

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA


Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen 

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA


More information about this subseries at <http://www.springer.com/series/7409>

Madhusudan Singh · Dae-Ki Kang ·
Jong-Ha Lee · Uma Shanker Tiwary ·
Dhananjay Singh · Wan-Young Chung (Eds.)

Intelligent Human Computer Interaction

12th International Conference, IHCI 2020
Daegu, South Korea, November 24–26, 2020
Proceedings, Part I


Editors


Madhusudan Singh 
Woosong University
Daejeon, Korea (Republic of)

Jong-Ha Lee 
Keimyung University
Daegu, Korea (Republic of)

Dhananjay Singh 
Hankuk University of Foreign Studies
Yongin, Korea (Republic of)

Dae-Ki Kang 
Dongseo University
Busan, Korea (Republic of)

Uma Shanker Tiwary 
Indian Institute of Information Technology
Allahabad, India

Wan-Young Chung 
Pukyong National University
Busan, Korea (Republic of)

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-68448-8 ISBN 978-3-030-68449-5 (eBook)
<https://doi.org/10.1007/978-3-030-68449-5>

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI

© 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 science and technology of Human Computer Interaction (HCI) has taken a giant leap forward in the last few years. This has given impetus to two opposing trends. One divergent trend is to organize separate conferences on focused topics such as Interaction Design, User-Centered Design, etc., which earlier would have been covered under HCI. The other convergent trend is to assimilate new areas into HCI conferences, such as Computing with Words, Prosocial Agents Development, Attention-based Applications, etc. IHCI is one of the rare conferences focusing on those issues of Intelligence and Human Computer Interaction which exist at the crossroads of the abovementioned trends. IHCI is an annual international conference in the Human Computer Interaction field, where we explore research challenges emerging in the complex interaction between machine intelligence and human intelligence. It is a privilege to present the proceedings of the 12th International Conference on Intelligent Human Computer Interaction (IHCI 2020), organized on site and online by the Korea Institute of Convergence Signal Processing (KICSP) during November 24–26, 2020 at EXCO Daegu, South Korea. The twelfth instance of the conference was on the theme of “Intelligent Interaction for Smart Community Services”, having 9 special sessions related to the main theme of the conference.

Out of 175 submitted papers, 93 papers were accepted for oral presentation and publication by the Program Committee, in each case based on the recommendations of at least 3 expert reviewers. The proceedings are organized in 9 sections corresponding to the 9 tracks of the conference. The 12th IHCI conference included keynote and invited talks with powerful expert session chairs who have worked in both industry and academia. It attracted more than 200 participants from more than 27 countries.

IHCI has emerged as the foremost worldwide gathering of the field’s academic researchers, graduate students, top research think tanks, and industry technology developers. Therefore, we believe that the biggest benefit to the participant is the actualization of their goals in the field of HCI. That will ultimately lead to greater success in business, which is ultimately beneficial to society. Moreover, our warm gratitude should be given to all the authors who submitted their work to IHCI 2020. During the submission, review, and editing stages, the EasyChair conference system proved very helpful. We are grateful to the technical program committee (TPC) and local organizing committee for their immeasurable efforts to ensure the success of this conference. Finally we would like to thank our speakers, authors, and participants for their contribution to making IHCI 2020 a stimulating and productive conference. This IHCI conference series cannot achieve yearly milestones without their continued support in future.

November 2020

Wan-Young Chung
Dhananjay Singh

Organization

General Chairs

Wan-Young Chung	Pukyong National University (PKNU), Busan, Korea
Dhananjay Singh	Hankuk University of Foreign Studies (HUFS), Seoul, Korea

Technical Program Chairs

Uma Shanker Tiwary	IIIT-Allahabad, Allahabad, India
Dae-Ki Kang	Dongseo University, Busan, Korea
Jong-Ha Lee	Keimyung University, Daegu, Korea
Madhusudan Singh	Woosong University, Daejeon, Korea

Steering Committee

Uma Shanker Tiwary	IIIT-Allahabad, India
Santanu Chaudhury	IIT Jodhpur, India
Tom D. Gedeon	Australian National University, Australia
Debasis Samanta	IIT Kharagpur, India
Atanendu Sekhar Mandal	CSIR-CEERI, Pilani, India
Tanveer Siddiqui	University of Allahabad, India
Jaroslav Pokorný	Charles University, Czech Republic
Sukhendu Das	IIT Madras, India
Samit Bhattacharya	IIT Guwahati, India

