rodrigo Linfati	Universidad del Bío Bío, Chile
Roman Neruda	Charles University in Prague and Czech Academy of Sciences, Czech Republic
Sebastián Jaramillo-Isaza	Universidad Antonio Nariño, Colombia
Sergio Rojas-Galeano	Universidad Distrital Francisco José de Caldas, Colombia
Vladik Kreinovich	University of Texas at El Paso, USA
Yesid Díaz-Gutierrez	Universidad Santo Tomás de Aquino, Colombia
Yurilev Chalco-Cano	Universidad de Tarapacá, Chile

Contents

Computational Intelligence

Can Communication Topology Improve a Multi-swarm PSO Algorithms? 3
José Guzmán, Mario García-Valdez, and Juan J. Merelo-Guervós

Solving Dynamical Systems Using Windows of Sliding Subproblems 13
Angel Fernando Garcia Contreras and Martine Ceberio

Landslide Susceptibility Model by Means of Remote Sensing Images and AutoML 25
Diego Renza, Elsa Adriana Cárdenas, Carlos Marcelo Jaramillo, Serena Sarah Weber, and Estibaliz Martinez

Fake Speech Recognition Using Deep Learning 38
Steven Camacho, Dora Maria Ballesteros, and Diego Renza

Automatic Classification of Energy Consumption Profiles in Processes of the Oil & Gas Industry in Colombia 49
Bryan Escobar-Restrepo, Juan Felipe Botero Vega, and Juan Rafael Orozco-Arroyave

Organizational Online Reputation Measurement Through Natural Language Processing and Sentiment Analysis Techniques 60
Christian Orrego, Luisa Fernanda Villa, Lina Maria Sepúlveda-Cano, and Lillyana M. Giraldo M.

Robust Automatic Speech Recognition for Call Center Applications 72
Luis Felipe Parra-Gallego, Tomás Arias-Vergara, and Juan Rafael Orozco Arroyave

Dynamic Recognition and Classification of Trajectories in SLRecon Adopted Artificial Intelligence in Kinect 84
Tomas S. Gavilanez, Edgar A. Gómez, Eduardo Estevez, and Saravana Prakash Thirumuruganandham

Heterogeneous Acoustic Features Space for Automatic Classification of Drone Audio Signals 97
Andrés Felipe Sabogal, Manuel Gómez, and Juan P. Ugarte

Career Recommendation System for Validation of Multiple Intelligence to High School Students 110
Maryori Sabalza Mejia, Carolina Campillo Jimenez, and Juan Carlos Martínez-Santos

Evaluation of Different Word Embeddings to Create Personality Models in Spanish 121
Felipe Orlando López-Pabón and Juan Rafael Orozco-Arroyave

Power Conditioner for AC PV Systems Using GA 133
Luis David Pabon Fernandez, Edison Andres Caicedo Peñaranda, and Jorge Luis Diaz Rodriguez

Bioengineering

Multivariate Analysis of Adaptation Level in Low-Cost Lower Limb Prostheses: An Unsupervised Learning Approach 147
Gabriel Maldonado Colmenares and Jenny Kateryne Nieto Aristizabal

Carbon Monoxide Effect on Human Cardiac Tissue. In Silico Study 160
Catalina Tobón, Geraldine Durango-Giraldo, and Juan Pablo Ugarte

Gender Recognition in Informal and Formal Language Scenarios via Transfer Learning 171
Daniel Escobar-Grisales, Juan Camilo Vásquez-Correa, and Juan Rafael Orozco-Arroyave

Towards Event-Trigger Impulsive MPC for the Treatment of T1DM Handling Limited Resources 180
Jhon E. Goez-Mora, Monica Ayde Vallejo, and Pablo S. Rivadeneira

Automation of Study Design Classification and Clinical Evidence Ranking for Health Technology Assessment of Medical Devices 190
Mabel Catalina Zapata, Juan Guillermo Barreneche, and Jenny Kateryne Nieto Aristizabal

Online System Based on Microservices for Rapid Diagnostic of Pathogenic Bacteria in Seafood from Biogenic Amines Biosensors 202
Juan M. Álvarez Q., José I. García M., and John A. Sanabria O.

Estimation of Limbs Angles Amplitudes During the Use of the Five Minute Shaper Device Using Artificial Neural Networks 213
Cristian Felipe Blanco-Diaz, Cristian David Guerrero-Mendez, Mario Enrique Duarte-González, and Sebastián Jaramillo-Isaza

SSCF-Hyperthermia Study in MCF-7 Spheroids – In Silicio 225
Hector Fabian Guarnizo-Mendez, Angela Victoria Fonseca Benítez, Sandra Janneth Perdomo Lara, Sandra Johanna Morantes Medina, Cristian Andrés Triana Infante, Christian Camilo Cano Vásquez, Juan David Jaiquel Villamil, and Sebastian Mesa Zafra

Internet of Things (IoT)

Smart UTB: An IoT Platform for Smart Campus 239
Leonardo Castellanos Acuña, Ray Narváez, Carlos Salas, Luz Alejandra Magre, and María José González

Development of a Short-Range Continuous Wave Radar Prototype Kit as a Learning Tool for Theoretical and Practical Technical Training 250
Felipe Silva Gómez, Tomás Francisco Guzmán, and Yolanda Parra Guacaneme

