2022 IEEE International Conference on Digital Health (ICDH)

ICDH 2022

Table of Contents

Message from the 2022 Steering Committee Chair .................................................. xii
Message from the 2022 Steering Committee Chair-Elect ........................................... xiii
Message from the Congress General Chair ............................................................... xiv
Message from the Program Chairs-in-Chief ............................................................. xv
Message from the General Co-Chair ................................................................ xvi
Message from the TCSVC Chair ........................................................................ xvi
Message from the ICDH 2022 Organizing Committee ........................................... xviii
ICDH 2022 Organizing Committee ........................................................................ xix
ICDH 2022 Reviewers .......................................................................................... xxii
Digital Health Security & Privacy Symposium ..................................................... xxiv

IEEE International Conference on Digital Health

Analytics & Visualization

Automated Analysis of Drawing Process for Detecting Prodromal and Clinical Dementia ............ 1
Yasunori Yamada (Digital Health, IBM Research, Japan), Masatomo Kobayashi (Digital Health, IBM Research, Japan), Kaoru Shinkawa (Digital Health, IBM Research, Japan), Miyuki Nemoto (University of Tsukuba, Japan), Miho Ota (University of Tsukuba, Japan), Kiyo Taka Nemoto (University of Tsukuba, Japan), and Tetsuya Arai (University of Tsukuba, Japan)

Extracting, Visualizing, and Learning from Dynamic Data: Perfusion in Surgical Video for Tissue Characterization ................................................................................................ 7
Jonathan P Epperlein (IBM Research Europe, Ireland), Niall P Hardy (UCD Centre for Precision Surgery, University College Dublin, Ireland), Pol Mac Aonghusa (IBM Research Europe, Ireland), and Ronan A Cahill (UCD Centre for Precision Surgery, University College Dublin, Ireland)

Health Policy

Data-Driven Interpretable Policy Construction for Personalized Mobile Health ...................... 13
Dimitris Bertsimas (Massachusetts Institute of Technology, USA), Predrag Klasnja (University of Michigan, USA), Susan Murphy (Harvard University, USA), and Liangyuan Na (Massachusetts Institute of Technology, USA)
Designing User-Friendly Medical AI Applications - Methodical Development of User-Centered Design Guidelines

Laura Wiebelitz (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany), Peter Schmid (University of Stuttgart, Germany), Thomas Maier (University of Stuttgart, Germany), and Malte Volkwein (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany)

IOT Data Analytics

Brain Tumor Segmentation in MRI Images Using A Modified U-Net Model

Thong Vo (Toronto Metropolitan University, Canada), Pranjal Dave (Toronto Metropolitan University, Canada), Gaurav Bajpai (Toronto Metropolitan University, Canada), Rasha Kashef (Toronto Metropolitan University, Canada), and Naimul Khan (Toronto Metropolitan University, Canada)

Preliminary Data Collection for Collaborative Emergency Department Crowd Management Using Wearable Devices

Victoire Metuge (Kennesaw State University, USA), Maria Valero (Kennesaw State University, USA), Liang Zhao (Kennesaw State University, USA), Valentina Nino (Montana State University, USA), and David Claudio (University of Massachusetts Lowell, USA)

Using Data from Wearables for Better Sleep

Juan F. Arias (Marist College, USA)

Health Data Analytics Platform

Health Guardian Platform: A Technology Stack to Accelerate Discovery in Digital Health Research

Bo Wen (IBM T.J. Watson Research Center, USA), Vince S. Siu (IBM T.J. Watson Research Center, USA), Italo Buleje (IBM T.J. Watson Research Center, USA), Kuan Yu Hsieh (IBM T.J. Watson Research Center, USA), Takashi Itoh (IBM Research, Japan), Lukas Zimmerli (IBM Research), Nigel Hinds (IBM T.J. Watson Research Center, USA), Elif Eyigoz (IBM T.J. Watson Research Center, USA), Bing Deng (IBM T.J. Watson Research Center, USA), Stefan von Cavallar (Origen Digital, Australia), and Jeffrey L. Rogers (IBM T.J. Watson Research Center, USA)

Definition and Clinical Validation of Pain Patient States from High-Dimensional Mobile Data: Application to a Chronic Pain Cohort

Jenna M. Reinen (IBM Research), Carla Agurto (IBM Research), Guillermo Cecchi (IBM Research), Jeffrey L. Rogers (IBM Research), Navitas and Envision Studies Navitas and Envision Studies, and Boston Scientific

