

## Editorial

# Advanced Internet of Things and Big Data Technology for Smart Human-Care Services

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Recently, the range of Internet of things (IoT) technology could be utilized in the real world by the rapid spread of sensor devices. Various sensed information such as temperature, illumination, pressure, and object detection has become a basic point for solving solutions to complex problems that have been difficult to solve by convergence with big data. Particularly, not only the detection of human health and changes in the natural environment but also the rapid development of the analysis and application technology is continuing. As a result, it is expected to dramatically improve the prediction of disaster and quality of life.

In order to implement IoT-based human-care technology for improving the quality of life, we aim to deal with sensor technology and communication technologies as well as big data analytics and its applications. This includes a wide range of application technologies that can be realized in real life as well as theoretical problem solving in relation to the IoT.

In this special issue, the latest research efforts on new theories, technologies, and research are related to IoT and big data technology for smart human-care services and to improve advanced technology. 25 research papers are published in this issue, covering a wide variety of topics including advanced sensor technology for smart human-care services, management issues of social network big data for smart human-care services, data and knowledge mining for smart human-care services, emerging IoT applications and systems for smart human-care services, and IoT solutions

for well-being and active ageing. The highlights of these papers are summarized as follows.

The article titled “A Study on a Secure USB Mechanism That Prevents the Exposure of Authentication Information for Smart Human Care Services” by K. Lee et al. presents a secure USB mechanism that prevents leakages of authentication data and does not compare authentication data for smart human-care services, which have been a fundamental problem of existing flash drives.

The article titled “Fog Computing-Based IoT for Health Monitoring System” by A. Paul et al. was proposed to use fog computing to help monitor patients suffering from chronic diseases such that the data are collected and processed in an efficient manner.

The article titled “Beacon-Based Time-Spatial Recognition toward Automatic Daily Care Reporting for Nursing Homes” by T. Morita et al. presented an automatic daily report generation system that monitors the activities of nursing home residents. The proposed system estimated the multiple locations at which residents are situated with a BLE beacon and recognizes the activity of each resident from the estimated area information.

In the article titled “OperaBLE: An IoT-Based Wearable to Improve Efficiency and Smart Worker Care Services in Industry 4.0,” L. Roda-Sanchez et al. introduced OperaBLE, a Bluetooth Low Energy (BLE) wearable proposal which is aimed at enhancing working conditions and efficiency in Industry 4.0 scenarios. The proposed approach had developed two algorithms for OperaBLE focused on power

awareness as Low-Frequency Movement Characterisation Algorithm (LoMoCA) and Adaptive Heart Rate Algorithm (AHRA).

In the article titled “Secure Data Encryption for Cloud-Based Human Care Services,” T. Park et al. proposed efficient parallel implementations of Simeck family block ciphers on modern 64-bit Intel processors. In order to accelerate the performance, an adaptive encryption technique was also exploited for load balancing of the resulting big data. Finally, the proposed implementations achieved 3.5 cycles/byte and 4.6 cycles/byte for Simeck32/64 and Simeck64/128 encryption, respectively.

The article titled “Human Emotional Care Purposed Automatic Remote Portrait Drawing Generation and Display System Using Wearable Heart Rate Sensor and Smartphone Camera with Depth Perception” by G. Lee et al. proposed a system that automatically generates portrait drawings for the purpose of human emotional care. The user can recall the exciting and happy moment of the day through admiring the drawings and heal the emotion accordingly. To stylize photographs as portrait drawings, nonphotorealistic rendering (NPR) methods including a portrait etude stylization were proposed.

In the article titled “Biological-Signal-Based User-Interface System for Virtual-Reality Applications for Healthcare” by S. H. Nam et al., the proposed system extracted biological signal data from multiple biological signal data and simultaneously extracted and analyzed the data from a virtual reality-specific eye-tracking device that was developed so that users who develop healthcare contents based on virtual reality technology can easily use the biological signals.

In the article titled “Landmark-Guided Local Deep Neural Networks for Age and Gender Classification,” Y. Zhang and T. Xu proposed to construct a local deep neural network for age and gender classification. The proposed model selected local image patches based on the detected facial landmarks.

The article titled “Video Retrieval System for Meniscal Surgery to Improve Health Care Services” by S. Amanat et al. proposed a training mechanism to the decumbent ratio through a video retrieval system. This research work was focused on developing a corpus and video retrieval system for meniscus surgery. Using the proposed system, surgeons can access guidance by watching the videos of surgeries performed by an expert and their seniors.

The article titled “Application of a Mobile Chronic Disease Health-Care System for Hypertension Based on Big Data Platforms” by D. Li et al. presented the provision of a practical assistant system for self-based patient health care, as well as the design of a complementary system for patient disease diagnosis.

The article titled “IoT Smart Home Adoption: The Importance of Proper Level Automation” by H. Yang et al. examined the smart home service features that current users require and empirically evaluates the relationship between the critical factors and the adoption behavior with 216 samples from Korea. The moderating effect of personal characteristics on behavior is also tested.

The article titled “Real-Time Cloud-Based Health Tracking and Monitoring System in Designed Boundary for Cardiology Patients” by A. Shahzad et al. was made to track and monitor the real-time medical information, bounded in an authorized area, through the modeling of private cloud computing. The private cloud-based environment is designed, for patient health monitoring called the bounded telemonitoring system, to acquire the real-time medical information of patients that resided in the boundary, inside medical wards and outside medical wards, of the medical center.

