2021 IEEE 34th International Symposium on Computer-Based Medical Systems (CBMS 2021)

Virtual Conference 7 – 9 June 2021



IEEE Catalog Number: CFP21CBM-POD **ISBN:**

978-1-6654-3107-1

Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

*** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

CFP21CBM-POD
978-1-6654-3107-1
978-1-6654-4121-6
2372-918X

Additional Copies of This Publication Are Available From:

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400 Fax: (845) 758-2633 E-mail: curran@proceedings.com Web: www.proceedings.com



2021 34th International Symposium on Computer-Based Medical Systems (CBMS) CBMS 2021

Table of Contents

Welcome from the CBMS 2021 General Co-Chairs .xxii
Organizing Committee xxiii
Programme Committee .xxiv

Biomedical Signal and Image Processing

Automated Segmentation of the Central Serous Chorioretinopathy Fluid Regions using Optical Coherence Tomography Scans .1. Joaquim de Moura (Universidade da Coruña, Spain), Jorge Novo (Universidade da Coruña, Spain), Marcos Ortega (Universidade da Coruña, Spain), Noelia Barreira (Universidade da Coruña, Spain), and Manuel G. Penedo (Universidade da Coruña, Spain) Automatic Segmentation and Estimation of Ischemic Regions in OCT Angiography Scans .7..... Macarena Díaz (Centro de Investigación CITIC, Universidade da Coruña, Spain; Grupo VARPA, Instituto de Investigación Biomédica de A Coruña (INIBIC)), Plácido L. Vidal (Centro de Investigación CITIC, Universidade da Coruña, Spain; Grupo VARPA, Instituto de Investigación Biomédica de A Coruña (INIBIC)), Jorge Novo (Centro de Investigación CITIC, Universidade da Coruña, Spain; Grupo VARPA, Instituto de Investigación Biomédica de A Coruña (INIBIC)), Marcos Ortega (Centro de Investigación CITIC, Universidade da Coruña, Spain; Grupo VARPA, Instituto de Investigación Biomédica de A Coruña (INIBIC)), and Manuel G. Penedo (Centro de Investigación CITIC, Universidade da Coruña, Spain; Grupo VARPA, Instituto de Investigación Biomédica de A Coruña (INIBIC)) Comparative and Behavioural Analysis of a Diffuse Paradigm for the Evaluation of Diabetic Macular Edema in OCT Images .13..... Plácido L. Vidal (Universidade da Coruña, Spain), Joaquim de Moura (Universidade da Coruña, Spain), Macarena Díaz (Universidade da Coruña, Spain), Jorge Novo (Universidade da Coruña, Spain), and Marcos Ortega (Universidade da Coruña, Spain)

Automatic Detection of Tonic-Clonic and Myoclonic Epileptic Seizures Using Prefrontal Electroencephalography (EEG) .19. <i>Ana Sofia Carmo (Instituto de Telecomunicações, Instituto Superior</i> <i>Técnico, Portugal), Mariana Abreu (Instituto de Telecomunicações,</i> <i>Instituto Superior Técnico, Portugal), Hugo Plácido da Silva</i> <i>(Instituto de Telecomunicações, Instituto Superior Técnico, Portugal),</i> <i>and Ana Luísa Nobre Fred (Instituto de Telecomunicações, Instituto</i> <i>Superior Técnico, Portugal)</i>
Hierarchical Visual Concept Interpretation for Medical Image Classification .25 Mohammed Khaleel (Iowa State University, USA), Wallapak Tavanapong (Iowa State University, USA), Johnny Wong (Iowa State University, USA), Junghwan Oh (University of North Texas, USA), and Piet de Groen (University of Minnesota, USA)
Tumor Segmentation in Brain MRI: U-Nets Versus Feature Pyramid Network .31 Sourodip Ghosh (KIIT University, India) and K.C. Santosh (KC's PAMI Research Lab – Computer Science, University of South Dakota, USA)
NanoNet: Real-Time Polyp Segmentation in Video Capsule Endoscopy and Colonoscopy .37 Debesh Jha (SimulaMet, Norway; UiT The Arctic University of Norway, Norway), Nikhil Kumar Tomar (SimulaMet, Norway), Sharib Ali (Institute of Biomedical Engineering, University of Oxford, UK; Oxford NIHR Biomedical Research Centre, UK), Michael A. Riegler (SimulaMet, Norway), Håvard D. Johansen (UiT The Arctic University of Norway, Norway), Dag Johansen (UiT The Arctic University of Norway, Norway), Thomas de Lange (Bærum Hospital, Norway; Augere Medical AS, Norway; Sahlgrenska University Hospital-Mölndal Hospital, Sweden; Sahlgrenska Academy, University of Gothenburg, Sweden), and Pål Halvorsen (SimulaMet, Norway; Oslo Metropolitan University, Norway)
Black Hole Algorithm with Convolutional Neural Networks for the Creation of a Brain-Switch using Visual Perception .44 Fabio R. Llorella (Universitat de Girona, Spain), José M. Azorín (Brain-Machine Interface Systems Lab, Miguel Hernández University of Elche, Spain), and Gustavo Patow (Universitat de Girona, Spain)
Autism Spectrum Disorder Diagnosis Based on Trajectories of Eye Tracking Data .50 Thiago V. Cardoso (School of Arts, Sciences and Humanities (EACH), University of Sao Paulo (USP), Brazil), Gabriel C. Michelassi (School of Arts, Sciences and Humanities (EACH), University of Sao Paulo (USP), Brazil), Felipe O. Franco (Interunit PostGraduate Program on Bioinformatics, Institute of Mathematics and Statistics (IME), (USP)), Fernando M. Sumiya (University of Sao Paulo's School of Medicine, Brazil), Joana Portolese (University of Sao Paulo's School of Medicine, Brazil), Helena Brentani (University of Sao Paulo's School of Medicine, Brazil), Ariane Machado-Lima (School of Arts, Sciences and Humanities (EACH), University of Sao Paulo (USP), Brazil), and Fátima L. S. Nunes (School of Arts, Sciences and Humanities (EACH), University of Sao Paulo (USP), Brazil)