Special Session Chairs

Uma Shanker Tiwary	IIIT-Allahabad, Allahabad, India
Suzana Brown	The State University of New York, Korea
Mark D. Whitaker	The State University of New York, Korea
Arvind W. Kiwelekar	Dr. Babasaheb Ambedkar Technological University, India
Kenneth A. Yates	University of Southern California, USA
Mohd Helmy Abd Wahab	Universiti Tun Hussein Onn Malaysia, Malaysia
Masoud Mohammadian	University of Canberra, Australia
Eui-Chul Lee	Sangmyung University, Korea
Hakimjon Zaynidinov	Tashkent University of Information Technologies, Uzbekistan
Jan-Willem van 't Klooster	University of Twente, The Netherlands
Thierry Oscar Edoh	University of Bonn, Germany
Zia Uddin	Woosong University, Korea

Muhammad Sohaib	Lahore Garrison University, Pakistan
Jong-Ha Lee	Keimyung University, South Korea
Shyam Perugu	National Institute of Technology Warangal, India
Nagamani M.	University of Hyderabad, India
Irish Singh	Ajou University, Korea

Publicity Chairs

Mario José Diván	National University of La Pampa, Argentina
Amine Chellali	University of Évry Val d'Essonne, France
Nirmalya Thakur	University of Cincinnati, USA

Industry Chairs

Antonio Jara	HOPU, Spain
Sangsu Jung	VESTELLA, Korea
Gyanendra Kumar	infoTrust, Singapore
Prem Singh	COIKOSITY, India

Local Organizing Committee

Daejin Park	Kyungpook National University, Korea
Jonghun Lee	DGIST, Korea
Do-Un Jeong	Dongseo University, Korea
Hoon-Jae Lee	Dongseo University, Korea
Sang-Gon Lee	Dongseo University, Korea
Yeon Ho Chung	Pukyong National University, Korea
Andrew Min-Gyu Han	Hansung University, Korea
Paul Moon Sub Choi	Ewha Womans University, Korea
Jae Hee Park	Keimyung University, Korea
Sukho Lee	Dongseo University, Korea
Sang-Joong Jung	Dongseo University, Korea
Pamul Yadav	GREW Creative Lab, Korea
Hyo-Jin Jung	Daegu Convention and Visitors Bureau, Korea

Technical Program Committee

Jong-Hoon Kim	Kent State University, USA
N. S. Rajput	Indian Institute of Technology (BHU) Varanasi, India
Ho Jiacang	Dongseo University, Korea
Ahmed Abdulhakim	Kyungdong University, Korea
Al-Absi	
Rodrigo da Rosa Righi	Unisinos, Brazil
Nagesh Yadav	IBM Research, Ireland
Jan Willem van 't Klooster	University of Twente, The Netherlands
Hasan Tinmaz	Woosong University, Korea

Zhong Liang Xiang	Shandong Technology and Business University, China
Hanumant Singh Shekhawat	Indian Institute of Technology Guwahati, India
Md. Iftekhar Salam	Xiamen University, Malaysia
Alvin Poernomo	University of New Brunswick, Canada
Surender Reddy Salkuti	Woosong University, Korea
Suzana Brown	State University of New York, Korea
Dileep Kumar	MR Research, Siemens HealthCare, India
Gaurav Trivedi	Indian Institute of Technology Guwahati, India
Prima Sanjaya	University of Helsinki, Finland
Thierry Oscar Edoh	University of Bonn, Germany
Garima Agrawal	Vulcan AI, Singapore
David (Bong Jun) Choi	Soongsil University, Korea
Gyanendra Verma	NIT Kurukshetra, India
Jia Uddin	Woosong University, Korea
Arvind W. Kiwelekar	Dr. Babasaheb Ambedkar Technological University, India
Alex Wong Ming Hui	Osaka University, Japan
Bharat Rawal	Gannon University, USA
Wesley De Neve	Ghent University Global Campus, Korea
Satish Kumar L. Varma	Pillai College of Engineering, India
Alex Kuhn	State University of New York, Korea
Mark Whitaker	State University of New York, Korea
Satish Srirama	University of Hyderabad, India
Nagamani M.	University of Hyderabad, India
Shyam Perugu	National Institute of Technology Warangal, India
Neeraj Parolia	Towson University, USA
Stella Tomasi	Towson University, USA
Marcelo Marciszack	National Technological University, Argentina
Andrés Navarro Newball	Pontificia Universidad Javeriana Cali, Colombia
Marcelo Marciszack	National Technological University, Argentina
Indranath Chatterjee	Tongmyong University, Korea
Gaurav Tripathi	BEL, India
Bernardo Nugroho Yahya	HUFS, Korea
Carlene Campbell	University of Wales Trinity Saint David, UK