Systems & Interoperability

Digital Health Promotion for Fitness Enthusiasts in Africa

Oritsetimeyin Arueyingho (University of Bristol, United Kingdom) and Korede Sanyaolu (University of Bristol, United Kingdom)
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interoperability Challenges and Critical Success Factors in the Deployment of Cross-Border Digital Medical Prescriptions in Finland and Estonia</td>
<td>60</td>
</tr>
<tr>
<td>Flor Nino Palma (Tallinn University of Technology, Estonia)</td>
<td></td>
</tr>
<tr>
<td>The Need for an Adaptive Sociotechnical Model for Managing Mental Health in a Pandemic</td>
<td>66</td>
</tr>
<tr>
<td>Braden Tabisula (Claremont Graduate University, USA) and Chinazunwa Uwaoma (Claremont Graduate University, USA)</td>
<td></td>
</tr>
</tbody>
</table>

**Behavior & Lifestyle Monitoring**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Classification of Multiple Interacting Gait Abnormalities Using Insole Sensors and Machine Learning</td>
<td>69</td>
</tr>
<tr>
<td>Alexander Turner (University of Nottingham, UK), David Scott (University of Hull, UK), and Stephen Hayes (Nottingham Trent University, UK)</td>
<td></td>
</tr>
<tr>
<td>On the Pose Estimation Software for Measuring Movement Features in the Finger-to-Nose Test</td>
<td>77</td>
</tr>
<tr>
<td>Enrico Martini (University of Verona, Italy), Nicola Valè (University of Verona, Italy), Michele Boldo (University of Verona, Italy), Anna Righetti (University of Verona, Italy), Nicola Smania (University of Verona, Italy), and Nicola Bombieri (University of Verona, Italy)</td>
<td></td>
</tr>
<tr>
<td>Analysis of Mobile Typing Characteristics in the Light of Cognition</td>
<td>87</td>
</tr>
<tr>
<td>Maximilian Kapsecker (Technical University of Munich), Simon Osterlehner (Technical University of Munich), and Stephan M. Jonas (University Hospital Bonn)</td>
<td></td>
</tr>
</tbody>
</table>

**Language & Social Media**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Climate Recognition in Interactive Conversational Speech Using Deep Learning</td>
<td>96</td>
</tr>
<tr>
<td>Ghada Alhussein (Khalifa University of Science and Technology, UAE), Mohanad Alkhodari (Khalifa University of Science and Technology, UAE), Ahsan Khandokher (Khalifa University of Science and Technology, UAE), and Leontios Hadjileontiadis (Khalifa University of Science and Technology, UAE; Aristotle University of Thessaloniki, Greece)</td>
<td></td>
</tr>
<tr>
<td>Smartphone Addiction and Self-Esteem Among Indonesian Teenage Students</td>
<td>104</td>
</tr>
<tr>
<td>Muhammad Arsyad Subu (University of Sharjah, USA), Iman Waluyo (Padmakumara Foundation, Indonesia), Nabeel Al-Yateem (University of Sharjah, UAE), Ika Riana (Midwifery Department Pontianak Aisyah Polytechnic Indonesia, Indonesia), Jacqueline Maria (University of Sharjah, UAE), Ahmad Saifan (Applied Science Private University, Jordan), Syed Azizur Rahman (University of Sharjah, UAE), Sheikh Iqbal Ahamed (Marquette University, UAE), Jinten Jumiati (Akademi Fisioterapi “YAB” Yogyakarta, Indonesia), Fatma Refaat Ahmed (University of Sharjah, UAE), and Amina Al-Marzouqi (University of Sharjah, UAE)</td>
<td></td>
</tr>
<tr>
<td>Using Deep Learning to Identify Linguistic Features that Facilitate or Inhibit the Propagation of Anti- and Pro-Vaccine Content on Social Media</td>
<td>107</td>
</tr>
<tr>
<td>Young Anna Argyris (Michigan State University), Nan Zhang (Michigan State University), Bidhan Bashyal (Michigan State University), and Pang-Ning Tan (Michigan State University)</td>
<td></td>
</tr>
</tbody>
</table>
Surveillance & Nursing

