Artificial intelligence in Healthcare

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ABSTRACT: Healthcare is one of the paramount features of human life. As a consequence of change in life style and food habits recent healthcare is under immense burden due to increase in chronic diseases. Hence it is the prime intent of every nation to indulge with cost-effective, proactive, preventive and fast in response healthcare methods to the population. From last decade artificial intelligence has made technical intersection to each and every attribute of human life starting from E- Commerce, Education, Environment and Healthcare. Basic inclination behind this paper is to descry futuristic methods of Artificial intelligence in healthcare and elementary challenges in the era of research. In this paper we have envelope five significant fields of healthcare i.e. neurology, radiology, diabetics, cardiology, and electronic health records. Privacy enhanced Electronic health record system is the need of the society to provide cost effective, reliable and fast healthcare solutions to world population. In spite of these challenges, rapid development in artificial intelligence shows great promise to the future healthcare and researcher.

Keywords: Artificial intelligence, Radiology, Neurology, Diabetic Care, Cardiology and Electronic health care.

INTRODUCTION: Preventive, proactive, fast and cost-effective healthcare is the demand of society. These all features are cardinal inspiration for evolution of Artificial intelligence in healthcare system from last decade. A number of research studies have explored the use of deep learning in the field of neurological and cognitive science to tackle complex neurological problems like mental disorder, Neurological complications due to strokes, Alzheimer and Parkinson diseases[1-7]. Area of Radiology becomes more accurate and fast in response due to the support of artificial intelligence from last decade. Deep learning algorithms are more helpful to radiologist for image classification, segmentation and enhancement. Deep learning algorithms are also useful to make prediction in case of complex image data from CT,MRI and PET scans[8-12]. Image processing, computer vision and natural language processing of AI technology are establishing support to the new form of radiology in past and future. Advancement of sensor technology and deep learning algorithm can be future research hope for the world[23-26]. The existing data base was constructed in a centralized database environment which was stored and managed in the context of hospital system. This approach causes larger cost and system maintenance, and having issues with the patient medical information incompatible with other systems. Privacy enhanced cloud computing based electronic health record system can be the future alternative of eHealth[23-24].

LITERATURE REVIEW: In this article we have reviewed many research papers in healthcare domain and for better understanding of the paper flow we have divided literature review into five groups which are shown in following figure. This figure shows different areas of healthcare in which Artificial intelligence research applications are under development.

1. Neurology: It's the field of healthcare which is dealing with disorder of nervous system. Clinical examination of nervous system is the integral part of healthcare system. Many literature evaluations justify that neurological care can be taken by AI in terms of monitoring, treatments and prediction.AI for neurology is not a simple path for researcher, but rise in healthcare cost is the motivational factor for future development of AI in Neurology.

REVIEWED RESENT TRADES OF AI IN NEUROLOGY

One of the most common causes for Neurological disorder is the stroke. AI can become most important tool with the help of wireless sensor to observe neurological condition round the clock [1]. Another neurodegenerative disorder is Alzheimer's disease which will gradually decrease patient's neurological and cognitive condition and such condition can be easily predicated earlier with the help of machine learning algorithms. Movement disorder like Parkinson disease can also be detected earlier by using artificial algorithms. Recent study shows that deep leaning (DNN) and discrete wavelength transforms (DWT) can

classify brain images more accurately [2]. Strong association between AI reinforcement learning and control theory can marshal important advances in concept and implementations of healthcare in future. In

short Neuroscience and cognitive science insights are the key drives in development of future AI applications [3]. Another study focuses on organised based segmentation to produce PVS within the white matter which plays important role in the clearance of metabolic waste from the brain. Also PVS of whole brain can provide better diagnosis in case of Alzheimer, strokes, elderly population analysis, sleep, and cognitive impairment with the help of artificial algorithms [4]. Using AI technique we can analyse change in stages of brain from healthy to old age for functional cognitive analysis [5]. Artificial intelligence also proved its significance in movement path tortuosity specially known as Fractal Dimension (Fractal D) application for cognitive impairment and the prediction of falls in older adults [6]. Another area where we can utilize artificial intelligence is Blind Source Separation technique in which we can use Magnetic Resonance Spectroscopic Imaging (MRSI) which can disclose chemical information that characterizes different tissue type in brain tumours [7]. Even though there is continuous development of AI in healthcare, AI applications are facing some challenges in this area like very small number of professionals are available who are perfect in both medical and programming proficiency. Lack of international medical information sharing platforms. No standard protocol is available to handle legal and ethical issues. Dynamic change in individual medical requirement. Collection and storage of heterogeneous database.