Keynote Speakers

P. Nagabhushan	IIIT-Allahabad, India
Maode Ma	Nanyang Technological University, Singapore
Dugan Um	Texas A&M University, USA
Ajay Gupta	Western Michigan University, USA

Invited Speakers

Yeon-Ho Chung	Pukyong National University, Korea
James R. Reagan	IdeaExplorer, Korea

Mario J. Diván	Universidad Nacional de La Pampa, Argentina
Jae-Hee Park	Keimyung University, Korea
Antonio M. Alberti	Inatel, Brazil
Rodrigo Righi	Unisinos, Brazil
Antonio Jara	HOP Ubiquitous, Spain
Boon Giin Lee	University of Nottingham Ningbo China, China
Gaurav Trivedi	Indian Institute of Technology Guwahati, India
Madhusudan Singh	Woosong University, Korea
Mohd Helmy Abd Wahab	Universiti Tun Hussein Onn Malaysia, Malaysia
Masoud Mohammadian	University of Canberra, Australia
Jan Willem van' t Klooster	University of Twente, The Netherlands
Thierry Oscar Edoh	University of Bonn, Germany

Organizing Chair

Dhananjay Singh	Hankuk University of Foreign Studies (HUFS), Korea
-----------------	--

Contents – Part I

Cognitive Modeling and System

A Two-Systems Perspective for Computational Thinking	3
<i>Arvind W. Kiwelekar, Swanand Navandar, and Dharmendra K. Yadav</i>	
Detection of Semantically Equivalent Question Pairs	12
<i>Reetu Kumari, Rohit Mishra, Shrikant Malviya, and Uma Shanker Tiwary</i>	
Concentration Level Prediction System for the Students Based on Physiological Measures Using the EEG Device	24
<i>Varsha T. Lokare and Laxman D. Netak</i>	
A Correlation Analysis Between Cognitive Process and Knowledge Dimension in Software Engineering by Using the Revised Bloom’s Taxonomy	34
<i>Manjushree D. Laddha, Laxman D. Netak, and Hansaraj S. Wankhede</i>	
A Study on Comparative Analysis of the Effect of Applying DropOut and DropConnect to Deep Neural Network.	42
<i>Hyun-il Lim</i>	
HHAR-net: <u>H</u> ierarchical <u>H</u> uman <u>A</u> ctivity <u>R</u> ecognition using Neural <u>N</u> etworks	48
<i>Mehrdad Fazli, Kamran Kowsari, Erfaneh Gharavi, Laura Barnes, and Afsaneh Doryab</i>	
Analysis of Streaming Information Using Subscriber-Publisher Architecture. . .	59
<i>Aparajit Talukdar</i>	
Fraudulent Practices in Dispensing Units and Remedies	70
<i>Undru Vimal Babu, M. Nagamani, Shalam Raju, and M. Rama Krishna</i>	

Biomedical Signal Processing and Complex Analysis

Digital Processing of Blood Image by Applying Two-Dimensional Haar Wavelets	83
<i>H. N. Zaynidinov, I. Yusupov, J. U. Juraev, and Dhananjay Singh</i>	