Sequential Pattern Mining of Large Combinable Items with Values for a Set-of-Items Recommendation .56 Hieu Hanh Le (Tokyo Institute of Technology, Japan), Yutaka Horino (Tokyo Institute of Technology, Japan), Tomoyoshi Yamazaki (University of Miyazaki Hospital, Japan), Kenji Araki (University of Miyazaki Hospital, Japan), and Haruo Yokota (Tokyo Institute of Technology, Japan)
 Identification of Signs of Depression Relapse using Audio-Visual Cues: A Preliminary Study.62 Muhammad Muzammel (LISSI, Université Paris-Est Créteil (UPEC), France), Alice Othmani (LISSI, Université Paris-Est Créteil (UPEC), France), Himadri Mukherjee (SMART Research Lab, New York University, UAE), and Hanan Salam (SMART Research Lab, New York University, UAE)
Predictive Analytics Based on Open Source Technologies for Acute Respiratory Distress Syndrome .68
Vaggelis Chaniotakis (FORTH-ICS, Greece), Lefteris Koumakis (FORTH-ICS, Greece), Haridimos Kondylakis (FORTH-ICS, Greece), George Notas (University of Crete, Greece), Dimitris Plexousakis (FORTH-ICS, Greece), and Manolis Tsiknakis (FORTH-ICS, Greece)

Biomedical Signal, Image Processing and Data Mining in Healthcare

An End-to-End 3D ConvLSTM-Based Framework for Early Diagnosis of Alzheimer's Disease from Full-Resolution Whole-Brain sMRI Scans .74 Selene Tomassini (Marche Polytechnic University, Italy), Nicola Falcionelli (Marche Polytechnic University, Italy), Paolo Sernani (Marche Polytechnic University, Italy), Henning Müller (University of Applied Sciences Western Switzerland, Switzerland), and Aldo Franco Dragoni (Marche Polytechnic University, Italy)
Ret-GAN: Retinal Image Enhancement using Generative Adversarial Networks .79 K.C. Santosh (KC's PAMI Research Lab – Computer Science, University of South Dakota, USA), Sourodip Ghosh (KIIT University, India), and Moinak Bose (KIIT University, India)
Motor Imagery EEG Signal Classification Based on Deep Transfer Learning .85 Mingnan Wei (Xi'an Jiaotong-Liverpool University, China), Rui Yang (Xi'an Jiaotong-Liverpool University, China), and Mengjie Huang (Xi'an Jiaotong-Liverpool University, China)
Sperm Cell Segmentation in Digital Micrographs Based on Convolutional Neural Networks using U-Net Architecture .91 Roy Melendez (Pontificia Universidad Católica del Perú, Postgraduate School, Perú), César Beltrán Castañón (Pontificia Universidad Católica del Perú, Postgraduate School, Perú), and Rosario Medina-Rodríguez

(Pontificia Universidad Católica del Perú, Postgraduate School, Perú)

Data Analysis and Knowledge Discovery

Facilitating CPAP Adherence with Personalized Recommendations Using Artificial Neural Networks .97..... Matheus Araujo (University of Minnesota, USA), Tara Pereira (University of Minnesota, USA), Jaideep Srivastava (University of Minnesota, USA), and Conrad Iber (M Health Fairview, Minnesota) Classification of Static Infrared Images using Pre-Trained CNN for Breast Cancer Detection.101.... Caroline B. Gonçalves (Federal University of Uberlandia, Brazil), Jefferson R. Souza (Federal University of Uberlandia, Brazil), and Henrique Fernandes (Federal University of Uberlandia, Brazil) A Fully Automated Deep Learning Pipeline to Assess Muscle Mass in Brain Tumor Patients .107.... Radvile Mauricaite (Computational Oncology Laboratory, Institute of Global Health Innovation Imperial College London, United Kindgdom), Ella Mi (Computational Oncology Laboratory, Institute of Global Health Innovation Imperial College London, United Kindgdom), Jiarong Chen (Clinical Experimental Center Jiangmen Central Hospital, Affiliated Jiangmen Hospital of Sun Yat-sen University, China), Andrew Ho (Norfolk and Norwich University Hospitals, United Kindgdom), Lillie Pakzad-Shahabi (John Fulcher Neuro-Oncology Laboratory, Imperial College London, United Kindgdom), and Matt Williams (Computational Oncology Laboratory, Institute of Global Health Innovation Imperial College London, United Kindgdom) Comparison of Automated Volume Extraction with FreeSurfer and FastSurfer for Early Alzheimer's Disease Detection with Machine Learning .113..... Louise Bloch (University of Applied Sciences and Arts Dortmund, Germany; University Hospital Essen, Germany) and Christoph M. Friedrich (University of Applied Sciences and Arts Dortmund, Germany; University Hospital Essen, Germany)

