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Editorial

Current Research in Future Information and Communication Engineering 2022

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1. Introduction

The digital revolution has transformed the way we communicate, access information, and interact with technology [1]. With rapid advancements in artificial intelligence (AI), the Internet of Things (IOTs), and communication networks, the future of information and communication engineering (ICE) promises remarkable opportunities and challenges. This Special Issue contains a series of excellent research works on ICE selected from the International Conference of Future Information and Communication Engineering (ICFICE 2022), which was held at the Jeju Island in the Republic of Korea on 12–14 January 2022, and also those related to the future of ICE. This Special Issue consists of 18 regular and 2 review papers focusing on the following areas: communication systems and applications, networking and services, intelligent information systems, multimedia and digital convergence, semiconductor and communication services, biomedical imaging and engineering, ubiquitous sensor networks, databases and internet applications, IOT and big data, and information technology (IT) and convergence technology. There were 28 papers submitted to this Special Issue, and 20 papers were accepted (i.e., a 71% acceptance rate). Looking back on the Special Issue, various topics were addressed, mainly on intelligent information systems communication systems and application, biomedical imaging, and engineering, IOT, and multimedia and digital convergence.

2. Future Information and Communication Engineering 2022

There are two review papers included in this Special Issue. One of the reviews was written by Mozumder et al. [2] who highlighted that the integration of AI, blockchain (BC), and IOT technologies can enable more personalized, efficient, and secure care delivery, reduce costs, and increase patient life expectancy. Methods on how to improve healthcare quality using the metaverse environment and increase patient life expectancy through more confident processes such as chronic disease management, fitness, and mental health care in the metaverse were investigated. The other of the reviews was constructed by Mudeng et al. [3] who provided comprehensive insights related to state-of-the-art structural similarity (SSIM) approaches which were underlined for medical imaging, as well as the medical image examination research methods that could potentially be improved through the use of SSIM. Potential research directions in applying such similarities related to medical image analyses are also described.

Two papers focused on biomedical image classification using fuzzy-based learning approaches. The first one, by Kim et al. [4], proposed and evaluated a robust automatic segmentation method using double-layered outlier rejection fuzzy c-means (DORFCM) to identify an inflamed appendix from abdominal ultrasound images. The second one, by Kim

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et al. [5], also proposed and evaluated a hierarchical combination of the fuzzy unsupervised learning component (FCM) and supervised learning component (FMM: fuzzy max–min neural network) in diabetes diagnosis, a highly noisy domain with not much labelled data and many missing values in the dataset.

Four papers focused on multimedia and digital convergence. The first one, authored by Zhang et al. [6], proposed a self-adaptive approximated-gradient-simulation method for black-box adversarial attacks (SAGM) to generate efficient perturbation samples. Knowledge-based differential evolution was used to simulate gradients and the self-adaptive momentum gradient to generate adversarial samples. The proposed method can quickly and efficiently search for perturbation samples to misclassify the original samples. The second paper, authored by Wahyutama et al. [7], developed a training service for non-native speakers of Korean to increase their ability to speak the language. The service can generate a score automatically based on how similar the recorded voice is to the actual sentence using speech-to-text (STT) engines and sentence transformers. The third paper, authored by Park et al. [8], introduced the automatic generation of movie tags to improve the movie recommendation system. Background sounds from movie trailer videos were extracted, and the sounds using short-time Fourier transform (STFT) and major audio attribute features were analyzed, and a genre prediction model was created. The other paper, authored by Tan et al. [9], proposed a multi-population differential evolution (MUDE) algorithm with a uniform local search to balance exploitation and exploration for the compensation of population diversity and local search ability for gradual deterioration.

Two papers focused on virtual and augmented reality. The first one, authored by Kim et al. [10], compared and explored the effect of passive haptic parameters on the user's perception by using different transformation conditions in immersive virtual environments. From the experiments, it was shown that the participants felt the same within a certain range, which seems to support the "minimum cue" theory in providing sufficient sensory stimulation. The second paper, authored by Chung et al. [11], presented a novel method to adjust the automatic gaze alignment of the teleported avatar to match the local site for mixed reality (MR) collaborative environments. Comparative validation experiments to measure the spatial accuracy of the gaze and evaluate the user's communication efficiency using the method were performed.