Development of the Method, Algorithm and Software of a Modern Non-invasive Biopotential Meter System	95
<i>J. X. Djumanov, F. F. Rajabov, K. T. Abdurashidova, D. A. Tadjibaeva, and N. S. Atadjanova</i>	
Deception Detection Using a Multichannel Custom-Design EEG System and Multiple Variants of Neural Network.	104
<i>Ngoc-Dau Mai, Trung-Hau Nguyen, and Wan-Young Chung</i>	
A Study on the Possibility of Measuring the Non-contact Galvanic Skin Response Based on Near-Infrared Imaging	110
<i>Geumbi Jo, Seunggeon Lee, and Eui Chul Lee</i>	
EEG Motor Classification Using Multi-band Signal and Common Spatial Filter.	120
<i>Tan Yu Xuan, Norashikin Yahya, Zia Khan, Nasreen Badruddin, and Mohd Zuki Yusoff</i>	
Segmentation of Prostate in MRI Images Using Depth Separable Convolution Operations	132
<i>Zia Khan, Norashikin Yahya, Khaled Alsaih, and Fabrice Meriaudeau</i>	
Bone Age Assessment for Lower Age Groups Using Triplet Network in Small Dataset of Hand X-Rays	142
<i>Shipra Madan, Tapan Gandhi, and Santanu Chaudhury</i>	
A Development of Enhanced Contactless Bio Signal Estimation Algorithm and System for COVID19 Prevention	154
<i>Chan-il Kim and Jong-ha Lee</i>	
Stress Detection from Different Environments for VIP Using EEG Signals and Machine Learning Algorithms	163
<i>Mohammad Safkat Karim, Abdullah Al Rafsan, Tahmina Rahman Surovi, Md. Hasibul Amin, and Mohammad Zavid Parvez</i>	
Natural Language, Speech, Voice and Study	
Analysis of Emotional Content in Indian Political Speeches	177
<i>Sharu Goel, Sandeep Kumar Pandey, and Hanumant Singh Shekhawat</i>	
A Bengali Voice-Controlled AI Robot for the Physically Challenged.	186
<i>Abul Bashar Bhuiyan, Anamika Ahmed, Sadid Rafsun Tulon, Md. Rezwan Hassan Khan, and Jia Uddin</i>	

How to Enhance the User Experience of Language Acquisition in the Mobile Environment: A Case Study of Amkigoraе(암기고래), a Vocabulary Acquisition Mobile Application.	195
<i>Chiwon Lee, Donggyu Kim, Eunsuh Chin, and Jihyun Kim</i>	
Screening Trauma Through CNN-Based Voice Emotion Classification.	208
<i>Na Hye Kim, So Eui Kim, Ji Won Mok, Su Gyeong Yu, Na Yeon Han, and Eui Chul Lee</i>	
Interchanging the Mode of Display Between Desktop and Immersive Headset for Effective and Usable On-line Learning	218
<i>Jiwon Ryu and Gerard Kim</i>	
Verification of Frequently Used Korean Handwritten Characters Through Artificial Intelligence.	223
<i>Kyung Won Jin, Mi Kyung Lee, Woohyuk Jang, and Eui Chul Lee</i>	
Study of Sign Language Recognition Using Wearable Sensors	229
<i>Boon Giin Lee and Wan Young Chung</i>	
Automated Grading of Essays: A Review.	238
<i>Jyoti G. Borade and Laxman D. Netak</i>	
Voice Attacks to AI Voice Assistant	250
<i>Seyitmammet Alchekov Saparmammedovich, Mohammed Abdulhakim Al-Absi, Yusuph J. Koni, and Hoon Jae Lee</i>	
Skills Gap is a Reflection of What We Value: A Reinforcement Learning Interactive Conceptual Skill Development Framework for Indian University	262
<i>Pankaj Velavan, Billy Jacob, and Abhishek Kaushik</i>	
PRERONA: Mental Health Bengali Chatbot for Digital Counselling	274
<i>Asma Ul Hussna, Azmiri Newaz Khan Laz, Md. Shammyo Sikder, Jia Uddin, Hasan Tinmaz, and A. M. Esfar-E-Alam</i>	
Speech Based Access of Kisan Information System in Telugu Language	287
<i>Rambabu Banothu, S. Sadiq Basha, Nagamani Molakatala, Veerendra Kumar Gautam, and Suryakanth V. Gangashetty</i>	
Voice Assistant for Covid-19	299
<i>Shokhrukhbek Primkulov, Jamshidbek Urolov, and Madhusudan Singh</i>	
Combining Natural Language Processing and Blockchain for Smart Contract Generation in the Accounting and Legal Field	307
<i>Emiliano Monteiro, Rodrigo Righi, Rafael Kunst, Cristiano da Costa, and Dhananjay Singh</i>	