Data Analysis and Visualization

I-CovidVis - A Visual Analytics Tool for Interoperable Healthcare Databases using Graphs .125.... Claudio D. G. Linhares (Universidade de São Paulo - USP, Brazil), Daniel M. Lima (Universidade de São Paulo - USP, Brazil), Christian C. Bones (Universidade de São Paulo - USP, Brazil), Marina F. S. Rebelo (Universidade de São Paulo - USP, Brazil), Marco A. Gutierrez (Universidade de São Paulo - USP, Brazil), Caetano Traina Jr. (Universidade de São Paulo - USP, Brazil), and Agma J. M. Traina (Universidade de São Paulo - USP, Brazil) Hyperspectral Signal Analysis for Thyroid Neoplasm Typification on Infrared Spectrum .131..... Matheus de Freitas Oliveira Baffa (University of São Paulo, Brazil), Luciano Bachmann (University of São Paulo, Brazil), Thiago Martini Pereira (Federal University of São Paul, Brazil), and Joaquim Cezar Felipe (University of São Paulo, Brazil) Is it a Good Time to Survey you? Cognitive Load Classification from Blood Volume Pulse .137..... Aneta Lisowska (Institute of Computing Science Poznań University of Technology, Poland), Szymon Wilk (Institute of Computing Science Poznań University of Technology, Poland), and Mor Peleg (University of Haifa, Israel) Classification of Autism Spectrum Disorder Severity Using Eye Tracking Data Based on Visual Attention Model 142..... Mirian C. Revers (University of Sao Paulo's School of Medicine, Brazil), Jessica S. Oliveira (School of Arts, Sciences and Humanities, University of Sao Paulo, Brazil), Felipe O. Franco (Interunit PostGraduate Program on Bioinformatics, Institute of Mathematics and Statistics, University of Sao Paulo, Brazil), Joana Portolese (University of Sao Paulo's School of Medicine, Brazil), Thiago V. Cardoso (School of Arts, Sciences and Humanities, University of Sao Paulo, Brazil), Andréia F. Silva (University of Sao Paulo's School of Medicine, Brazil), Ariane Machado-Lima (School of Arts, Sciences and Humanities, University of Sao Paulo, Brazil), Fátima L. S. Nunes (School of Arts, Sciences and Humanities, University of Sao Paulo, Brazil), and Helena Brentani (University of Sao Paulo's School of Medicine, Brazil) DETR and YOLOv5: Exploring Performance and Self-Training for Diabetic Foot Ulcer Detection.148 Raphael Brüngel (University of Applied Sciences and Arts Dortmund, Germany) and Christoph M. Friedrich (University of Applied Sciences and Arts Dortmund, Germany; Institute for Medical Informatics, Biometry and Epidemiology (IMIBE), University Hospital Essen, Germany) Personalised Short-Term Glucose Prediction via Recurrent Self-Attention Network 154..... Ran Cui (The Australian National University, Australia), Chirath Hettiarachchi (The Australian National University, Australia), Christopher J Nolan (The Australian National University, Australia), Elena Daskalaki (The Australian National University, Australia), and Hanna Suominen (University of Turku, Finland)

Data Mining in Healthcare

Prediction of ICU Admission for COVID-19 Patients: A Machine Learning Approach Based on Complete Blood Count Data .160 Lorenzo Famiglini (Università degli Studi di Milano-Bicocca, Italy), Giorgio Bini (Università degli Studi di Milano-Bicocca, Italy), Anna Carobene (Laboratory Medicine, IRCCS San Raffaele Scientific Institute, Italy), Andrea Campagner (Università degli Studi di Milano-Bicocca, Italy), and Federico Cabitza (Università degli Studi di Milano-Bicocca, Italy)
3D Deep Learning for Anatomical Structure Segmentation in Multiple Imaging Modalities .166 Barbara Villarini (University of Westminster, United Kingdom), Hykoush Asaturyan (University of Westminster, United Kingdom), Sila Kurugol (Boston Children's Hospital & Harvard Medical School, USA), Onur Afacan (Boston Children's Hospital & Harvard Medical School, USA), Jimmy D. Bell (University of Westminster, United Kingdom), and E. Louise Thomas (University of Westminster, United Kingdom)
Optimizing Recurrent Neural Network Architectures for De Novo Drug Design .172 Beatriz P. Santos (University of Coimbra, Portugal), Maryam Abbasi (University of Coimbra, Portugal), Tiago Pereira (University of Coimbra, Portugal), Bernardete Ribeiro (University of Coimbra, Portugal), and Joel P. Arrais (University of Coimbra, Portugal)
Improvements in Lymphocytes Detection using Deep Learning with a Preprocessing Stage .178 Rodrigo Escobar Díaz Guerrero (BMD Software & University of Aveiro, Portugal) and José Luís Oliveira (University of Aveiro, Portugal)
Detecting COVID-19 from Breathing and Coughing Sounds using Deep Neural Networks .183 Mina A. Nessiem (University of Augsburg, Germany), Mostafa M. Mohamed (University of Augsburg, Germany), Harry Coppock (Imperial College London, UK), Alexander Gaskell (Imperial College London, UK), and Björn W. Schuller (University of Augsburg, Germany; Imperial College London, UK)
Enhanced CNN-Based Gaze Estimation on Wireless Capsule Endoscopy Images .189 Panagiota Gatoula (University of Thessaly, Greece), George Dimas (University of Thessaly, Greece), Dimitris K. Iakovidis (University of Thessaly, Greece), and Anastasios Koulaouzidis (Pomeranian Medical University Szczecin, Poland)
Improved Gastrointestinal Screening: Deep Features using Stacked Generalization .196 Sourodip Ghosh (KIIT University, India) and K.C. Santosh (KC's PAMI Research Lab – Computer Science, University of South Dakota, USA)
Semi-Supervised Learning for Cervical Precancer Detection .202 Sandeep Angara (National Library of Medicine, National Institutes of Health, USA), Peng Guo (National Library of Medicine, National Institutes of Health, USA), Zhiyun Xue (National Library of Medicine, National Institutes of Health, USA), and Sameer Antani (National Library of Medicine, National Institutes of Health, USA)

