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Health Information Science and Systems

EDITORIAL

Guest editorial: special issue on "Artificial Intelligence in Health and Medicine"

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Introduction

The aim of this special issue is to introduce the burgeoning topic of artificial intelligence (AI) in health and medicine and to showcase some of the recent developments and novel applications of AI in health and medicine fields.

AI, defined by Oxford Dictionary, is the theory and development of computer systems to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision making, and translation between languages. With the rapid advance of technology, AI techniques are being effectively used in the fields of health and medicine to improve the efficiency of treatments and avoid the risks of false diagnosis, the making of therapeutic decisions and the prediction of outcome in many clinical scenarios. Modern medicine is faced with the challenge of acquiring, analysing and applying the large amount of knowledge necessary to solve complex problems [1]. AI in health and medicine mainly uses computer techniques to perform clinical diagnoses and suggest treatments.

This special issue provides a forum for the publication of articles that address broad challenges on both theoretical and application aspects of AI in health and medicine. The development of medical artificial intelligence has been related to the development of AI programs intended to help the clinician in the formulation of a diagnosis, the making of therapeutic decisions and the prediction of outcome. They are designed to support healthcare workers in their everyday duties, assisting with tasks that rely on the manipulation of data and knowledge. In this issue, we invited scholars and researchers to contribute original research articles as well as review articles that will stimulate the continuing effort on the application of AI approaches to solve health and medical problems.

The open call for this special issue has attracted eighteen papers (18) covering broad range of artificial intelligence technologies and applications. After two rounds of peer-reviews by a team of international experts, 14 papers were selected to be included in this special issue and currently 1 paper is under in 3rd revision. Those accepted papers represent a wide spectrum of research under the theme of the special issue ranging from breast cancer detection, of Amyotrophic Lateral Sclerosis (ALS) disease identification, to big medical data handling. In "Summary of accepted papers" section, we present a brief summation of the selected papers for this special issue and "Conclusion" section provides concluding remarks.

Summary of accepted papers

This issue consists of 14 papers that are briefly discussed as follows:

The article, by Taran et al. [2] "An optimum allocation sampling based feature extraction scheme for distinguishing seizure and non-seizure EEG signals" undertakes an analysis on on optimum allocation sampling based Teager energy operator for detection of seizure and non-seizure EEG signals. The proposed scheme showed capability to effectively distinguish seizure and non-seizure from EEG signal data.

In "Classification of Amyotrophic Lateral Sclerosis Disease Based on Convolutional Neural Network and Reinforcement Sample Learning Algorithm" [3], the authors present a deep learning based artificial intelligent scheme for efficient identification of ALS from Electromyogram (EMG) signals. In this proposed scheme, the convolutional neural network (CNN) architecture is trained with the reinforcement sample learning strategy.

The paper entitled "Beamforming for hyperthermia treatment by training a weighted network of an ultrasonic array" by Li et al. [4] introduces a beamforming algorithm based on waveform diversity for hyperthermia

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treatment of breast cancer using an ultrasonic array. The effectiveness of the algorithm is demonstrated by using numerical simulations.

The article by Budak et al. [5], titled "A Novel Microaneurysms Detection Approach Based on Convolutional Neural Networks with Reinforcement Sample Learning Algorithm" focuses on the idea of development of computer aided diagnostic systems to detect the Microaneurysms (MAs) in colored fundus images. MAs are known as early signs of diabetic-retinopathy (DR). In this paper, a new MA detection method is proposed which is constructed on image pre-processing, candidate MAs extraction and deep convolutional neural network (DCNN) based classification.

The paper "Cognitive Computing and eScience in Health and Life Science Research: Artificial Intelligence and Obesity Intervention Programs" by Marshall et al. [6] provides a view of the impact of artificial intelligence on our human computer support and health and life science research.

In the article titled "Statistical Sleep Pattern Modelling for Sleep Quality Assessment based on Sound Events", Wu et al. [7] proposes a novel method to assess the sleep quality through sound events recorded in the bedroom. They use individual sleep quality as training label, combining several machine learning approaches including kernelized self-organizing map, hierarchical clustering and hidden Markov model. The proposed method provides a new aspect of sleep monitoring to indicate sleep pattern of specific quality level.