2. Radiology: Radiology medical practise is all about detection, monitoring and segmentation of medical images for diagnosis. Research of AI has been running pervasive in the area of radiology from last decade. Advancement of AI technology in medical imaging pillars like CT, MRI, and PET scan are advancing in terms of validity, sensitivity and resolutions. Deep learning with convolutional neural network (CNN) are recently gaining more attention due to its high performance in recognizing medical images for predictions. AI has also covered other major circles of radiology like thoracic imaging, colonoscopy, mammography, brain imaging, radiation oncology, DNA and RNA sequencing. There are two approaches used in radiology known as machine learning and deep learning. In machine learning we provide predefined feature, but this approach is having demerits to adopt variation in imaging data available from CT, MRI, and PET scans. Another method is known as deep learning method which automatically learn features from available data ,hence Deep learning is robust in case of undesired variations in image data. Recent research shows that deep learning approach is superior in terms of accuracy, sensitivity and specificity. perfect in their interpretation with lesser errors and utilizes more time on patient's treatments [12]. Fast evaluations in AI and its applications into routine clinical imaging will cause a major change to the practice of radiology. Machine learning in form of image processing, computer vision and natural language processing of AI technology enhance support to the new form of radiology in future. For precise development of this area, there are still untangle challenges glimpsing the adoption of artificial intelligence like how to over fit the problem of machine learning due to unavailability of larger Reviewed recent trades of AI in radiology

Automated breast ultrasound lesions detection can be possible by convolutional neural networks. In recent study the author had propose the deep learning approach for breast ultrasound lesion detection and investigate three different methods like a patch based LeNet, a U-net and a transfer approach with FCN-AlexNet and their performance is compared with other four other methods. The performance of these algorithms shows improvement in results. In future work accuracy of these algorithms can be increased by adding more trained data and same technique can be suitable to other medical imaging such as three dimensional ultrasound and electrograph [8]. Another research study shows applications of anatomically constrained neural networks (ACNNs) in the field of cardiac image enhancement and segmentation. This algorithm follows the global anatomical properties of the underlying anatomy (shape, label structure) via learnt nonlinear representation of the shapes. This technique acts as the most promising technique for CNN-based segmentation which does not incorporate this prior knowledge. In future this technique can be useful for human pose estimation, anatomical and facial landmark localizations [9]. Automatic localization of landmark is an important steps in medical imaging. Another article shows use of Stratified decision forest for accurate Anatomical landmark localization in cardiac images. This model does not require train data as compare to the other methods [10]. Early breast cancer detection improves the chances of survival, increase the option for curative treatments and help to reduce the cost. There are variety of screening available to detect the breast cancer like mammography, magnetic resonance imaging and ultrasound but their sensitivity and specificities are not up to the mark, especially in case of dense breast. One of the recent study shows that dynamic infrared thermography can be used to improve the detection of breast cancer and reduce false positive and negative rates with the help of Artificial

intelligence algorithms and also demand for more research in this area [11]. Deep learning becomes more powerful tool for image processing. Deep learning has effect on lesion detection, disease detection, classification, quantification, and segmentations.

3. Diabetic care:

Recently the whole world population is facing another noncommunicable disease known as Diabetics. There are many reasons behind this disease like increased economic burden, change in life style, less activity and improper food intake. This disease covers all population from old age to child and cause lot of early deaths and financial burden. Recent development in AI technology, wearable devices and sensor technology can provide new hope in the field of diabetic treatments. Recent research of AI indicates, its support to achieve better healthcare in the area of diabetic like activity monitoring, food monitoring, development of non-invasive sensor for continuous monitoring of blood sugar, intelligent foot, and Artificial pancreas.

Recently many research is in progress in terms of non-invasive biosensor which is prime need of diabetic patients for continuous monitoring blood glucose level. There are many types of biosensor under development like electrochemical, optical, and piezoelectric. Their recent applications shows that they can be the best alternative if they overcome problems like signal conversion stability, range and accuracy. Localization of sensor is also one of the important areas for future research. Reduction in error and improvement in the accuracy of localization of sensor by using deep learning, neural network, and genetic algorithms can improve the accuracy [13].Another research article shows development of other types of biosensor like cloth- based capacitive sensor and ECG based biosensor ,but it consists problem of accuracy and calibration which can also be solved by deep or machine learning algorithms [14 -15]. Diabetic patient has to undergo insulin administration on daily basis in which carbohydrate intake calculation is another major area under the research. Basic drawback of all this available products is step count error due to no real time measurements.

One of the recent research shows the use of deep learning methodology which combines feature learned from internal sensor data and information from a set of shallow features to enable accurate and real time activity classification [17] foot ulcerations and infection. Foot information like pressure, plantar pressure, force, velocity, acceleration, contact time, temperature, and humidity can be measured with help of sensors and these parameters are useful for research, diagnosis and evaluation of human physiological condition. With the help of these parameters and combination of proper sensor technology, machine learning algorithms and wearable devices we can design precise intelligent foot [18-20]. Development of Artificial pancreas can also make great impact on diabetic management by maintaining blood glucose level at normal level. Another model in which nonlinear control system based on (TS) Fuzzy model is used for successful designing of artificial pancreas. In future we can use different technique for design artificial pancreas like fuzzy logic, nonlinear control system and combination of artificial intelligence [21-22]. Some of the recent models available in market known as Dexcom

Next used for measurement of blood glucose. DIABNEXT is personalized metric analysis to provide a decision support to

patient and physician. Xbird is used to analyse insulin data points with artificial intelligence to create effective insulin solutions.