Decision Support and Recommendation Systems

Treatment Recommendations for COVID-19 Patients Along with Robust Explanations .207 Panagiotis Symeonidis (University of the Aegean, Greece), Christos Andras (International Hellenic University, Greece), and Markus Zanker (Free University of Bozen-Bolzano, Italy)
Recommending What Drug to Prescribe Next for Accurate and Explainable Medical Decisions .213 Panagiotis Symeonidis (University of the Aegean, Greece), Stergios Chairistanidis (Aristotle University of Thessaloniki, Greece), and Markus Zanker (Free University of Bolzano, Italy)
A Meta-Path-Based Prediction Method for Disease Comorbidities 219 Eduardo P. García del Valle (ETS Ingenieros Informáticos, Universidad Politécnica de Madrid, Pozuelo de Alarcón, Spain), Lucía Prieto Santamaría (Centro de Tecnología Biomédica, Universidad Politécnica de Madrid, Pozuelo de Alarcón, Spain), Gerardo Lagunes García (Centro de Tecnología Biomédica, Universidad Politécnica de Madrid, Pozuelo de Alarcón, Spain), Massimiliano Zanin (Instituto de Física Interdisciplinar y Sistemas Complejos IFISC, Campus UIB, Palma de Mallorca, Spain), Ernestina Menasalvas Ruiz (Centro de Tecnología Biomédica, ETS Ingenieros Informáticos, Universidad Politécnica de Madrid, Spain), and Alejandro Rodríguez-González (Centro de Tecnología Biomédica, ETS Ingenieros Informáticos, Universidad Politécnica de Madrid, Spain)
Predicting Opioid Prescriptions Based on Patient Demographics in MIMIC-IV .225 Snigdha Kodela (School of Informatics and Computing, Indiana University Purdue University Indianapolis, USA), Jahnavi Pinnamraju (School of Informatics and Computing, Indiana University Purdue University Indianapolis, USA), Judy W. Gichoya (Emory University, USA), and Saptarshi Purkayastha (School of Informatics and Computing, Indiana University Purdue University Indianapolis, USA)
An Intelligent Drug Delivery System for Neuromuscular Blockade in Healthcare .231 Jorge Silva (University of Porto, Portugal), Teresa Mendonça (University of Porto, Portugal), and Paula Rocha (University of Porto, Portugal)
Assessing the Clinical Validity of Attention-Based and SHAP Temporal Explanations for Adverse Drug Event Predictions .235 Jonathan Rebane (Stockholm University, Sweden), Isak Samsten (Stockholm University, Sweden), Panteleimon Pantelidis (Stockholm University, Sweden), and Panagiotis Papapetrou (Stockholm University, Sweden)
Exploiting Clinical Staging Data to Constrain Pseudo-Time Modelling of Disease Progression.241 Seyed Erfan Sajjadi (Brunel Univeristy London, UK) and Allan Tucker (Brunel Univeristy London, UK)

Monitoring Breast Cancer Neoadjuvant Treatment using Thermographic Time Series .247......
Adriel S. Araujo (Institute of Computing, Fluminense Federal
University, Brazil), Milena H. S. Issa (Faculty of Medicine,
Fluminense Federal University, Brazil), Petrucio R. T. Medeiros
(Institute of Computing, Fluminense Federal University, Brazil), Ángel
Sánchez (Technical School of Computer Science, Rey Juan Carlos
University, Spain), Débora C. Muchaluat-Saade (Institute of Computing,
Fluminense Federal University, Brazil), and Aura Conci (Institute of
Computing, Fluminense Federal University, Brazil)

Healthcare Data and Knowledge Management

Multilevel Clustering Explainer: An Explainable Approach to Electronic Health Records .253..... José M Clementino (Institute of Mathematics and Computer Sciences, University of São Paulo (USP)- São Carlos), Bruno S. Faiçal (Institute of Mathematics and Computer Sciences, University of São Paulo (USP)-São Carlos), Christian C. Bones (Institute of Mathematics and Computer Sciences, University of São Paulo (USP)- São Carlos), Caetano Traina (Institute of Mathematics and Computer Sciences, University of São Paulo (USP)- São Carlos), Marco Á. Gutierrez (Heart Institute Clinical Hospital, Faculty of Medicine, University of São Paulo (HCFMUSP)- São Paulo), and Agma J. M. Traina (Institute of Mathematics and Computer Sciences, University of São Paulo (USP)- Šão Carlos) Evaluating a Longitudinal Synthetic Data Generator using Real World Data .259..... Zhenchen Wang (CPRD, Medicines and Healthcare products Regulatory Agency, UK), Puja Myles (CPRD, Medicines and Healthcare products Regulatory Agency, UK), Anu Jain (CPRD, Medicines and Healthcare products Regulatory Agency, UK), James L. Keidel (Sensyne Health, UK), Roberto Liddi (Sensyne Health, UK), Carmelo Velardo (Sensyne Health, UK), Lucy Mackillop (Sensyne Health, UK), and Allan Tucker (Brunel University London, UK) Evaluating Hierarchical Medical Workflows using Feature Importance .265..... Urja Pawar (Munster Technological University, Ireland), Christopher T. Culbert (McKesson, England), and Ruairi O'Reilly (Munster Technological University, Ireland) Towards Clustering Human Behavioral Patterns Based on Digital Phenotyping 271..... José Daniel P. Ribeiro Filho (Federal Institute of Maranhão, Brazil; Federal University of Maranhão, Brazil), Ariel S. Teles (Federal Institute of Maranhão, Brazil; Federal University of Maranhão, Brazil), Francisco J.S. Silva (Federal University of Maranhão, Brazil), and Luciano R. Coutinho (Federal University of Maranhão, Brazil) APEHR: Automated Prognosis in Electronic Health Records using Multi-Head Self-Attention .277. Alexander Yc Florez (University of Sao Paulo, Brazil), Lucas Scabora (University of Sao Paulo, Brazil), Danilo M Eler (Sao Paulo State University, Brazil), and Jose F Rodrigues (University of Sao Paulo, Brazil)

beHEALTHIER: A Microservices Platform for Analyzing and Exploiting Healthcare Data .283 Argyro Mavrogiorgou (University of Piraeus, Greece), Spyridon Kleftakis (University of Piraeus, Greece), Konstantinos Mavrogiorgos (University of Piraeus, Greece), Nikolaos Zafeiropoulos (University of Piraeus, Greece), Andreas Menychtas (BioAssist S.A., Greece), Athanasios Kiourtis (University of Piraeus, Greece), Ilias Maglogiannis (University of Piraeus, Greece), and Dimosthenis Kyriazis (University of Piraeus, Greece)
Classification and Localization Consistency Regularized Student-Teacher Network for Semi-Supervised Cervical Cell Detection .289 Menglu Zhang (Shenzhen University, China), Xuechen Li (Shenzhen University, China; Guangdong Laboratory of Artificial Intelligence and Digital Economy (SZ), Shenzhen University, China), and Linlin Shen (Shenzhen University, China; Guangdong Laboratory of Artificial Intelligence and Digital Economy (SZ), Shenzhen University, China)
 Love thy Neighbours: A Framework for Error-Driven Discovery of Useful Neighbourhoods for One-Step Forecasts on EMA Data 295