The article titled "Using Neutrosophic Graph Cut Segmentation Algorithm for Qualified Rendering Image Selection in Thyroid Elastography Video" by Guo et al. [8] presents an efficient thyroid ultrasound image segmentation algorithm based on neutrosophic graph cut (NGC) to find the qualified rendering images. The proposed scheme assists the radiologists to diagnose the thyroid diseases using the qualified rendering images.

In title "A Novel Glomerular Basement Membrane Segmentation using Neutrsophic Set and Shearlet Transform on Microscopic Images", the authors [9] proposes a computer-aided detection system to provide accurate glomerular basement membrane (GBM) segmentation. The experimental evaluation demonstrates that this proposed method utilizing the shearlet features and neutrosophic set is able to improve the accuracy of GBM segmentation.

The article by Wahba et al. [10] on "Combined Empirical Mode Decomposition and Texture Features for Skin Lesion Classification using Quadratic Support Vector Machine" reports a novel technique to classify skin lesion images into two classes, namely the malignant Basal Cell Carcinoma and the benign nevus. A hybrid combination of bi-dimensional empirical mode decomposition and gray-level difference method features is proposed after hair removal. The combined features are further classified using quadratic support vector machine (Q-SVM).

The article, titled "Mining Comorbidity Patterns Using Retrospective Analysis of Big Collection of Outpatient Records" by Boytcheva et al. [11] presents an innovative drug extractor algorithm for mining sets of events, which identifies strong co-occurrence patterns. They design a numerical value extractor where experiments run on a relatively large corpus of Outpatient Records (ORs).

In this article, "Supporting Breast Cancer Decisions Using Formalized Guidelines and Experts Decision Patterns-Initial Prototype & Evaluation" the authors [12] introduces an approach to support the Decision system in medicine which can assist the experts/patients to have quality assurance regarding transparent documentation of individualized therapeutic decisions. They compare their automatically generated decision system with manually expert decisions with recommendations and their results are promising.

Li et al. [13] have contributed an article titled "Building Diversified Multiple Trees for Classification in High Dimensional Noisy Biomedical Data". This article applies Diversified Multiple Tree (DMT) on three real world biomedical data sets from different laboratories in comparison with four benchmark ensemble methods, AdaBoost, Bagging, Random Forests, and Random Trees. This paper demonstrates that the diversified multiple tree (DMT) approach is more robust than other ensemble methods, such as AdaBoost, Bagging, and Random Forests (RF), in real world biomedical data sets.

The article by Shahin et al. [14] titled "A Novel White Blood Cells Segmentation Algorithm Based on Adaptive Neutrosophic Similarity Score" focuses on developing a novel segmentation algorithm for White blood cells (WBCs) in the blood smear images using multi-scale similarity measure based on the neutrosophic domain. They employ neutrosophic similarity score to measure the similarity between different color components of the blood smear image. The proposed segmentation algorithm can be utilized for fully automated classification systems, such systems can be either for the healthy WBCs or even for non-healthy WBCs specially the leukemia cells.

In article, "The Effect of Imputing Missing Clinical Attribute Values on Training Lung Cancer Survival Prediction Model Performance", the authors [15] investigate the effect of imputation methods for missing data in preparing a training dataset for a Non-Small Cell Lung Cancer survival prediction model using several machine learning algorithms.

Conclusions

Collectively, these 14 papers illustrate the diverse range of issues of AI to provide a detailed compilation currently being investigated in the field of health and medical. The papers included in this special issue are representatives of the current research challenges in advanced understanding, modeling and implementation of AI in health and medicine which are capable of solving a variety of clinical and health problems. It is expected that these papers can provide researchers with valuable resources and motivations to work on the challenging issues in this research theme. There is convincing evidence that medical AI can play a vital role in assisting the clinician to deliver health care efficiently in coming days.

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