Surveillance of SARS-CoV-2 in Urban Wastewater in Italy

Mirko Rossi (National Center for Innovative Technologies in Public Health, Istituto Superiore di Sanità, Italy), Giuseppe D'Avenio (National Center for Innovative Technologies in Public Health, Istituto Superiore di Sanità, Italy), Giuseppina La Rosa (Istituto Superiore di Sanità, Italy), Giusy Bonanno Ferraro (Istituto Superiore di Sanità, Italy), Giorgia Mancini (Istituto Superiore di Sanità, Italy), Carolina Veneri (Istituto Superiore di Sanità, Italy), Marcello Iaconelli (Istituto Superiore di Sanità, Italy), Luca Lucentini (Istituto Superiore di Sanità, Italy), Lucia Bonadonna (Istituto Superiore di Sanità, Italy), Mario Cerroni (Istituto Superiore di Sanità, Italy), Federica Simonetti (Istituto Superiore di Sanità, Italy), David Brandtner (independent researcher, Italy), Elisabetta Suffredini (Istituto Superiore di Sanità, Italy), and Mauro Grigioni (Istituto Superiore di Sanità, Italy)

A New Low-Cost and Accurate Diagnostic mHealth System for Patients with COVID-19 Pneumonia

Tarek El Salti (Sheridan College, Canada), Edward Sykes (Sheridan College, Canada), Javier Nievas (Sheridan College, Canada), and Chen Tong (Sheridan College, Canada)

Implementing Virtual Nursing in Health Care: An Evaluation of Effectiveness and Sustainability

Oana Tudorache (Kennesaw State University, USA), John Brandon Kenemer (Kennesaw State University, USA), Janna Pruett (Kennesaw State University, USA), Maria Valero (Kennesaw State University, USA), Margot Lisa Hedenstrom (Kennesaw State University, USA), Hossain Shahriar (Kennesaw State University, USA), and Sweta Sneha (Kennesaw State University, USA)

Activity Monitoring

GMH-D: Combining Google MediaPipe and RGB-Depth Cameras for Hand Motor Skills Remote Assessment

Gianluca Amprino (Politecnico di Torino, Italy), Claudia Ferraris (National Research Council, Italy), Giulia Masi (University of Turin, Italy), Giuseppe Pettiti (National Research Council, Italy), and Lorenzo Priano (University of Turin, Italy)

An mHealth Lifestyle Intervention Service for Improving Blood Pressure Using Machine Learning and IoMTs

Jared Leitner (University of California, San Diego, USA), Po-Han Chiang (University of California, San Diego, USA), Brian Khan (University of California, San Diego, USA), and Sujit Dey (University of California, San Diego, USA)
Computer Vision Based Cognition Assessment for Developmental-Behavioral Screening .......... 151
Chi-Yu Chen (National Yang Ming Chiao Tung University, Taiwan),
Po-Chien Hsu (National Tsing Hua University, Taiwan), Tang-Chen Chang
(National Tsing Hua University, Taiwan), Huan Ho (University of
California, United States), Min-Chun Hu (National Tsing Hua
University, Taiwan), Chi-Chun Lee (National Tsing Hua University,
Taiwan), Hui-Ju Chen (Mackay Children’s Hospital, Taiwan), Mary
Hsin-Ju Ko (Hsinchu Mackay Memorial Hospital, Taiwan), Chia-Fan Lee
(National Taipei University of Nursing and Health Sciences, Taiwan),
and Pei-Yi Wang (Mackay Medical College, Taiwan)

Deep Learning in Digital Health

Privacy Preserving Loneliness Detection: A Federated Learning Approach ......................... 157
Malik Muhammad Qirtas (University College Cork, Ireland), Dirk Pesch
(University College Cork, Ireland), Evi Zafeiridi (University College
Cork, Ireland), and Eleanor Bantry White (University College Cork,
Ireland)

Combining Deep Learning and Fuzzy Logic to Predict Rare ICD-10 Codes from Clinical Notes ..... 163
Taridzo Chomutare (Norwegian Centre for E-health Research, Norway),
Andrius Budrionis (Norwegian Centre for E-health Research, Norway),
and Hercules Dalianis (Stockholm University, Sweden)

Deep Learning-Based Discrete Calibrated Survival Prediction .............................................. 169
Patrick Fuhlert (Institute of Medical Systems Biology, Center for
Biomedical AI (bAIome), Center for Molecular Neurobiology (ZMNH),
University Medical Center Hamburg-Eppendorf, Germany), Anne Ernst
(Institute of Medical Systems Biology, Center for Biomedical AI
(bAIome), Center for Molecular Neurobiology (ZMNH), University Medical
Center Hamburg-Eppendorf, Germany), Esther Dietrich (Institute of
Medical Systems Biology, Center for Biomedical AI (bAIome), Center for
Molecular Neurobiology (ZMNH), University Medical Center
Hamburg-Eppendorf, Germany), Fabian Westhaeusser (Institute of Medical
Systems Biology, Center for Biomedical AI (bAIome), Center for
Molecular Neurobiology (ZMNH), University Medical Center
Hamburg-Eppendorf, Germany), Karin Kloiber (Institute of Medical
Systems Biology, Center for Biomedical AI (bAIome), Center for
Molecular Neurobiology (ZMNH), University Medical Center
Hamburg-Eppendorf, Germany), and Stefan Bonn (Institute of Medical
Systems Biology, Center for Biomedical AI (bAIome), Center for
Molecular Neurobiology (ZMNH), University Medical Center
Hamburg-Eppendorf, Germany)