Algorithm and Related Applications

Fault Identification of Multi-level Gear Defects Using Adaptive Noise Control and a Genetic Algorithm 325
Cong Dai Nguyen, Alexander Prosvirin, and Jong-Myon Kim

Applying Multiple Models to Improve the Accuracy of Prediction Results in Neural Networks 336
Hyun-il Lim

OST-HMD for Safety Training 342
Christopher Koenig, Muhannad Ismael, and Roderick McCall

One-Dimensional Mathematical Model and a Numerical Solution Accounting Sedimentation of Clay Particles in Process of Oil Filtering in Porous Medium. 353
Elmira Nazirova, Abdug’ani Nematov, Rustamjon Sadikov, and Inomjon Nabiyeu

A Novel Diminish Smooth L1 Loss Model with Generative Adversarial Network 361
Arief Rachman Sutanto and Dae-Ki Kang

Interactive Machine Learning Approach for Staff Selection Using Genetic Algorithm. 369
Preethi Ananthachari and Nodirbek Makhtumov

Software of Linear and Geometrically Non-linear Problems Solution Under Spatial Loading of Rods of Complex Configuration. 380
Sh. A. Anarova, SH. M. Ismoilov, and O. Sh. Abdirozikov

Mathematical Modeling of Pascal Triangular Fractal Patterns and Its Practical Application. 390
Sh. A. Anarova, Z. E. Ibrohimova, O. M. Narzulloyev, and G. A. Qayumova

Crowd Sourcing and Information Analysis

An NLP and LSTM Based Stock Prediction and Recommender System for KOSDAQ and KOSPI 403
Indranath Chatterjee, Jeon Gwan, Yong Jin Kim, Min Seok Lee, and Migyung Cho

The Commodity Ecology Mobile (CEM) Platform Illustrates Ten Design Points for Achieving a Deep Deliberation in Sustainable Development Goal #12 414
Mark D. Whitaker

The Design and Development of School Visitor Information Management System: Malaysia Perspective 431
Check-Yee Law, Yong-Wee Sek, Choo-Chuan Tay, Wei-Ann Lim, and Tze-Hui Liew

The Impact of the Measurement Process in Intelligent System of Data Gathering Strategies 445
Mario José Diván and Madhusudan Singh

Detecting Arson and Stone Pelting in Extreme Violence: A Deep Learning Based Identification Approach 458
Gaurav Tripathi, Kuldeep Singh, and Dinesh Kumar Vishwakarma

A Scientometric Review of Digital Economy for Intelligent Human-Computer Interaction Research 469
Han-Teng Liao, Chung-Lien Pan, and Jieqi Huang

eGovernance for Citizen Awareness and Corruption Mitigation. 481
A. B. Sagar, M. Nagamani, Rambabu Banothu, K. Ramesh Babu, Venkateswara Rao Juturi, and Preethi Kothari

Towards a Responsible Intelligent HCI for Journalism: A Systematic Review of Digital Journalism 488
Yujin Zhou and Zixian Zhou

A Systematic Review of Social Media for Intelligent Human-Computer Interaction Research: Why Smart Social Media is Not Enough 499
Han-Teng Liao, Zixian Zhou, and Yujin Zhou

Author Index 511

Contents – Part II

Intelligent Usability and Test System

IoT System for Monitoring a Large-Area Environment Sensors and Control Actuators Using Real-Time Firebase Database	3
<i>Giang Truong Le, Nhat Minh Tran, and Thang Viet Tran</i>	
A Method for Localizing and Grasping Objects in a Picking Robot System Using Kinect Camera	21
<i>Trong Hai Nguyen, Trung Trong Nguyen, and Thang Viet Tran</i>	
A Comparative Analysis on the Impact of Face Tracker and Skin Segmentation onto Improving the Performance of Real-Time Remote Photoplethysmography	27
<i>Kunyoung Lee, Kyungwon Jin, Youngwon Kim, Jee Hang Lee, and Eui Chul Lee</i>	
Fuzzy-PID-Based Improvement Controller for CNC Feed Servo System	38
<i>Nguyen Huu Cuong, Trung Trong Nguyen, and Tran Viet Thang</i>	
Plastic Optical Fiber Sensors Based on in-Line Micro-holes: A Review	47
<i>Hyejin Seo and Jaehee Park</i>	
Long-Distance Real-Time Rolling Shutter Optical Camera Communication Using MFSK Modulation Technique	53
<i>Md Habibur Rahman, Mohammad Abrar Shakil Sejan, and Wan-Young Chung</i>	
A Systematic Review of Augmented Reality in Multimedia Learning Outcomes in Education	63
<i>Hafizul Fahri Hanafi, Mohd Helmy Abd Wahab, Abu Zarrin Selamat, Abdul Halim Masnan, and Miftachul Huda</i>	
RFID Technology for UOH Health Care Center	73
<i>Velugumetla Siddhi Chaithanya, M. Nagamani, Venkateswara Juturi, C. Satyanarayana Prasad, and B. Sitaram</i>	
An IOT Based Smart Drain Monitoring System with Alert Messages.	84
<i>Samiha Sultana, Ananya Rahaman, Anita Mahmud Jhara, Akash Chandra Paul, and Jia Uddin</i>	

