Guest Editorial Medical Image Analysis Embedded on Microprocessors

WIRELESS telemedicine uses modern communication technology and computer multimedia technology to provide long-distance medical information and services. Wireless transmission, such as cellular 5G/6G and WiFi technologies, allow the access to vital information anywhere and at any time within the healthcare networks. Patient data, the main data of telemedicine [4] which are needed to be transmitted by wireless, including current treatments, health history, allergies to medications, laboratory tests and results, and insurance information need to be retrieved at any time from the healthcare personnel. Most of the current patient data captured by novel embedded sensors, are required to wirelessly transmitted from the embedded sensors to ubiquitous and pervasive computing devices with embedded microprocessors. The wireless transmission for medical data on ubiquitous and pervasive computing devices with embedded microprocessor has higher requirement of real-time, accuracy and progressive. The medical image lesion detection technology combines computers with other high-speed, large-scale integrated digital hardware. The current medical imaging diagnosis requires the doctor's experience to determine. Using image processing technology to analyze and process 2D slice images can assist doctors in qualitative and even qualitative analysis of lesions and other areas of interests, thereby significantly improving the accuracy and reliability of medical diagnosis. With the aid of wearable computing technology and artificial intelligence, emotion and mental disorder detections are available through sensing and analyzing psychological parameters [1].

Employing embedded technology into Medical 4.0 [2] based medical image lesion detection systems is becoming possible. The embedded medical image lesion detection has many advantages such as small size, low cost, good stability, and strong adaptability, which is applied to medical image recognition and diagnosis, which can significantly alleviate the burden of massive and complex medical image data on doctors and help doctors diagnose diseases that are difficult to detect. Considering data gathered from different sources of low quality and full of noise [3], building a paradigm of health informatics for human wellness and patient monitoring should also be taken into consideration [5].

As wireless telemedicine is applied and developed, the transmission of high-quality images is a major issue worthy of medical and communication research. Through wavelet vector quantization compression coding, concatenated coding, spread spectrum modulation, and anti-interference technology, the influence of fading channel and interference on medical image transmission is suppressed to ensure the reliability of transmission. The concatenated code with high compression ratio and weak error correction for the high-frequency sub-image can obtain effective visual effect and image quality.

Therefore, this special issue focuses on embedded microprocessors under wireless transmission in medical imaging lesion detection systems and provides researchers in related fields with opportunities for discussions.

A Secure multimedia transformation approach is proposed in [A1] using a deep learning-based chaotic logistic map. The proposed work achieves novelty by the integration of a lightweight encryption function using a chaotic logistic map. It also uses the ResNet model to perform classification for identifying the fake medical multimedia data. A linear feedback shift register operations and an interactive user interface facilitate ease of usage to secure the medical multimedia data. The chaotic map provides the security properties such as confusion and diffusion necessary for the encryption ciphers. At the same time, they are highly sensitive to input conditions, thus making the proposed encryption algorithm more secure and robust. The proposed encryption mechanism helps in securing the medical image and video data. On the receiver side, Multilayer perceptions (MLP) of the deep learning approach are used to classify the medical data according to the features required to make other processes. When tested, the proposed work proves efficient in securing medical data against various cyber-attacks and exhibits high entropy levels.

In [A2], the authors propose a novel hybrid end-to-end network, called TD-Net, which incorporates Transformer and direction information into convolution network to segment liver tumor from CT images automatically. The proposed TD-Net is composed of a shared encoder, two decoding branches, four skip connections, and a direction guidance block. The shared encoder is utilized to extract multi-level feature information, and the two decoding branches are respectively designed to produce initial segmentation map and direction information. To preserve spatial information, four skip connections are used to concatenate each encoder layer and its corresponding decoder layer, and in the fourth skip connection a Transformer module is constructed to extract global context. Furthermore, a direction guidance block is well-designed to rectify feature maps to further improve segmentation accuracy.

In [A3], the authors introduced a TransFusionNet framework, which consists of a semantic feature extraction module, a local

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spatial feature extraction module, an edge feature extraction module, and a multi-scale feature fusion module to achieve fine-grained segmentation of liver tumors and vessels. In addition, they applied the transfer learning approach to pre-train using public datasets and then fine-tune the model to further improve the fitting effect. Furthermore, they proposed an intelligent quantization scheme to compress the model weights and achieved high performance inference on JetsonTX2.

In [A4], the authors sought to access the performance of classification models along with different feature selection approaches on the structural magnetic resonance imaging data. The data consist of 72 subjects with Schizophrenia and 74 healthy control subjects. They evaluated different classification algorithms based on support vector machine (SVM), random forest, kernel ridge regression and randomized neural networks. Moreover, they evaluated T-Test, Receiver Operator Characteristics (ROC), Wilcoxon, entropy, Bhattacharyya, Minimum Redundancy Maximum Relevance (MRMR) and Neighbourhood Component Analysis (NCA) as the feature selection techniques. Based on the evaluation, SVM based models with Gaussian kernel proved better compared to other classification models and Wilcoxon feature selection emerged as the best feature selection approach. Moreover, in terms of data modality the performance on integration of the grey matter and white matter proved better compared to the performance on the grey and white matter individually.

In [A5], the authors propose a Pseudo-Siamese Feature Fusion Generative Adversarial Network (PSFFGAN), synthesizing high-quality fetal FC views using FC sketch images. In addition, we propose a novel Triplet Generative Adversarial Loss Function (TGALF), which optimizes PSFFGAN to fully extract the cardiac anatomical structure information provided by FC sketch images to synthesize the corresponding fetal FC views with speckle noises, artifacts, and other ultrasonic characteristics.

In [A6], the authors propose a novel and lightweight framework termed 'Biceph-net' for AD diagnosis using 2D MRI scans that models both the intra-slice and inter-slice information. 'Biceph-net' has been experimentally shown to perform equally or better than spatio-temporal neural networks while being computationally more efficient. Biceph-net also is also superior in performance when compared to vanilla 2D convolutional neural networks (CNN) for AD diagnosis using 2D MRI slices. Biceph-net also has an inbuilt neighbourhood based model interpretation feature which can be exploited to further understand the classification decision taken by the network.

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APPENDIX
RELATED ARTICLES

[A1] C. Rupa, M. Harshita, G. Srivastava, T. R. Gadekallu, and P. K. R. Maddikunta, "Securing multimedia using a deep learning based chaotic logistic map," *IEEE J. Biomed. Health Inform.*, vol. 27, no. 3, Mar. 2023, doi: 10.1109/JBHI.2022.3178629.

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