Human-Computer Interaction (HCI) in Healthcare

CHART-ADAPT: Enabling Actionable Analytics at the Critical Care Unit Bedside .301..... Laura Moss (NHS Greater Glasgow and Clyde, UK), Martin Shaw (NHS Greater Glasgow and Clyde, UK), Ian Piper (University of Glasgow, UK), John Kinsella (University of Glasgow, UK), and Christopher Hawthorne (NHS Greater Glasgow and Clyde, UK)

User-Centric vs Whole-Stream Learning for EMA Prediction .307 Saijal Shahania (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany), Vishnu Unnikrishnan (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany), Rüdiger Pryss (Institute of Clinical Epidemiology and Biometry, University of Würzburg, Germany), Robin Kraft (Institute of Databases and Information Systems, Ulm University, Germany), Johannes Schobel (DigiHealth Institute, Neu-Ulm University of Applied Sciences, Germany), Ronny Hannemann (WSAudiology, Sivantos GmbH, Germany), Winfried Schlee (University of Regensburg, Germany), and Myra Spiliopoulou (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany)
How Healthcare Professionals Comprehend Process Models — An Empirical Eye Tracking Analysis 313 Michael Winter (Ulm University, Germany), Cynthia Bredemeyer
(University of Würzburg, Germany), Manfred Reichert (Ulm University, Germany), Heiko Neumann (Ulm University, Germany), Thomas Probst (Danube University Krems, Austria), and Rüdiger Pryss (University of Würzburg, Germany)
Analysing Games for Health through Users' Opinion Mining .319 Renato Santos (University of Coimbra, Portugal), Joel P. Arrais (DEI – CISUC, University of Coimbra, Portugal), and Paula Alexandra Silva (DEI – CISUC, University of Coimbra, Portugal)

Information Technologies in Healthcare

More Agile than Ever: The Case Study of the Development of a Dashboard for the Management of ICU Beds During the Coronavirus Outbreak .324 Itamir de Morais Barroca Filho (Federal University of Rio Grande do Norte - UFRN, Brazil), Silvio Costa Sampaio (Federal University of Rio Grande do Norte - UFRN, Brazil), Anderson Paiva Cruz (Federal University of Rio Grande do Norte - UFRN, Brazil), Victor Hugo Freire Ramalho (Federal University of Rio Grande do Norte - UFRN, Brazil), Jefferson Augusto Rodrigues de Azevedo (Federal University of Rio Grande do Norte - UFRN, Brazil), and Atila Caetano da Silveira (Federal University of Rio Grande do Norte - UFRN, Brazil) Supporting IoT-Based Applications to Combat the Aedes Aegypti Mosquito: A Case in Brazil .330. Henrique de A. Silva (Univ. São Paulo, Brazil), Elias Adriano (DACOM-UTFPR, Brazil), Denise Scatolini (Sao Carlos City Hall, Brazil), and Rosana T. Vaccare Braga (Univ. São Paulo, Brazil) Risk Management of a Low-Cost Insulin Infusion Pump: A Case Study with a Brazilian Company.336 Aldo Martinazzo (Federal University of São Paulo, Brazil), Luiz Eduardo Galvão Martins (Federal University of São Paulo, Brazil), Sebastião Vagner Aredes (Deltalife), and Tatiana Sousa Cunha (Federal University of São Paulo, Brazil)

Public Perception of the German COVID-19 Contact-Tracing App Corona-Warn-App .342..... Felix Beierle (University of Würzburg, Germany), Uttam Dhakal (Technische Universität Berlin, Germany), Caroline Cohrdes (Robert Koch Institute, Germany), Sophie Eicher (Robert Koch Institute, Germany), and Rüdiger Pryss (University of Würzburg, Germany)

Intelligent Medical Devices and Smart Technologies

Empowering Home Health Monitoring of Covid-19 Patients with Smartwatch Position and Fitness Tracking .348. Silvia Panicacci (University of Pisa), Gianluca Giuffrida (University of Pisa), Massimiliano Donati (University of Pisa), Alberto Lubrano (University of Pisa), Alessio Ruiu (IngeniArs S.r.l., Italy), and Luca Fanucci (University of Pisa) Circadian Conditional Granger Causalities on Ecological Momentary Assessment Data from an mHealth App 354 Noor Jamaludeen (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany), Vishnu Unnikrishnan (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany), Ruediger Pryss (Institute of Clinical Epidemiology and Biometry, University of Wurzburg, Germany), Johannes Schobel (Institute DigiHealth, Neu-Ulm University of Applied Sciences, Neu-Ulm, Germany), Winfried Schlee (University of Regensburg, Germany), and Myra Spiliopoulou (Knowledge Management & Discovery Lab, Otto-von-Guericke University Magdeburg, Germany) A Nonverbal Recognition Method to Assist Speech .360..... Fernando Meloni (University of São Paulo, Brazil), Bianca Sicchieri (University of São Paulo, Brazil), Patricia Mandrá (University of São Paulo, Brazil), Renato Bulcão-Neto (Federal University of Goiás, Brazil), and Alessandra Alaniz Macedo (University of São Paulo, Brazil)

Semantics and Knowledge Representation

A Comparative Analysis of Data Platforms for Rare Diseases .366..... Mariana Sequeira (DETI / IEETA, University of Aveiro, Portugal), João Rafael Almeida (DETI / IEETA, University of Aveiro, Portugal), and José Luís Oliveira (DETI / IEETA, University of Aveiro, Portugal)

Towards Semantic-Awareness for Information Management and Planning in Health Dialogues .37.2 Milene Santos Teixeira (Fondazione Bruno Kessler, Italy), Vinícius Maran (Federal University of Santa Maria, Brazil), and Mauro Dragoni (Fondazione Bruno Kessler, Italy)