An Hybrid CPU-GPU Parallel Multi-tracking Framework for Long-Term Video Sequences 263
Juan P. D'amato, Leonardo Dominguez, Franco Stramana, Aldo Rubiales, and Alejandro Perez

Implementation of End User Radio Key Performance Indicators Using Signaling Trace Data Analysis for Cellular Networks 275
Hector Daniel Bernal Amaya, Elvis Eduardo Gaona Garcia, and Julian Camargo

Approach Pencil-on-Paper to Flexible Piezoresistive Respiration Sensor 290
Luiz Antonio Rasia, Carlos Eduardo Andrades, Thiago Gomes Heck, and Julia Rasia

Maintenance Management of an Additive Manufacturing System Based on the I4.0 Model 299
Juan David Contreras, Jose Isidro Garcia, and Julian Gomez

Optimization and Operations Research

A Mixed-Integer Linear Programming Model for the Cutting Stock Problem in the Steel Industry 315
Daniel Morillo-Torres, Mauricio Torres Baena, John Wilmer Escobar, Alfonso R. Romero-Conrado, Jairo R. Coronado-Hernández, and Gustavo Gatica

Metaheuristics with Local Search Miscellany Applied to the Quadratic Assignment Problem for Large-Scale Instances 327
Rogelio González-Velázquez, Erika Granillo-Martínez, María Beatriz Bernábe-Loranca, and Jairo E. Powell-González

Linear Programming Model for Production Cost Minimization at a Rice Crop Products Manufacturer 335
Jairo R. Coronado-Hernández, Leonardo J. Olarte-Jiménez, Zulmeira Herrera-Fontalvo, and Johana Cómbita Niño

Comparison Between Amazon Go Stores and Traditional Retails Based on Queueing Theory 347
Jairo R. Coronado-Hernandez, Andrés F. Calderón-Ochoa, Ivan Portnoy, and Jorge Morales-Mercado

Analysis of Traceability Systems for Reducing the Bullwhip Effect in the Perishable Food Supply Chain: A System Dynamics Approach 362
Jeysser Johan Otero-Diaz, Javier Arturo Orjuela-Castro, and Milton M. Herrera

Exploring Efficiency and Accessibility in Healthcare Network Design 374
Edgar Duarte-Forero and Gustavo Alfredo Bula

Scenario-Based Model for the Location of Multiple Uncapacitated Facilities: Case Study in an Agro-Food Supply Chain 386
Gean Pablo Mendoza-Ortega, Manuel Soto, José Ruiz-Meza, Rodrigo Salgado, and Angelica Torregroza

Application of the CERT Values Measurement Model for Organizational Culture in the Management and Quality Company 399
Claudia Yadira Rodríguez-Ríos, Abigail Calderón Narváez, and Santiago Cárdenas Jiménez

Engineering Applications

Methodology for the Implementation of Kalman Filters on Real Applications 411
Juan David Núñez, Mónica Aydé Vallejo, and Héctor Botero

Agro-Smart Caribe: Soil Moisture Measurement System 422
Eduardo Gomez, Jorge Eliecer Duque, Alvaro José Rojas, Cristian Camilo Jaik, and Jose Angel Pertuz

Entrepreneurial Intention in Vocational Technical Schools in Emerging Economies: A Case Study of Barranquilla, Colombia 435
David Ovallos-Gazabon, Nataly Puello-Pereira, Kevin Parra-Negrete, and Karol Martinez-Cueto

Improvement of Visual Perception in Humanoid Robots Using Heterogeneous Architectures for Autonomous Applications 447
Joaquin Guajo, Cristian Alzate Anzola, Daniel Betancur, Luis Castaño-Londoño, and David Marquez-Viloria

Computational Design of a Road Safety Model Elaborated in Epoxy Material Reinforced with Glass Fibers and SiO2 Addition 459
M. Echeverri Peláez, G. Suárez Guerrero, J. Cruz Riaño, H. Kerguelen Grajales, and E. Vallejo Morales

Modeling, Analysis and Simulation of Curved Solar Cell's Encapsulation Reinforcement 468
Gabriel Espitia-Mesa, Efraín Hernández-Pedraza, Santiago Molina-Tamayo, and Ricardo Mejía-Gutiérrez

Variable-Prioritizing and Instrumentation for Monitoring of an Electrically-Powered Fluvial Vessel Through a FDM Approach 480
Felipe Mendoza, Camilo Vélez, Santiago Echavarría, Alejandro Montoya, Tatiana Manrique, and Ricardo Mejía-Gutiérrez

A Framework for Multispectral Instance Classification Using Examples 493
Camilo Peláez-García, Víctor-Alejandro Patiño-Martínez, Juan-Bernardo Gómez-Mendoza, and Manuel-Alejandro Tamayo-Monsalve

Advanced Engineering Control Strategies Applied to Occupational Noise Management in Mining Dump Trucks 505
Diego Mauricio Murillo Gómez, Enney González León, Hugo Piedrahíta, Jairo Yate, and Camilo E. Gómez Cristancho

Prerequisite Relationships of the OntoMath^{Edu} Educational Mathematical Ontology 517
Alexander Kirillovich, Marina Falileeva, Olga Nevzorova, Evgeny Lipachev, Anastasiya Dyupina, and Liliana Shakirova

Author Index 525