MultiGRehab: Developing a Multimodal Biosignals Acquisition and Analysis Framework for
Personalizing Stroke and Cardiac Rehabilitation Based on Adaptive Serious Games ............... 175
Sofia Balula Dias (Khalifa University, United Arab Emirates;
Universidade de Lisboa, Portugal), Leontios J. Hadjileontiadis
(Khalifa University, United Arab Emirates; Aristotle University of
Thessaloniki, Greece), and Herbert F. Jelinek (Khalifa University,
United Arab Emirates)
Medical Image & Text Analysis

CurvMRI: A Curvelet Transform-Based MRI Approach for Alzheimer’s Disease Detection  .......... 178
Chahd Chabib (Khalifa University, UAE), Leontios Hadjileontiadis (Khalifa University, UAE; Aristotle University of Thessaloniki, Greece), Sherlyn Jemimah (Khalifa University, UAE), and Aamna Al Shehhi (Khalifa University, UAE)

Fatty Liver Diagnosis Using Deep Learning in Ultrasound Image ........................................ 185
Chun-Hsien Wu (National Yang Ming Chiao Tung University, Taiwan), Che-Lun Hung (National Yang Ming Chiao Tung University, Taiwan), Teng-Yu Lee (Taiichung Veterans General Hospital, Taiwan), Chun-Ying Wu (National Yang Ming Chiao Tung University, Taiwan), and William Cheng-Chung Chu (Tunghai University, Taiwan)

Maxx Richard Rahman (Saarland University, Germany), Jacob Bejder (University of Copenhagen, Denmark), Thomas Christian Bonne (University of Copenhagen, Denmark), Andreas Breenfeldt Andersen (University of Copenhagen, Denmark), Jesús Rodríguez Huertas (University of Granada, Spain), Reid Aikin (World Anti-Doping Agency, Canada), Nikolai Baastrup Nordsborg (University of Copenhagen, Denmark), and Wolfgang Maass (Saarland University, Germany)

Data Knowledge & Management

A Comprehensive and Holistic Health Database ................................................................. 202
Melissa J Morine (Vydiant, USA), Corrado Priami (University of Pisa, Italy), Edith Coronado (Vydiant, USA), Juliana Haber (Wild Rose Research, USA), and Jim Kaput (Vydiant, USA)

PHASE: Security Analyzer for Next-Generation Smart Personalized Smart Healthcare System ...... 208
Nur Imtiazul Haque (Florida International University, USA) and Mohammad Ashiqur Rahman (Florida International University, USA)

Knowledge Management in a Healthcare Enterprise: Creation of a Digital Knowledge Repository ......................................................... 215
Lee Solomon (Kennesaw State University, USA), Reddy Bhavya Gudi (Kennesaw State University, USA), Humera Asfandiyar (Kennesaw State University, USA), Sweta Sneha (Kennesaw State University, USA), and Hossain Shahriar (Kennesaw State University, USA)

IEEE Digital Health Security & Privacy Symposium

Security-Privacy

DeepCAD: A Stand-Alone Deep Neural Network-Based Framework for Classification and Anomaly Detection in Smart Healthcare Systems .................................................. 218
Nur Imtiazul Haque (Florida International University, USA), Mohammad Ashiqur Rahman (Florida International University, USA), and Sheikh Iqbal Ahamed (Department of Computer Science, Marquette University, USA)
Towards Strengthening the Security of Healthcare Devices Using Secure Configuration
Provenance ............................................................................................................................................. 228
   Ragib Hasan (University of Alabama at Birmingham, USA)

Contactless Authentication for Wearable Devices Using RFID .............................................................. 234
   Valerio Bellandi (Università degli Studi di Milano, Italy), Paolo Ceravolo (Università degli Studi di Milano, Italy), Mauro Conti (Università degli Studi di Padova, Italy), and Maryam Ehsanpour (Università degli Studi di Padova, Italy)

Author Index ............................................................................................................................................... 241