Semantic Annotation and Classification of Mammography Images using Ontologies .37.8..... Juliana Wolf Pereira (Federal University of São Carlos, Brazil) and Marcela Xavier Ribeiro (Federal University of São Carlos, Brazil)

Easing the Questioning of Semantic Biomedical Data .384.... Arnaldo Pereira (DETI / IEETA, University of Aveiro, Portugal), Rui Pedro Lopes (CeDRI, Polytechnic Institute of Bragança, Portugal), and José Luís Oliveira (DETI / IEETA, University of Aveiro, Portugal)

Radiomics and Radiogenomics

 BEAUT: A Radiomic Approach to Identify Potential Lumbar Fractures in Magnetic Resonance Imaging .389. Jonathan S. Ramos (Institute of Mathematics and Computer Science (ICMC), University of São Paulo (USP)), Jamilly G. Maciel (Ribeirão Preto Medical School (FMRP), University of São Paulo (USP)), Mirela T. Cazzolato (Institute of Mathematics and Computer Science (ICMC), University of São Paulo (USP)), Caetano Traina (Institute of Mathematics and Computer Science (ICMC), University of São Paulo (USP)), Caetano Traina (Institute of Mathematics and Computer Science (ICMC), University of São Paulo (USP)), Marcello H. Nogueira-Barbosa (Ribeirão Preto Medical School (FMRP), University of São Paulo (USP)), and Agma J.M. Traina (Institute of Mathematics and Computer Science (ICMC), University of São Paulo (USP))
A Multi-Expert System to Detect COVID-19 Cases in X-ray Images .395 Valerio Guarrasi (University Campus Bio-Medico of Rome, Italy; Control, and Management Engineering, Sapienza University of Rome, Italy), Natascha Cluadia D'Amico (Centro Diagnostico Italiano S.p.A., Milan, Italy; University Campus Bio-Medico of Rome, Italy), Rosa Sicilia (University Campus Bio-Medico of Rome, Italy), Ermanno Cordelli (University Campus Bio-Medico of Rome, Italy), and Paolo Soda (University Campus Bio-Medico of Rome, Italy)
Deep Embedded Clustering Algorithm for Clustering PACS Repositories .401 Teo Manojlović (University of Rijeka, Croatia), Matija Milanič (University of Ljubljana, Slovenia; Jozef Stefan Institute, Slovenia), and Ivan Štajduhar (University of Rijeka, Croatia)
 Exploring Deep Pathomics in Lung Cancer .407. Charles Z. Liu (Unit of Computer Systems & Bioinformatics, University Campus Bio-Medico di Roma, Italy), Rosa Sicilia (Unit of Computer Systems & Bioinformatics, University Campus Bio-Medico di Roma, Italy), Matteo Tortora (Unit of Computer Systems & Bioinformatics, University Campus Bio-Medico di Roma, Italy), Ermanno Cordelli (Unit of Computer Systems & Bioinformatics, University Campus Bio-Medico di Roma, Italy), Lorenzo Nibid (Anatomical Pathology, University Campus Bio-Medico di Roma, Italy), Giovanna Sabarese (Anatomical Pathology, University Campus Bio-Medico di Roma, Italy), Giuseppe Perrone (Anatomical Pathology, University Campus Bio-Medico di Roma, Italy), Sara Ramella (Radiation Oncology, University Campus Bio-Medico di Roma, Italy), and Paolo Soda (Unit of Computer Systems & Bioinformatics, University Campus Bio-Medico di Roma, Italy)

ST: CBMEH - Computational based Biomarkers for Mental and **Emotional Health**

On the Identification of Chronodisruption-Based Biomarkers to Estimate Pregnancy Attempt Time .413..... Ana G. Rúa (University of Oviedo, Spain), Noelia Rico-Pachón (University of Oviedo, Spain), Ana Alonso (University of Oviedo, Spain), Elena Díaz (University of Oviedo, Spain), and S. Irene Díaz-Rodríguez (University of Oviedo, Spain)

A Preliminary Study on Automatic Detection and Filtering of Artifacts from EEG Signals .420 Fernando Moncada (University of Oviedo, Spain), Víctor M. González (University of Oviedo, Spain), Víctor Álvarez (University of Oviedo, Spain), Beatriz García (Hospital of Burgos, Spain), and José R. Villar (University of Oviedo)
Preliminary Analysis of Features Based on GSR/RR Signals for Spinal Cord Injury Patients .426 Nagore Sagastibeltza (University of the Basque Country, Spain), Asier Salazar-Ramirez (University of the Basque Country, Spain), Raquel Martinez (University of the Basque Country, Spain), Maitane Martinez-Eguiluz (University of the Basque Country, Spain), Javier Muguerza (University of the Basque Country, Spain), Nora Cívicos Sánchez (Cruces University Hospital, Spain), Montserrat Cuadrado (Cruces University Hospital, Spain), and María Luisa Jauregui Abrisqueta (Cruces University Hospital, Spain)
Diagnosing Schizophrenia from Activity Records using Hidden Markov Model Parameters .432 Matthias Boeker (SimulaMet, Norway; Karlsruhe Institute of Technology, Germany), Michael A. Riegler (SimulaMet, Norway), Hugo L. Hammer (SimulaMet, Norway; Oslo Metropolitan University, Norway), Pål Halvorsen (SimulaMet, Norway; Oslo Metropolitan University, Norway), Ole Bernt Fasmer (NORMENT, Haukeland University Hospital, Norway; University of Bergen, Norway), and Petter Jakobsen (NORMENT, Haukeland University Hospital, Norway; University of Bergen, Norway)
Understanding Affective Behaviour from Physiological Signals: Feature Learning Versus Pattern Mining 438 Natalia Mordvanyuk (University of Girona, Spain), Jaume Gauchola (University of Girona, Spain), and Beatriz López (University of Girona, Spain)
 Wearable and Continuous Prediction of Passage of Time Perception for Monitoring Mental Health .444 Lara Orlandic (Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland), Adriana Arza Valdes (Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland), and David Atienza (Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland)
 Optimized Alpha Band Patterns Correlated with Trait Anxiety .450 C. Vidaurre (Public University of Navarre Pamplona, Spain), V. V. Nikulin (Dp. of Neurology, Max Planck Institute for Human Cognitiveand Brain Sciences, Germany; National Research University, Russian), and M. Herrojo Ruiz (University of London, United Kingdom; National Research University, Russian)