Design and Implementation of a Safety Device for Emergency Situations Using Arduino and GSM Module	96
<i>Samiha Sultana, Ananya Rahaman, Akash Chandra Paul, Evea Zerin Khan, and Jia Uddin</i>	
Design and Implementation of an IoT System for Predicting Aqua Fisheries Using Arduino and KNN	108
<i>Md. Monirul Islam, Jia Uddin, Mohammad Abul Kashem, Fazly Rabbi, and Md. Waliul Hasnat</i>	
A Fast and Secure Uniform Handover Authentication Scheme for 5G HetNets	119
<i>Alican Ozhelvaci and Maodess Ma</i>	
Assistive Living	
An Automated Wheelchair for Physically Challenged People Using Hand Gesture and Mobile App	135
<i>Md. Farhan Razy, Sabah Shahnoor Anis, Md. Touhiduzzaman Touhid, and Jia Uddin</i>	
Gait Analysis Using Video for Disabled People in Marginalized Communities	145
<i>Achilles Vairis, Johnathan Boyak, Suzana Brown, Maurice Bess, Kyu Hyun Bae, and Markos Petousis</i>	
Implementation of CNN Model for Classification of User Sitting Posture Based on Pressure Distribution	154
<i>Ji-Yun Seo, Ji-Su Lee, Sang-Joong Jung, Yun-Hong Noh, and Do-Un Jeong</i>	
Implementation of Rehabilitation Exercise Posture Determination System Based on CNN Using EMG and Acceleration Sensors	160
<i>Ji-Su Lee, Ji-Yun Seo, Sang-Joong Jung, Yun-Hong Noh, and Do-Un Jeong</i>	
Grabbing Pedestrian Attention with Interactive Signboard for Street Advertising	167
<i>Heeyoon Jeong and Gerard Kim</i>	
Requirements for Upper-Limb Rehabilitation with FES and Exoskeleton	172
<i>Woojin Kim, Hyunwoo Joe, HyunSuk Kim, Seung-Jun Lee, Daesub Yoon, Je Hyung Jung, Borja Bornail Acuña, Hooman Lee, Javier Fínez Raton, Carlos Fernández Isoird, Iker Mariñelarena, Miguel Angel Aldudo Alonso, Myung Jun Shin, and Tae Sung Park</i>	

