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EDITORIAL

Improving healthcare outcomes using multimedia big data analytics

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The field of health informatics has revolutionized the face of healthcare in the past decade. The increasingly aging population, prevalence of chronic diseases, and rising costs have brought about some unique healthcare challenges to our global society. Informatics-based solutions have changed how information is collected and stored and have also played a crucial role in the management and delivery of healthcare. Intelligent and automated data processing has never been more critical than it is today. In recent years, intelligent systems have emerged as a promising tool for solving various healthcare-related domains. With the advent of various swift data acquisition systems and recent developments in healthcare information technology, vast amounts of data have been amassed in different forms. One of the key challenges in this domain is to build intelligent systems for effectively modeling, organizing, and interpreting the available healthcare data [11]. Healthcare service providers are increasingly acknowledging the strategic importance of data analytics. However, the challenge becomes how to take Big Data and translate it into information that healthcare professionals can use for decision making to improve healthcare outcomes and improve the quality of care.

This special issue aims to respond to the research challenges by encouraging researchers in the computing world to bring to bear novel techniques, combinations of tools, and so forth to build effective ways to handle, retrieve, and make use of healthcare data. The Guest Editor team (Imran Razzak, Peter Eklund, and Guandong Xu) hopes that the articles in the special issue can contribute to the body of knowledge on enhancing the Healthcare sector and benefit us in improving the quality of health through early detection, classification, and diagnosis using modern machine learning and data analytics methods. Based on the reviewers' feedback and editors' evaluations, 14 papers were selected from more than 46 submissions in this particular section. The 14 papers, which cover broad topics, are introduced briefly.

The reduction of the input data helps building the model with less machine effort and increases the speed of machine learning and generalization steps [10]. We received several papers in the optimization of feature extraction. Breast cancer is one of the most common cancers that usually affects females but can also occur in males, however, less common in men. It often starts out too small to be felt. Around 95, 85 and 75% woman survive their cancer for 1, 5 and 10 years respectively. Early detection of breast cancer gives the best possible chance of survival. The earlier an abnormality is discovered, the greater the number of effective treatment options are available. Masud et al. presented deep transfer learning for early diagnosis of breast cancer [8]. Eight different fine-tuned pre-trained models are developed using ultrasound images that showed 92% accuracy and 0.972 AUC score. In another work, Richhariya et al. presented fuzzy-based least squares twin SVM algorithm is presented using Universum data [12]. The fuzzy memberships are adopted to remove the impact of outliers, and Universum data are utilized to give prior information about data distribution. Results showed that fuzzy twin SVM is superior, especially in the presence of outliers. In other work, Gupta et al. presented a fuzzy-based Lagrangian twin parametric-margin support vector machine (FLTPMSVM) to reduce the effect of the outliers presented in biomedical data [5]. Results showed that FLTPMSVM improved the generalization performance of the decision surface and took less training time.

Mazher et al. developed a graph theory-based brain connectivity framework to find the complex underlying behaviors of the brain in the simplest way [9]. The framework is implemented on, mental workload assessments on multimedia animations obtained while performing using a brain connectivity approach based on partial

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directed coherence (PDC) with graph theory analysis. The experiment showed that graph theory-based deep framework achieved 85.77% accuracy in comparison to the 78.50% accuracy. Healthcare is an attractive target for hackers because of sensitive medical data, which is between ten and twenty times more lucrative than credit card or banking details. Leracitano et al. presented an explainable machine learning inverse problem solution for EEG signals [6]. A deep CNN is trained to perform 2-ways classification tasks: pre-hand close (HC) vs. resting state (RE) and pre-hand open (HO) vs. RE. A. Experiments conducted on BCI dataset showed significantly better performance in comparison to state-of-the-art methods. To further show the gain in performance and effectiveness of the framework, an occlusion sensitivity analysis was performed that shows the contribution of the cortical area for classification. Chen et al. analyzed the recent research on EEG and the impact of technology in achieving the objectives [4].

Amin et al. developed a deep learning-based platform for malware detection to monitor a host of the applications [3]. Deep learning-based features are extracted from smartphone data which can be used with any classifier for the detection of cyber threats. Experiments showed that the framework achieved 98.97 and 98% F-Score and accuracy.

Genetic algorithm has shown promising implications in various medical specialties, including radiology, radiotherapy, oncology, pediatrics, cardiology, endocrinology, and surgery. Tahir et al. presented a binary chaotic genetic algorithm for feature selection and replaced the random variables' selection process with the chaotic sequence value to improve the quality of the solution [15]. An experiment conducted on different datasets showed significantly better performance in finding the optimal subset of features that achieves better fitness values. Alweshah et al. developed monarch butterfly optimization algorithm for solving feature selection problems [2]. Experiments on 18 benchmark datasets using WOASAT, ALO, GA and PSO), MBO was superior, giving a high classification accuracy rate.

COVID-19 pandemic resulted in an extreme shortage of beds in the hospital. To address the problem of bed management, Jena et al. developed a fuzzy rule-based approach using a priority-based method for bed management in hospitals during the COVID-19 pandemic [7]. The bed management system minimizes the number of hospital beds required for the treatment of COVID-19 infected patients in order to handle such a tough situation. Sedik et al. developed the convolutional long short-term memory (ConvLSTM) framework for COVID-19 diagnosis using CT and X-rays images [13]. Besides, a new COVID dataset is introduced consisting of both CT and X-ray images. The experiment conducted on a benchmark dataset showed significant COVID-19 diagnostic performance.

Circular RNAs are currently classed as non-coding RNA (ncRNA), which forms a covalently closed continuous loop unlike linear RNA. Stricker et al. presented a deep end-to-end framework that does not require manual features [14]. The framework takes raw RNA sequences and utilizes encoder–decoder-based convolutional operations to learn lower dimensional latent representation. The extracted representation is further passed to CNN to extract discriminant features, followed by classification. Experiments conducted on benchmark datasets showed significant improvement (10.29%) in comparison to benchmark methods.

Dysphonia is a disorder of the voice due to poor voice quality without any obvious anatomical, neurological, or other organic difficulties affecting the larynx or voice box. Ali et al. developed IoT-based cost, efficient platform that continuously monitors patients and avoids unnecessary hospital visits and long waiting times to see practitioners [1]. Higher-order directional derivatives are used on the time–frequency spectrum of signals to analyze the voice signal. Experiments showed that the IoT-based framework achieved 99.1% accuracy, while the sensitivity and specificity were 99.4 and 98.1%. Rapid growth in IoT networks has revolutionized the healthcare industry by bringing major improvements in terms of e-health/medical records (EHR/EMR), prescription drug data, and insurance information. Yaqoob et al. presented a comprehensive analysis of how blockchain leverages healthcare technology to improve the healthcare sector and stimulate innovations [16]. The paper presents blockchain features and characteristics followed by open issues and opportunities.

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