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Editorial

Artificial Intelligence for Health

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Health is one of the major research topics that has been attracting cross-disciplinary research groups. The deployment of new emerging ICT technologies for health, especially based on artificial intelligence, computational intelligence, and the Internet of things (IoT), is attracting the interest of many researchers.

Within this general framework, a Special Issue on "Artificial Intelligence for Health" has focused on original research covering novel theories, innovative methods, and meaningful applications that could potentially lead to significant advances in artificial intelligence for health. The list of topics was quite wide, covering issues related to artificial intelligence and machine learning, with reference to their application to, among others areas, knowledge management, data mining, decision support systems, information systems, medical systems, sensors, biomedical applications, and ambient intelligence in healthcare. Particular emphasis was given in the call for papers to papers focusing on the application to any issue related to COVID-19. In addition, review papers on the topics of interest have been considered.

The response from the international scientific community has been very positive, and the amount of submitted papers indicates well the large appeal of the topics involved; their number turned out to be equal to 28, from which 13 high-quality papers were selected.

We are very satisfied with these papers because of, on the one hand, their quality in themselves, and on the other hand, their showing a wide variety in the topics discussed, which cover a large part of the issues mentioned in the call for papers.

In the following, we very shortly introduce each of them. The presentation of each paper will be based on the authors' own words so that its contributions can be better presented.

Alqithami [1] aimed at investigating and predicting the viral spread of COVID-19 based on human sociobehavioral analyses in various community settings with unknown structural patterns. The author examines the spreading and social contagions in unstructured networks by proposing a model able to (1) reorganize and synthesize the infected clusters of any networked agents; (2) clarify any noteworthy members of the population through a series of analyses of their behavioral and cognitive capabilities; (3) predict where the direction is heading with any possible outcomes; and (4) propose applicable intervention tactics that can be helpful in creating strategies to mitigate the spread. Additionally, a spectra-based methodology that leverages configuration models as a reference network is proposed.

Sallay, Bourouis and Bouguila [2] dealt with the problem of accurate detection of abnormalities in medical images (like X-ray and CT scans) due to blurred boundary contours, different sizes, variable shapes and uneven density in images. They tackled this via a new and effective online variational learning model for both mixtures of finite and infinite gamma distributions. Three different batch and online learning methods based on robust texture-based feature extraction are proposed. Their work approaches the

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classification problem in an unsupervised manner, and it is evaluated and validated on several real challenging datasets for different kinds of pneumonia infection detection.

Oudah, Al-Naji and Chahl [3] considered the problem of the recognition of hand gestures for the health care of elderly people and aimed at providing natural interaction with the assistance system through a camera by making specific gestures. They considered deaf-mute elderly people performing five different hand gestures, each related to a specific request, proposed three different scenarios using a Microsoft Kinect V2 depth sensor and evaluated the effectiveness of their outcomes. Once recognized, the request was sent via GSM as a text message to the care provider's smartphone, because the elderly subjects could not execute any activity independently.

Panicacci et al. [4] worked on the early identification of people suffering from multimorbidity, because this can help to improve people's quality of life and reduce healthcare costs. They describe a population health management tool based on state-of-the-art intelligent algorithms, starting from administrative and socioeconomic data, for the early identification of high-risk patients. After a trade-off on machine learning models and on input data, the random forest method applied to 1 year of historical data achieved the best results, outperforming state-of-the-art models. The resulting model allows general practitioners the possibility to adopt personalized medicine early.

Kimmatkar and Babu [5] aimed at detecting emotional states by processing electroencephalography (EEG) signals and at testing the effects of meditation music therapy to stabilize mental states in their research study. This study allowed for identifying 12 subtle emotions, related in groups of three to anger, calmness, happiness and sadness. A total of 120 emotion signals were collected by using an Emotive 14-channel EEG headset. Emotions were elicited by using three types of stimulus thoughts through audio and video, and a total of 24 features were extracted by performing the Chirplet transform. It was found that meditation music therapy changed the emotions of both intellectually disabled and normal participants from the annoyed state to the relaxed state.

Ecarot et al. [6] noted that healthcare improvement hinges on efficient knowledge transfer to clinicians and patients. They stated that within the emerged learning health system (LHS) framework, security requirements to support LHSs are not well established. To address this, the sensitive data access model (SDAM) was proposed. Using a representation of agents and processes of data access systems, specific security requirements were presented, and the SDAM layer architecture was described. A clinical application benefiting from the model was subsequently presented, and the analysis evaluated the security properties and the vulnerability mitigation strategies offered.