The article titled “IoT-Based Smart Building Environment Service for Occupants’ Thermal Comfort” by H. Park and S.-B. Rhee presented an Internet of things (IoT) platform for a smart building which provides human-care services for occupants. The individual health profiles of the occupants were acquired by the IoT-based smart building, which uses the accumulated knowledge of the occupants to provide better services. The proposed model was based on the heat balance equation of human body and thermal characteristics of the occupants.

The article titled “Efficient Heterogeneous Network-Routing Method Based on Dynamic Control Middleware for Cyber-Physical System” by H. Lee et al. proposed a routing technique which enables network devices to communicate using different protocols. The proposed network-routing module can register devices with various protocols and improve the stability of the efficient heterogeneous network.

In the article titled “Intrusion Detection System Based on Evolving Rules for Wireless Sensor Networks,” N. Lu et al. presented an evolving mechanism to extract the rules for intrusion detection. To extract diversified rules as well as control the quantity of rulesets, the extracted rules are examined according to the distance between the rules in the rule set of the same class and the rules in the rule set of different classes. Thereby, it alleviated the problem that the quantity of rules expands unexpectedly with the evolving genetic network programming.

The article titled “Multistandard Receiver Design for Telemedicine Monitoring System” by H. Wang et al. proposed a solution for aliasing in receivers that can reduce the limitations in sampling frequency, improve spectrum utilization, and realize multistandard receivers. This paper gave the constraint conditions for frequency selection and a method to process aliasing by more than two standard signals.

The article titled “T-S Fuzzy-Based Optimal Control for Minimally Invasive Robotic Surgery with Input Saturation” by F. Wang et al. presented a Takagi-Sugeno fuzzy model-based controller for a minimally invasive surgery robot with actuator saturation. The contractively invariant ellipsoid theorem was applied for the actuator saturation. The proposed approach can be derived using the infinity control theorem and parallel distributed compensation.

The article titled “Performance Analysis of Dual-Polarized Massive MIMO System with Human-Care IoT Devices for Cellular Networks” by J.-K. Hong archived the performance analysis when various human-care IoT devices

are connected to cellular networks via a dual-polarized massive MIMO system. There had not been an analysis that considers the performance between the massive MIMO system and IoT devices for cellular networks. In addition, dual-polarized transmit and receive antennas were proposed for BS and IoT devices, respectively, to install more antennas and achieve higher performances in limited space.

The article titled “A Development of Clinical Decision Support System for Video Head Impulse Test Based on Fuzzy Inference System” by D. T. A. Nguyen et al. presented the clinical decision support system for the video head impulse test (vHIT) based on a fuzzy inference system. It examined the eye and head movement recorded by the eye movement tracking device, calculates the vestibulo-ocular reflex (VOR) gain, and applies the fuzzy inference system to output the normality and artifact index of the test result.

In the article titled “Mcredit2: Enhanced High-Performance Xen Scheduler via Dynamic Weight Allocation,” M. Kang and S. Lee proposed the Mcredit2 scheduler, which improves the Credit2 scheduler. The Credit2 scheduler takes no action when the load on a specific domain causes increased processor usage. The proposed Mcredit2 scheduler allowed a domain to quickly process loads by temporarily assigning a greater weight value to a host with high processor usage.

In the article titled “A Study of Prescriptive Analysis Framework for Human Care Services Based on CKAN Cloud,” J. Gim et al. proposed a prescriptive analysis framework using a 5W1H method based on CKAN cloud. Through the CKAN cloud environment, IoT sensor data stored in individual CKANs can be integrated based on common concepts. As a result, it is possible to generate an integrated knowledge graph considering interoperability of data, and the underlying data is used as the base data for prescriptive analysis.

In the article titled “Theory and Application of Audio-Based Assessment of Cough,” Y. Shi et al. introduced some successful cough monitoring equipment and their recognition algorithm in detail. It can be obtained that, firstly, acoustic variability of cough sounds within and between individuals makes it difficult to assess the intensity of coughing.

In the article titled “Analysis of Shooting Consistency in Archers: A Dynamic Time Warping Algorithm-Based Approach,” C.-H. Quan et al. measured bow-forearm movement by using inertia sensors during archery shooting to evaluate the shooting consistency of archers. They also attempted to provide movement analysis tools that work precisely and conveniently. Shooting consistency was defined as the function of the dynamic time warping (DTW) distance between two time sequences of acceleration data calculated with the DTW algorithm.

In the article titled “The Intelligent Healthcare Data Management System Using Nanosensors,” U.-O. Dorj et al. developed a design of the Intelligent Healthcare Data Management System (IHDMS) using nanosensors and composed an application for a mobile device. The proposed IHDMS could coordinate the healthcare data of the patients

from nanosensors and transforms it into a worldwide consumed standard HL7 (Health Level Seven) for the conversion of healthcare data.

The article titled “Detection of Freezing of Gait Using Template-Matching-Based Approaches” by C. Xu et al. presented a template-matching-based improved subsequence dynamic time warping (IsDTW) method. The proposed approach could realize the real-time and high precision FOG detection and alarm.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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