

# COVID-19 special issue: Intelligent solutions for computer communication-assisted infectious disease diagnosis

Corona virus disease 19 (COVID-19) is an infectious disease which is having a significant health and economic impact across the world. The primary source for the transmission of the disease, its detection and treatment methods are still unknown. Hence, a scientific response to this new corona virus is being hampered by a lack of knowledge on how it spreads, possible prevention measures and vaccinations, which all need to be investigated further. Artificial intelligence (AI) and computer communication networks have a role to play, especially machine learning (ML) due to its learning-from samples capability and applicability over distributed computer systems and networks.

This special issue features eight selected papers with high quality. The article, 'Prediction of COVID-19 active cases using exponential and non-linear growth models,' compares different AI models against a newly proposed one (Mahanty et al., 2022). The main objective of this paper was discovering the rate of infection spread in India, Pakistan, Myanmar, Brazil, Italy, and Germany, in addition to designing a susceptible-infectious-recovered (SIR), Verhulst, Gompertz, and proposed model for the assessment of the disease spread. And finally, providing a prediction method for the COVID-19 outbreak using all the said models.

The article titled 'Value of medical imaging artificial intelligence in the diagnosis and treatment of new coronavirus pneumonia' applies AI to medical imaging, combined with embedded technology, RFID technology and signal processing technology, and applies the new coronavirus pneumonia image to the AI environment after processing, assisting doctors in diagnosis of the disease, and providing relevant information about patients record and manage the diagnosis and save and accumulate the experience and knowledge of famous doctors through the expert system, and then perform corresponding operations and analysis (Jia et al., 2022). Through the medical image intelligent analysis system, the risk of medical imaging AI diagnosis is reduced from 81% to 11%, which greatly reduces the hidden safety hazards for doctors and patients, reduces the workload of doctors, and also reduces the cost of medical care by 79%.

In the article with the title 'Endoscopic image recognition method of gastric cancer based on deep learning model', Qiu et al. (2022) aim to improve the efficiency of gastric cancer (GC) diagnosis. So deep learning (DL) algorithms are tentatively used to assist doctors in the diagnosis of gastric cancer. In the experiment, the collected 3591 gastroscopic images were divided into network training set and experimental verification test set. The lesion samples in the image are all marked by many endoscopists with many years of clinical experience. In order to improve the experimental effect, 5261 endoscopic images were obtained by expanding the training set. Then the obtained training set is fed into the convolutional neural network (CNN) for training, and finally get the algorithm model DLU-Net. Authors concluded that the DL algorithm model constructed in this paper can effectively identify the staging characteristics of cancer and other similar diseases as well as the gastroscopic images, greatly improve efficiency, and effectively assist physicians in the diagnosis of GC under gastroscopy.

The article titled 'Fuzzy logic control theory in clinical anaesthesia', mainly studies the application of fuzzy logic control theory in clinical anaesthesia (Tian et al., 2022). First, after introducing the basic content of fuzzy logic control theory, the determination method of commonly used membership functions, the relevant knowledge of clinical anaesthesia, and the fuzzy logic code rate control model, this article describes in detail the basic principle diagram of the clinical anaesthesia control system and the clinical anaesthesia process. The mathematical model of clinical anaesthesia control system is constructed based on the data fusion technology of the parameters of anaesthesia depth monitoring. The parameters in the model are adjusted by the time domain analysis method to measure the dynamic characteristics, and the stability of the system is analysed by root locus method. The heart rate does not change significantly when it is lower than 1MAC, and the heart rate increases when it reaches 1.5 ~ 2MAC. Experimental results show that the application of fuzzy logic control theory to clinical anaesthesia can reduce the risk of clinical anaesthesia.