Kulessa, Loza Mencía and Fürnkranz [7] aimed at monitoring the development of infectious diseases to prevent major outbreaks. They gave an overview of non-specific syndromic surveillance from the perspective of machine learning and proposed a unified framework based on global and local modeling techniques. Then, they presented a set of statistical modeling techniques which had not been used in a local modeling context before and could serve as benchmarks for the more elaborate machine learning approaches. In an experimental comparison of different approaches to non-specific syndromic surveillance, these simple statistical techniques already achieved competitive results and sometimes even outperformed more elaborate approaches.

Mustafa and Rahimi Azghadi [8] described automated machine learning (AutoML) technology, the use of which is emerging to accelerate embedding machine learning (ML) in more applications and incorporating it in real-world scenarios. They noted that there is still a need for applying AutoML for interpreting medical text. With reference to this, the paper first reviewed various AutoML tools and techniques with specific reference to the healthcare industry and discussed the developments specific to clinical settings and healthcare applications. Then, the paper surveyed relevant ML research for clinical notes and analyzed the literature of AutoML in this subfield. Finally, they proposed future research directions and shed light on the challenges and opportunities.

Ferreira et al. [9] presented a systematic investigation of articles that specifically addressed the measurement of wounds' sizes with image processing techniques, promoting the connection between computer science and health. Twenty studies were included in the review. They also proposed that a method for measuring the wound area must implement different stages, including conversion to grayscale for further implementation of the threshold and a segmentation method to measure the wound area as the number of pixels for further conversion to metric units. Regarding devices, they concluded that mobile technology has been shown to have reached a level of reliable accuracy.

Bartolini and Di Luzio [10] investigated the automatic detection of cataplexy symptoms with the aims of supporting neurologists in the diagnosis and monitoring of the disease and facilitating the experiences of the patients, allowing them to record videos at home. For this goal, they presented a CAT-CAD tool that included (1) a front-end medical interface for the playback and inspection of patient recordings and the retrieval of videos relevant to that currently played and (2) a back-end, AI-based video analyzer automatically detecting the presence of disease symptoms in the patient recording. Analysis of patients' videos for discovering disease symptoms was based on the detection of facial landmarks, and another implementation of the video analyzer exploiting deep learning techniques was introduced.

Pires et al. [11] noted that the Internet of things (IoT) paradigm relies on the use of mobile device sensors. An essential and reliable performance measure for sensors that is employed to determine functional mobility, gait and vestibular function is the 10-meter walk test. They reviewed multiple studies focusing on automated measurements of the 10-meter walk test with different sensors. Most of the analyzed studies measured similar parameters to the traditional methods, such as velocity, duration and other involuntary and dangerous patient movements after a stroke. This provided an opportunity to measure different parameters that could later be fed into machine learning models for analyzing more complex patterns.

Rezaei et al. [12] investigated atrial fibrillation and ventricular arrhythmia. To do this, they proposed an approach aiming at classifying heart arrhythmias, starting from electrocardiogram (ECG) data. This approach relies on two stages. In the first stage, the features of the ECG input are classified into two main classes: normal and abnormal. In the second stage, the features of the ECG are further categorized as abnormal and further classified into the two above diseases. For both stages, the XGBoost Classifier algorithm was used. This technique was applied and evaluated using an ECG dataset from the UKBioBank repository. The results show that the two-stage approach was effective for early diagnosis and for prevention of serious consequences.

Yadav and Jujjavarapu [13] aimed at the identification and classification of prospective drug candidates such as complex compounds, including lipopeptide, based on their SMILES string representations. They applied artificial neural networks for this task. A successful model was developed for the identification and classification of lipopeptides from their SMILES annotations that efficiently classified similar compounds and supports in decision making for analogue-based drug discovery. This will help in appropriate lead optimization studies for the prediction of potential anticancer and antimicrobial lipopeptide-based therapeutics.

Before we end this editorial, we do wish to thank all the main actors of this Special Issue, who have all played an important role in its success.

First, we thank the contributing authors for their original ideas and solutions and for choosing our Special Issue to present them to the international scientific community.

In addition, special thanks must be given to the reviewers for spending their time evaluating the papers and for providing the authors with sound suggestions aimed at further improving the papers.

Last but by no means least, we wish to wholeheartedly express our most sincere gratitude to everybody at the Computers journal for their effective support in the management of this Special Issue, as their help made everything easy to manage.

The combination of the efforts from all of the above actors has led to the Computers journal being able to publish this Special Issue that presents new, interesting and relevant contributions in the "Artificial Intelligence for Health" field. Our wish is that these papers can represent solid ground on which the international scientific community will base further research in the near future.

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