Internet of Things

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Editors

Integrating Artificial Intelligence and IoT for Advanced Health Informatics

AI in the Healthcare Sector

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Preface

The integration of Internet of Things (IoT) and artificial intelligence (AI), two emerging topics in computer communication and networking research, is becoming common practice in many interdisciplinary areas of application, among which smart healthcare plays an important role. Efficient collecting, monitoring, controlling, optimization, modeling, and predicting are the key steps that provide for the integration of AI algorithms and IoT systems. In the smart healthcare field, in which ubiquitous computing and traditional computational methods alone are often inadequate, many advantages and improvements arise when exploiting AI within IoT architectures. AI and IoT techniques, indeed, can play a crucial role to deal with such amounts of heterogeneous, multi-scale, and multi-modal data coming from IoT infrastructures [1]. The different and numerous issues in the healthcare environment requires innovative and advanced methodological, theoretical, and mathematical modelling and the implementation of protocols and computational methods to be effectively addressed [2]. This book explores how the fusion of IoT and AI allows the design of models, methodologies, algorithms, evaluation benchmarks, and tools that can address challenging problems related to health informatics, healthcare, and well-being.

Chapter "Lower-Gait Tracking Application Using Smartphones and Tablets" extends a previous application, the Lower-Body Motion Tracking version 1.0.1 (LGait), introducing a mobility analysis using smartphones and tablets. The proposed system is designed to support the medical qualifying of mobility in various settings, and can be generalized to other applications.

Chapter "One-Class Classification Approach in Accelerometer-Based Remote Monitoring of Physical Activities for Healthcare Applications" proposes an OCC-based HAR architecture with IoT integration. In proposed OCC scheme, the authors utilize artificial data generation (ADG) to generate training data for the negative class based on the target class. Results of an experimental study for our OCC model on a data set consisting of ambulatory and static activities are presented.

Chapter "Detecting and Monitoring Behavioural Patterns in Individuals with Cognitive Disorders in the Home Environment with Partial Annotations" seeks to characterize behavioral signatures of mild cognitive impairment (MCI) and

Alzheimer's disease (AD) dementia. The authors introduce bespoke machine learning techniques accounting for partial annotations to produce behavioral metrics of key symptoms and use these on a novel dataset of longitudinal sensor data from persons with MCI and AD.

Chapter "Toward On-Device Weight Monitoring from Selfie Face Images Using Smartphones" presents an evaluation of several lightweight CNNs such as MobileNet-V2, ShuffleNet-V2, and lightCNN-29 for BMI prediction and obesity classification from facial images captured using smartphones. The comparative analysis is done with heavyweight VGG-16 and ResNet-50 based CNN models.

Chapter "Convergence Between IoT and AI for Smart Health and Predictive Medicine" exhibits a literature review conducted to determine the most important technologies, methodologies, algorithms, and models for smart health systems. In addition, the main benefits and challenges of smart health were explored.

Chapter "An Artificial Intelligence and Internet of Things Platform for Healthcare and Industrial Applications" presents an artificial intelligence (AI) and Internet of Things (IOT) based platform. For applications where an AI is needed, e.g., face/object/scene detection/classification/recognition, an AI engine is presented, while for applications where large-scale searching is needed, a search engine is presented.

Chapter "Methods in Digital Mental Health: Smartphone-Based Assessment and Intervention for Stress, Anxiety, and Depression" presents an early attempt to codify the highly interdisciplinary relationship between technology and mental health. Indeed, technologies, especially artificial intelligence and Internet of Things, enable assessment and intervention to be tailored very specifically to the individual.

Chapter "AI for the Detection of the Diabetic Retinopathy" describes the state of the art of AI-based DR screening technologies, some of which are already commercially available.

Chapter "Enhancing EEG-Based Emotion Recognition with Fast Online Instance Transfer" proposes fast online instance transfer (FOIT) for enhancing the affective brain computer interface (aBCI). FOIT heuristically selects auxiliary data from historical sessions and (or) other subjects, which are subsequently combined with the training data for supervised training.

Chapter "Using Association Rules to mine Actionable Knowledge from Internet of Medical Thinks Data" investigates innovative methods to analyze efficiently data produced by the Internet of Medical Things (IoMT). Association rules (AR) are a simple and effective unsupervised learning methodology used to extract actionable knowledge from these dynamic data, which can be used at the edge of IoMT, or even directly embedded into the IoMt devices.

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About the Authors

Carmela Comito is a research scientist at the Institute of High Performance Computing and Networking of the Italian National Research Council (ICAR-CNR), Italy. She received her master's degree in computer engineering and her Ph.D. in systems and computer engineering from the University of Calabria, Italy. In 2006, she was a visiting researcher to the School of Computer Science at the University of Manchester, UK, and in 2017 she was a visiting researcher at LIRMM, University of Montpellier, France. She is adjunct professor at the University of Calabria. She co-authored over 80 papers in international journals, conference proceedings, and edited volumes. She served as a chair, program committee member, and reviewer of several international conferences. Her research interests include artificial intelligence, big data analysis and mining, mobility mining, social network data analysis and mining, and health informatics. She was the organizer and program chair of the International Workshop on Social Media Analytics for Healthcare (SMA4H), held in conjunction with Web Intelligence Conference (WI) in 2018, 2019, and 2020. She was the organizer and program chair of the special session "Machine Learning in Health" at the IEEE International Conference on Machine Learning and Applications (IEEE ICMLA) in 2019 and 2020. She was the organizer and program chair of the First International Workshop on Artificial Intelligence for Health, Personalized Medicine and Well-Being (HELPLINE), held in conjunction with the 24th European Conference on Artificial Intelligence (ECAI) 2020.

Agostino Forestiero is a researcher at the Institute for High Performance Computing and Networking of the National Research Council of Italy, (ICAR-CNR), Cosenza, since 2010. He received his Ph.D. in computer engineering (2007) and the master's degree in computer engineering (2002) from the University of Calabria. He has published more than 80 scientific papers at international conferences and journals among which are IEEE/ACM TON, IEEE TEVC, IEEE TGCN, Information Sciences, FGCS, and ACM TAAS. His research interests include artificial

intelligence, social mining, e-health, cloud computing, distributed systems, swarm intelligence, Internet of Things, multiagent system, and cyber security. He has served as a program committee member of several conferences/workshops, among which ICMLA 2020, HELPLINE 2020, ICAART 2020, ICMLA 2019, ASONAM 2019, SMA4H 2019, Web Intelligence 2019, ICAART 2019, Web Intelligence 2018, ICAART 2018, SMA4H 2018, ICNSC 2017, IoTGC 2017, ICAART 2017, ICAART 2016, IEEE Cluster 2015, Euro-Par 2014, Euro-Par 2013, and Euro-PAR 2010, and international journals, among which IEEE TPDS, IEEE/ACM TON, IEEE TC, IEEE TEVC, ACM TAAS, and several Elsevier and Springer journals. He is co-founder of the company eco4cloud srl, recognized as a spin-off of the University of Calabria and CNR, and he has filed for 6 international patents.

Ester Zumpano received her Ph.D. in computer science from the University of Calabria in 2003. From 2003 to 2006, she was an assistant professor at the University of Calabria. She has been an associate professor at the University of Calabria since 2006. Her research interests include inconsistent databases, integration techniques, P2P systems, and logic programs with preferences. She has published regularly in international journals and at international conferences.

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