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GUEST EDITORIAL

New directions in convergence computing

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In diverse industrial domains, data with highly complex objects, events, and relationships are collected and pre-processed through internal and external IoT sensing. Machine-learning-based convergence modeling technologies such as visualization for observation after data cleaning and processing; model-based error detection for estimation of causal relationships; fault prediction; and model evaluation have seen rapid development. As such, the paradigm has shifted from the consideration of modeling performance to explainable convergence computing reengineering to analyze the ground of a model. This paradigm shift has resulted in active research on the explainability of convergence data quality, model prediction, and performance. This approach is expected to simplify the procedure of verifying a value creation process and increase efficiency, thus being applicable in the development of convergence computing. This in turn will enable convergence modeling to draw significant knowledge in securing related technologies in different industrial domains.

New Directions in Convergence Computing was proposed to share and discuss research performance and solutions that both researchers and working-level persons achieved to find new convergence directions of explainable artificial intelligence. It is expected to draw new directions and create added values to improve people's quality of life through the cooperation of development teams and global research. Below, we present a summary of the accepted papers for this special track:

P. K. Mallick et al. [1] classifies the news convergence content of the TagMyNews dataset accurately using the Bernoulli document model. Here, content is categorized into six news classes by recognizing new headlines in real-time. Through explainability, it is possible to quickly and accurately classify online news. In C. Yi et al. [2], a deep convolutional generative adversarial network (DCGAN) was used to generate the image data of the INRIA person dataset. Thus, the size of the fractionally strided convolution image was increased, and the DNN was learned. The GAN model was used to generate learning data. This method reduces the cost and time required for convergence data labeling. S. Math et al. [3] proposes an efficient dynamic resource sharing scheme (E-DRSS), as well as an IoT data transmission method based on the dynamic resource sharing of a radio remote head (RRH). This protocol adjusts the resources transmitted to the RHH, and recommends a gateway to process massive requests. Accordingly, it is possible to reduce power consumption to ensure efficient convergence computing.

In the paper by H. Y. Bak et al. [4], a camera for film analysis was used to independently detect object movement. This study proposes motion detection for story and multimedia information convergence. With the use of ResNet-152, a truck and boom were added as camera motions, making it possible to recognize five motions (pan, tilt, zoom in, zoom out, truck, and boom). In the paper by M. S. Gu et al. [5], a semantic data-mining technique was proposed for the convergence of context and ontology in a mobile environment. This technique quantifies position information, context awareness, and preferences in a mobile device, develops reasoning for recommendation and information search modules, defines the ontology influencing model reliability, and overcomes the weaknesses of the predictive model. H. Jin et al. [6] analyzed how content characteristics (order of usefulness > ease of use > entertainment > interaction) in the convergence of mobile intelligence and wearable computing

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influence users' quantified immersive experience and continuous participation.

In J. W. Beak et al. [7], an attention-mechanism-based predictive model was designed through the analysis of data characteristics in industrial domains and the convergence of modalities in multiple modals. Through the convergence of structured and unstructured modalities, a prediction explainability and reliability visualization tool was developed for the accident risk model in the attention layer. In the paper by Y. S. Jeong et al. [8], a blockchain-based convergence multivariate data management technique was designed for an edge computing mobile environment. This technique links IoT device information with multiple hash boxes, and adds a digital signature to the start and finish boxes in order to minimize data loss and maintain reliability. This approach suggests different server overheads depending on the block size, performance optimization, and explainability for the generation time. In the paper by P. K. Mallick et al. [9], the classification of gene expression data was achieved by means of DNN-classifier-based convergence learning in industrial domains. Based on the bone marrow expression of leukemia patients, a 5-layer DNN classifier was implemented. Because it is possible to determine causes of the results, the proposed technique exhibits reliability of leukemia classification in terms of data characteristics and model prediction.

S. K. Satapathy et al. [10] proposes an RBF-based convergence network for EEG signal classification, with an artificial bee colony used to optimize parameters. To overcome the limitations of class imbalance generated in the EEG dataset, an adaptive synthetic oversampling process was performed. Thus, the optimized RBF classifier improves performance more effectively than the standard RBF classifier. In the paper by J. W. Beak et al. [11], a meta-learning-based image captioning model was proposed to secure the explainability of predicted results in data. Based on prior knowledge, image information is expressed in a bottom-up manner, thereby overcoming the limitation of data shortage. The LSTM model was used to ensure explainability, and the predicted and analyzed results of the performance were drawn. The paper by J. Jo et al. [12] proposes a game-based assessment tool for learning motivation in an online environment. The results of this study reveal that the application of the ranking system and game significantly changed students' concentration during video lectures. Furthermore, these results demonstrate that UI/UX, which is accessible to game-based learning tools, exhibits a positive impact in a learning environment.

In H. Ahn et al. [13], YOLO-based intelligent transport technology was designed to accurately recognize license plates in images irrespective of environmental conditions. C. M. Kim et al. [14] proposes an abnormality detection model for breast cancer diagnosis using YOLOv4-based histograms. Through the area removal technique for histograms, as well as light range control to improve the quality of noise and edges in mammography images, it is possible to expand a single channel of images to accurately diagnose breast cancer. In the paper by S. Sim et al. [15], a disease control system combined IoT with AI to collect infection information, measure similarities, and analyze the possibility of spread. This system enables the early detection, monitoring, and control of viral infections prior to spread.

The paper by S. T. Oh et al. [16] analyzed lighting characteristics to determine a safe combination of light sources and control conditions for UVB that avoids skin burns. By designing stand-type lighting in consideration of user convenience and photobiological safety standards, it is possible to satisfy the daily recommended UVB capacity for indoor residents. K. Chung et al. [17] analyzed the performance influence of an emotion learning model in a text corpus, and suggested the explainability of causal analysis on emotions and predicted results through conversion of voice signals to spectrograms. Through the analysis of spectrograms and facial expressions, it is possible to analyze the explainable causes of emotional flow in a convolutional network.

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