ST: Clinical & Biomedical Text Mining

Clinical Report Classification: Continually Learning from User Feedback .455..... Elias Moons (KU Leuven, Belgium) and Marie-Francine Moens (KU Leuven, Belgium)

EPICURE :Ensemble Pretrained Models for Extracting Cancer Mutations from Literature .461 Jiarun Cao (National Centre for Text Mining; The University of Manchester, United Kingdom), Elke M van Veen (Manchester University Hospitals NHS Foundation Trust; The University of Manchester, United Kingdom), Niels Peek (Imaging and Data Science; The University of Manchester, United Kingdom), Andrew G Renehan (The University of Manchester; Christie NHS Foundation Trust, United Kingdom), and Sophia Ananiadou (National Centre for Text Mining; The University of Manchester, United Kingdom)
BioSGAN: Protein-Phenotype Co-Mention Classification Using Semi-Supervised Generative Adversarial Networks .468 Francis Anokye (African Masters in Machine Intelligence (AMMI), African Institute for Mathematical Sciences (AIMS), Rwanda) and Indika Kahanda (School of Computing, University of North Florida, USA)
A GPT-2 Language Model for Biomedical Texts in Portuguese .47.4 Elisa Terumi Rubel Schneider (Pontificia Universidade Católica do Paraná, Brazil), João Vitor Andrioli de Souza (Pontificia Universidade Católica do Paraná, Brazil), Yohan Bonescki Gumiel (Pontificia Universidade Católica do Paraná, Brazil), Claudia Moro (Pontificia Universidade Católica do Paraná, Brazil), and Emerson Cabrera Paraiso (Pontificia Universidade Católica do Paraná, Brazi)
Patient Trajectory Modelling in Longitudinal Data: A Review on Existing Solutions .480 João Figueira Silva (University of Aveiro, Portugal) and Sérgio Matos

(University of Aveiro, Portugal)

ST: Explainable Machine Learning models in Medical Imaging

Convolutional Autoencoder Based Deep Learning Approach for Alzheimer's Disease Diagnosis using Brain MRI .486. Ekin Yagis (University of Essex, United Kingdom), Alba G. Seco De Herrera (University of Essex, United Kingdom), and Luca Citi (University of Essex, United Kingdom) A new Scheme for the Assessment of the Robustness of Explainable Methods Applied to Brain Age Estimation 492 Ahmed Salih (University of Verona, Italy), Ilaria Boscolo Galazzo (University of Verona, Italy), Zahra Raisi-Estabragh (Queen Mary University of London, United Kingdom), Steffen E. Petersen (Queen Mary University of London, United Kingdom), Polyxeni Gkontra (University of Barcelona, Spain), Karim Lekadir (University of Barcelona, Spain), Gloria Menegaz (University of Verona, Italy), and Petia Radeva (University of Barcelona & Computer Vision Center, Spain) Improved Deep Learning Explanations for Prostate Lesion Classification through Grad-CAM and Saliency Map Fusion .498..... Mehmet Akif Gulum (Computer Science Engineering, University of Louisville, United States), Christopher M. Trombley (Computer Science Engineering, University of Louisville, United States), and Mehmed Kantardzic (Computer Science Engineering, University of Louisville, United States)

On Cost-Sensitive Calibrated Uncertainty in Deep Learning: An Application on COVID-19 Detection 503
Biraja Ghoshal (Brunel University, United Kingdom) and Allan Tucker (Brunel University, United Kingdom)
FIRE: Unsupervised bi-Directional Inter-and Intra-Modality Registration using Deep Networks .510
Chengjia Wang (University of Edinburgh, UK), Guang Yang (Imperial
College London, UK), and Giorgos Papanastasiou (University of Essex, UK)
Visual Interpretation of CNN Decision-Making Process using Simulated Brain MRI .515 Edouard Villain (Université de Toulouse, France), Giulia Maria Mattia
(Toulouse NeuroImaging Center, France), Federico Nemmi (Toulouse
NeuroImaging Center, France), Patrice Péran (Toulouse NeuroImaging
Center, France), Xavier Franceries (Centre de Recherche en
Cancérologie de Toulouse, France), and Marie Véronique Le Lann (Université de Toulouse, France)
Explainable AI for COVID-19 CT Classifiers: An Initial Comparison Study .521
Qinghao Ye (University of California, San Diego, USA; Hangzhou Ocean's
Smart Boya Co., Ltd), Jun Xia (Shenzhen Second People's Hospital,
China), and Guang Yang (Royal Brompton Hospital, UK; National Heart

and Lung Institute, Imperial College London, UK)

ST: MedNetImaging2021 – Medical Imaging Systems and Networks

A Deep Clustering Method for Analyzing Uterine Cervix Images Across Imaging Devices .527...... Zhiyun Xue (National Library of Medicine, National Institutes of Health, USA), Peng Guo (National Library of Medicine, National Institutes of Health, USA), Kanan T. Desai (National Cancer Institute, National Institutes of Health, USA), Anabik Pal (National Library of Medicine, National Institutes of Health, USA), Kayode O. Ajenifuja (Obafemi Awolowo University, Nigeria), Clement A. Adepiti (Obafemi Awolowo University, Nigeria), L. Rodney Long (National Library of Medicine, National Institutes of Health, USA), Mark Schiffman (National Cancer Institute, National Institutes of Health, USA), and Sameer Antani (National Library of Medicine, National Institutes of Health, USA)
Dicomization of LSM Fluorescence Composite Microscopic Image with its Bioimaging Information .533....