By means of the CNN, the article 'Medical image analysis of multiple myeloma based on convolutional neural network', provides the application of neural network algorithm in multiple myeloma (He & Zhang, 2022). As such, the CNN model is constructed using existing medical data, and the retained case image data are input into the constructed CNN to verify the accuracy of the neural network. The results show that the accuracy rate of the neural network model constructed in this study is 0.87, which is higher than the accuracy rate of manual detection of 0.77. It can be concluded that using magnetic resonance imaging (MRI) to classify multiple myeloma has a high accuracy rate. Therefore, it has been proved that the CNN model established in this paper is effective. The proposed results prove that the neural network algorithm can be applied to MRI analysis, which helps to improve the efficiency of multiple myeloma diagnosis not only in COVID-19 related studies, but many other medical fields as well.

On the other hand, existing and utilized neural networks security are not fully considered image segmentation. Therefore, the article, titled 'Image segmentation algorithm of lung cancer based on neural network model', explores the application of neural network algorithm model in lung imaging, and provides a reference for the application and development of artificial neural network algorithm in lung cancer medical mirroring, while promoting the development of the artificial neural network in this field (He et al., 2022). It is hoped that the application of neural network algorithms in medical imaging can improve the survival rate and cure rate of lung diseases. In this study, an artificial neural network algorithm model was selected to establish a lung cancer recognition model. After determining the lung cancer lesion area, the image segmentation algorithm was used to separately display the lung cancer lesion area, and a comparison experiment was designed to verify the accuracy of the model. Using artificial neural networks to identify lung cancer has a shorter diagnosis time and higher accuracy. Combining image retrieval methods with lung cancer image segmentation algorithms can clearly show the lesion area of lung cancer. Therefore, the lung cancer image segmentation algorithm based on the neural network model has good recognition performance. In the future development of intelligent medical imaging technology, artificial neural networks will be trained to perform medical image recognition and diagnosis tasks, which can reduce diagnosis time and improve diagnosis efficiency.

In the article, titled 'Clinical study of serum procalcitonin in the early diagnosis of burns and sepsis under the background of healthy clouds', the purpose is to diagnose the sepsis early while utilizing the cloud services (Huang et al., 2022). The clinical symptoms and vital signs of sepsis are not particularly abnormal, and imaging examination may cause the focus of infection to be incorrect. As a result, the positive rate of positive results is low, which seriously affects the timely diagnosis and treatment of patients. Experimental data show that serum PCT of non-septic patients is obvious during the six groups of experiments 1–5 days, 6–10 days, 11–15 days, 16–20 days, 21–25 days, 26–30 days after treatment Serum PCT levels below sepsis. The data recorded during the experiment are in accordance with the relevant principles of statistics to ensure that the experiment is true and effective. The experimental results show that the PCT of burn sepsis group is higher than that of the cured group without burns, and the serum PCT level is crucial for the diagnosis of burn sepsis.

Meanwhile, recurrent neural networks (RNN) are extensively used to determine the optimal solutions to the various class recognition problems such as image processing, prediction of biomedical data and speech recognition. With the gradient problems, RNN is losing its shade which is replaced by the long short term memory (LSTM). However, the hardware implementation of the LSTM requires more challenge due to its complexity and high power consumption which makes it unsuitable for implementation in biological internet of things (BioT) networks for the prediction of medical diseases. Several algorithms were proposed for an effective implementation of LSTM, but hand-offs between the performance and utilization still needs improvisation. The article, titled 'P-SCADA - A novel area and energy efficient FPGA architectures for LSTM prediction of heart arrhythmias in BioT applications', proposes the novel energy efficient and high performance architecture pipelined stochastic adaptive distributed architectures (P-SCADA) for LSTM networks (Varadharajan & Nallasamy, 2022). In this architecture, hybrid structure has been developed with the help of new distributed arithmetic stochastic computing (DSC) along with the binary circuits to advance the performance of the FPGA such as energy, area and accuracy. The proposed system has been implemented in ARTIX-7 FPGA with special purpose software has been designed and evaluated with different ECG data sets. For the different series data, area utilization is about 40%–44% and power consumption is about 20%–25% with the prediction of accuracy of 98%. Moreover, the proposed architecture has been compared with the other existing architecture such as SPARSE architectures, normal stochastic architectures in which the proposed architecture excels in terms area, power and efficiency.

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