4. Cardiology

It is the another important field of healthcare which requires continuous monitoring and personalised care round the clock for heart related diseases. This ideal requirement is not possible in day to day life due to many limitations. Fast developments in machine learning, sensor technology and wearable devices it is quite possible in the future to provide cost-effective and personalised care to each patient.

5. ELECTRONIC HEALTH RECORD SYSTEM (HER):

Basic challenge for successful implementation of Artificial intelligence in healthcare requires big support from many attributes and one of them is privacy enhanced electronic healthcare system which consists of database of different community patient which is integrated on common platform known as electronic health record system. Basic motivation behind electronic healthcare system is to provide assistance to doctors to view the health records at the time of emergency. Further development in electronic health records system can be helpful to improve efficiency of medical treatment and make healthcare better.

REVIEWED RECENT TRADES OF AI IN CARDIOLOGY

Some of recent developments in this field are new potential genetic biomarkers for screening CVD. With this imaging technique and wearable devices it is possible to obtain faster response and higher resolution. In future we can develop new personalised predictive models which is suitable for early detection of CVD [23]. Another research for identification of location of specific feature points in a Cardiac cycle in which author proposes multichannel SCG spectrum to monitor the cardiac activity which identifies six new feature points which will be helpful to detect heart disease and heart failure[24]. Korotoff sound are known to be due to change in their characteristics during blood pressure measurements resulting in some uncertainties for systolic and diastolic pressure (SBP and DBP). Analysis using a convolutional neural network shows that korotoff sound is consistently identified by CNNN.This technique surely help to develop CNN based BP measurement [25]. Another clinically approval study known as Pocket – Echocardiography integrated mobile health device Assessments in modern structural heart disease in which Smart phone is connected to electrocardiogram blood pressure, oxygen measurement, activity monitoring reduces risk of hospitalization and hazard ratio[26].

CONCLUSION

Improving human health within physical, mental, emotional and social contexts by overcoming ethical, legal, economical and potential technical barriers to provide cost effective healthcare is the basic motivation behind technical intersection of Artificial intelligence in healthcare. Successful implementation of Artificial intelligence in healthcare requires intense multi-disciplinary conjunction of computing, communication, automation, biomedical engineering and health informatics.

REFERENCES:

[1] T. Nitin, S. Apoorvaa, S. Himanshi, and T. Krishna, "Diagnosing dengue: A faster, artificial intelligence based hack", International Journal Of Engineering And Computer Science, vol. 6, no. 7, pp. 21 895–21 915, 2017.

[2] O. Mahmoudi, F. Piltan, O. R. Sadrnia, M. Jafari, and M. Eram, "Design robust artificial intelligence model-base variable structure controller with application to dynamic uncertainties octam vi continuum robot", International Journal of Hybrid Information Technology, vol. 8, no. 1, pp. 51–72, 2015.

[3] F. Junejo, I. Amin, M. Hassan, A. Ahmed, and S. Hameed, "The application of artificial intelligence in grinding operation using sensor fusion," International Journal, vol. 12, no. 30, pp. 11–18, 2017.

[4] S. Saroha, V. Gupta, V. Shekher, P. Rana, and P. Singla, "Promoting short term load forecasting by using artificial intelligence", vol. 12, no. 30, pp. 11–18, 2017.

[5] L. Sharma and V. Srivastava, "Performance enhancement of information retrieval via artificial intelligence" International Journal of Scientific Research in Science, Engineering and Technology, vol. 3, no. 1, pp. 187–192, 2017.

[6] A. Anitha, G. Paul, and S. Kumari, "A cyber defense using artificial intelligence", International Journal of Pharmacy and Technology, vol. 8, no. 4, 2016.

[7] Z. JAGRUTI and S. P M, "Analysis of reliability using artificial intelligence technique," International Journal of Innovative Technology, vol. 5, no. 2, pp. 0247–0250, 2017.

[8] K. Amandeep and C. Deepti, "Cyber awarness improvement using artificial intelligence,", International Journal For Technological Research In Engineering, vol. 4, no. 9, pp. 2347–4718, 2017.

[9] R. Patel, A. A. Amin, and D. M. Hiren, "Optimal svc placement for loss minimization in electric power networks using artificial intelligence techniques", International Journal of Advance Research in Engineering, Science & Technology, vol. 4, no. 4, 2017.

[10] A.-A. Shayma M and A. Maysam, "Prediction of cancer behavior based on artificial intelligence", vol. 12, no. 30, pp. 11–18, 2017. vol. 12, no. 30, pp. 11–18, 2017.

[11] R. Sathya, M. Pavithra, and G. Girubaa, "Artificial intelligence for speech recognition", International Journal of Computer Science & Engineering Technology, ISSN, pp. 2229–3345, 2017.

[12] R. Patel, A. A. Amin, and D. M. Hiren, "Optimal svc placement for loss minimization in electric power networks using artificial intelligence techniques", International Journal of Advance Research in Engineering, Science & Technology, vol. 4, no. 4, 2017.