Yubraj Gupta (University of Aveiro, Portugal), Carlos Costa (University of Aveiro, Portugal), Eduardo Pinho (BMD Software, Portugal), Luís A. Bastião Silva (BMD Software, Portugal), Shibarjun Mandal (Leibniz-Institute of Photonic Technology, Germany), and Ute Neugebauer (Jena University Hospital, Germany)

A Self-Learning Teacher-Student Framework for Gastrointestinal Image Classification .539.....

Henrik L. Gjestang (SimulaMet, Norway), Steven A. Hicks (SimulaMet, Norway; Oslo Metropolitan University, Norway), Vajira Thambawita (SimulaMet, Norway; Oslo Metropolitan University, Norway), Pål Halvorsen (SimulaMet, Norway; Oslo Metropolitan University, Norway), and Michael A. Riegler (SimulaMet, Norway; UIT The Arctic University of Norway) An Architecture to Define Cohorts over Medical Imaging Datasets .545..... João Rafael Almeida (University of Aveiro, Portugal; University of A Coruña, Spain), Eriksson Monteiro (Incrediblepixel, Portugal), and José Luís Oliveira (University of Aveiro, Portugal)

ST: Security of e-Health Systems and Connected Medical Devices

Blockchain Technology in Healthcare: A Scientific and Technological Driving Force .550..... Chang Liu (Boston University), Shu Zhou (Boston University), Irena Vodenska (Boston University), Lou Chitkushev (Boston University), Guanglan Zhang (Boston University), Shahin Gheitanchi (Senior member of IEEE), and Reza Rawassizadeh (Boston University) Towards a Decentralized e-Prescription System using Smart Contracts .556..... Rodrigo Dutra Garcia (Institute of Mathematics and Computer Science, University of São Paulo, Brazil), Gabriel Augusto Zutião (Institute of Mathematics and Computer Science, University of São Paulo, Brazil), Gowri Ramachandran (USC Viterbi School of Engineering, University of Southern California, USA), and Jo Ueyama (Institute of Mathematics and Computer Science, University of São Paulo, Brazil) Learning Health Systems: An Anonymous Network Routing Protocol .562..... Thibaud Ecarot (Université de Sherbrooke, Canada), Benoit Fraikin (Université de Sherbrooke, Canada), Luc Lavoie (Université de Sherbrooke, Canada), Mark McGilchrist (University of Dundee, UK), and Jean-François Ethier (Université de Sherbrooke, Canada) Private Data Sharing in a Secure Cloud-Based Application for Acute Stroke Care .568..... Lúcio H. A. Reis (Amsterdam University Medical Centers, University of Amsterdam, The Netherlands; LabGen/MídiaCom – PPGEET/TET/IC – Universidade Federal Fluminense – UFF, Brazil), Marcela T. de Oliveira (Amsterdam University Medical Centers, University of Amsterdam, The Netherlands), Diogo M. F. Mattos (Amsterdam University Medical Centers, University of Amsterdam, The Netherlands), and Sílvia D. Olabarriaga (Amsterdam University Medical Centers, University of Amsterdam, The Netherlands) Securing Embedded Medical Devices using Dual-Factor Authentication .574..... Saurav Maji (Massachusetts Institute of Technology, USA), Utsav Banerjee (Massachusetts Institute of Technology, USA), Samuel H. Fuller (Analog Devices Inc., USA; Massachusetts Institute of Technology, USA), Rabia Tugce Yazicigil (Boston University, USA), and Anantha P. Chandrakasan (Massachusetts Institute of Technology, USA)

ST: Social Data and Medical Data Analytics

Defining and Monitoring Patient Clusters Based on Therapy Adherence in Sleep Apnea Management .580..... Mourya Karan Reddy Baddam (University of Minnesota, USA), Matheus Araujo (University of Minnesota, USA), and Jaideep Srivastava (University of Minnesota, USA)

BERT Model-Based Approach for Detecting Categories of Tweets in the Field of Eating Disorders (ED) 586
José Alberto Benítez-Andrades (University of León, Spain), José Manuel Alija-Pérez (University of León, Spain), Isaías García-Rodríguez (University of León, Spain), Carmen Benavides (University of León, Spain), Héctor Alaiz-Moretón (University of León, Spain), Rafael Pastor Vargas (Spanish National University for Distance Education (UNED), Spain), and María Teresa García-Ordás (University of León, Spain)
Representation and Knowledge Transfer for Health-Related Rumour Detection .591 Rosa Sicilia (Universitá Campus Bio-Medico di Roma, Italy), Luisa Francini (Universitá Campus Bio-Medico di Roma, Italy), and Paolo Soda (Universitá Campus Bio-Medico di Roma, Italy)
Juxtaposing 5G Coronavirus Tweets with General Coronavirus Tweets During the Early Months of Coronavirus Outbreak .597 Rafi Trad (Knowledge Management and Discovery Lab, Otto-von-Guericke-university Magdeburg, Germany) and Myra Spiliopoulou (Knowledge Management and Discovery Lab, Otto-von-Guericke-university Magdeburg, Germany)
A Recommendation System for Electronic Health Records in the Context of the HOPE Project .603. Ruben Vasallo González (Faculty of Health Sciences, Universitat Oberta de Catalunya, Spain), Antonio Robles-Gómez (Universidad Nacional de Educación a Distancia (UNED), Spain), Rafael Pastor-Vargas (Universidad Nacional de Educación a Distancia (UNED), Spain), Juan M. Haut (Universidad Nacional de Educación a Distancia (UNED), Spain), Nicolás A. Passadore (Comahues Integral Medicine Center, Argentina), Mercedes E. Paoletti (Universidad de Extremadura, Spain), Carlos L. Sánchez Bocanegra (Universidad Nacional de Educación a Distancia (UNED), Spain), Llanos Tobarra (Universidad Nacional de Educación a Distancia (UNED), Spain), Karla A. Chacón-Vargas (Faculty of Health Sciences, Universitat Oberta de Catalunya, Spain), Roberto Hernández Berlinches (Universidad Nacional de Educación a Distancia (UNED), Spain), and Francesc Saigí Rubió (Faculty of Health Sciences, Universitat Oberta de Catalunya, Spain)

Author Index 609