Four papers focused on deep-learning-based IOT systems. The first paper, authored by Shin et al. [12], proposed and evaluated an intelligent monitoring framework based on the IoT by applying a recurrent neural network (RNN) for the predictive maintenance of a biobanking system in real time. The second paper, authored by Kwon et al. [13], analyzed the effect of compressed sensing (CS) rates (from 100% to 10%) and video resolutions (1280×720, 640×480, 480×360) in the IoT sensing device on the pose score of the PoseNet model in the artificial intelligence of things (AIoT) edge server. In this article, when the CS rate is 80% and the video resolution is 1280×720, the most effective data traffic mitigation and pose score were achieved. The third paper, authored by Jeong et al. [14], introduced a fall detection system that combines a simple threshold method (STM) and LSTM, creating the STM-LSTM-based fall detection system. In terms of validating the data accuracy of the STM-LSTM-based fall detection system, optimal values of the parameters in the LSTM and normalization method were found as follows: best accuracy of 98.21% at no-normalization, no-sampling, 128 hidden layer nodes, and a regularization rate of 0.015. In the fourth paper, authored by Husain et al. [15], automatic pet monitoring applications include real-time monitoring and monitoring systems that accurately identify pets using the latest methods for classifying pet activities. An LSTM-based method to detect and classify dog activity based on sensor data (i.e., accelerometers and gyroscopes) was proposed. The activities of dogs using wearable sensor data and using cyclic RNN techniques were investigated.

Three papers focused on machine learning. The first one, authored by Khan et al. [16], presented a new multiple learning to prediction algorithm model that used three different combinations of machine learning methods to improve the accuracy of the α-β filter

algorithm. The deep belief network (DBN), the deep extreme learning machine (DELM), and the support vector machine (SVM) as three different learning algorithms were used. The second paper, authored by Jeong et al. [17], attempted to develop AI suitable for solving a problem when the number of scatterers was two or three, respectively, based on convolutional neural network (CNN) models and artificial neural network (ANN) models to solve the problem of inverse scattering in some cases. To verify the performance and overfitting of the developed learning model, new limited view data that were not used for learning were created and used. The third paper, authored by Zhang et al. [18], proposed and evaluated an intelligent direction of arrival (DOA) estimation error calibration method based on transfer learning which learns error knowledge from a small number of actual signal samples and improves the DOA estimation accuracy in a real application. In this article, a deep-CNN-based intelligent DOA estimation model to learn the mapping between the input signals and their azimuths was constructed.

One paper focused on optical communication. A dispersion map that can simultaneously compensate for a distorted wavelength division multiplexed signal while increasing the configurational flexibility was proposed by Chung et al. [19]. It was notable that the flexibility can be increased by randomly arranging residual dispersion per span (RDPS) in the former half, and compensation improvement can be achieved by inversing the order of the RDPS arrangement of the former half in the latter half.

One paper focused on image processing. To improve the blurring phenomenon that occurred in the edges of the image as a result of additive white Gaussian noise (AWGN) removal, a modified local steering kernel algorithm based on image matching was proposed and evaluated by Cheon et al. [20].

One paper focused on semiconductor displays. The article of Ahn et al. described the dependence of color tunability on the thickness of the metal-free phthalocyanine (H_2Pc) layer in DC-voltage-driven organic light-emitting diodes (OLEDs) for display application [21]. In experimental and theoretical results, the change in the emission color temperature from cool white to warm white at a low voltage can be controlled by adjusting the thickness of the H_2Pc layer in the color-tunable OLEDs (CTOLEDs). It was confirmed that the thermally treated H_2Pc thin film layer acts as a barrier to prevent the transfer of electrons to Alq_3 at a low applied voltage, resulting in white light emission with temperature tunability.

3. Conclusions

The Special Issue on "Future Information and Communication Engineering 2022" presents a collection of research papers that offer valuable insights into the future of this dynamic field. From artificial intelligence and communication to the metaverse, the papers in this Issue cover a broad range of topics, reflecting the multifaceted nature of information and communication engineering. The research presented in this Special Issue serves as a foundation for future advancements, inspiring further exploration and collaboration among researchers, engineers, and policymakers. As we navigate the complexities of the digital age, we must leverage these insights to shape a future that embraces the transformative potential of information and communication engineering while addressing the challenges that lie ahead.

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