Development of Biosensor for Pressure Sores Diagnosis and Treatment Using Bio Photonics with Impedance	178
<i>Eun-Bin Park and Jong-Ha Lee</i>	
Sustainably Stemming the Nursing Care Crisis in Germany	188
<i>Thierry Edoh and Madhusudan Singh</i>	
First Eyetracking Results of Dutch CoronaMelder Contact Tracing and Notification App	199
<i>Jan Willem Jaap Roderick van 't Klooster, Peter Jan Hendrik Slijkhuis, Joris van Gend, Britt Bente, and Lisette van Gemert-Pijnen</i>	
Architecture of an IoT and Blockchain Based Medication Adherence Management System	208
<i>Pravin Pawar, Colin K. Park, Injang Hwang, and Madhusudan Singh</i>	
Image Processing and Deep Learning	
Face Anti-spoofing Based on Deep Neural Network Using Brightness Augmentation	219
<i>Kun Ha Suh and Eui Chul Lee</i>	
Face Spoofing Detection Using DenseNet	229
<i>Su-Gyeong Yu, So-Eui kim, Kun Ha Suh, and Eui Chul Lee</i>	
1-Stage Face Landmark Detection Using Deep Learning	239
<i>Taehyung Kim, Ji Won Mok, and Eui Chul Lee</i>	
Image Identification of Multiple Parrot Species Belonging to CITES Using Deep Neural Networks.	248
<i>Woohyuk Jang, Si Won Seong, Chang Bae Kim, and Eui Chul Lee</i>	
Automatic Detection of Trypanosomosis in Thick Blood Smears Using Image Pre-processing and Deep Learning.	254
<i>Taewoo Jung, Esla Timothy Anzaku, Utku Özbülak, Stefan Magez, Arnout Van Messem, and Wesley De Neve</i>	
Adaptive Margin Based Liveness Detection for Face Recognition	267
<i>Gabit Tolendiyev, Mohammed Abdulhakim Al-Absi, Hyotaek Lim, and Byung-Gook Lee</i>	
A Study on a Mask R-CNN-Based Diagnostic System Measuring DDH Angles on Ultrasound Scans.	278
<i>Seok-min Hwang, Hee-Jun Park, and Jong-ha Lee</i>	

Comparison of SVM and Random Forest Methods for Online Signature Verification	288
<i>Leetesh Meena, Vijay Kumar Chaurasiya, Neetesh Purohit, and Dhananjay Singh</i>	
Human-Centered AI Applications	
Audio Augmented Reality Using Unity for Marine Tourism	303
<i>Uupil Chong and Shokhzod Alimardanov</i>	
A Prototype Wristwatch Device for Monitoring Vital Signs Using Multi-wavelength Photoplethysmography Sensors	312
<i>Nguyen Mai Hoang Long, Jong-Jin Kim, and Wan-Young Chung</i>	
User Perception on an Artificial Intelligence Counseling App	319
<i>Hyunjong Joo, Chiwon Lee, Mingeon Kim, and Yeonsoo Choi</i>	
Authentication of Facial Images with Masks Using Periocular Biometrics	326
<i>Na Yeon Han, Si Won Seong, Jihye Ryu, Hyeonsang Hwang, Jinoo Joung, Jeeghang Lee, and Eui Chul Lee</i>	
Analysis of User Preference of AR Head-Up Display Using Attrakdiff	335
<i>Young Jin Kim and Hoon Sik Yoo</i>	
IoT-Enabled Mobile Device for Electrogastrography Signal Processing	346
<i>Hakimjon Zaynidinov, Sarvar Makhmudjanov, Farkhad Rajabov, and Dhananjay Singh</i>	
A Study on the Usability Test Method of Collaborative Robot Based on ECG Measurement	357
<i>Sangwoo Cho and Jong-Ha Lee</i>	
The Human Factor Assessment of Consumer Air Purifier Panel Using Eye Tracking Device	363
<i>Shin-Gyun Kim and Jong-Ha Lee</i>	
AI-Based Voice Assistants Technology Comparison in Term of Conversational and Response Time	370
<i>Yusuph J. Koni, Mohammed Abdulhakim Al-Absi, Seyitmammet Alchekov Saparmammedovich, and Hoon Jae Lee</i>	
HCI Based In-Cabin Monitoring System for Irregular Situations with Occupants Facial Anonymization	380
<i>Ashutosh Mishra, Jaekwang Cha, and Shiho Kim</i>	

Achievement of Generic and Professional Competencies Through Virtual Environments.	391
<i>Zhoe Comas-Gonzalez, Ronald Zamora-Musa, Orlando Rodelo Soto, Carlos Collazos-Morales, Carlos A. Sanchez, and Laura Hill-Pastor</i>	
AARON: Assistive Augmented Reality Operations and Navigation System for NASA’s Exploration Extravehicular Mobility Unit (xEMU).	406
<i>Irvin Steve Cardenas, Caitlyn Lenhoff, Michelle Park, Tina Yuqiao Xu, Xiangxu Lin, Pradeep Kumar Paladugula, and Jong-Hoon Kim</i>	
Socio-Cognitive Interaction Between Human and Computer/Robot for HCI 3.0	423
<i>Sinae Lee, Dugan Um, and Jangwoon Park</i>	
Author Index	433