Artificial Intelligence in Medicine and Healthcare

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Abstract –
Artificial Intelligence (AI) is rapidly being applied to a good range of healthcare medicine has been considering as an approach which will augment or substitute human professionals in primary health. Several sorts of AI are already use in companies. There are various automated systems and tools like Brain-computer interfaces (BCIs), arterial spin labeling (ASL), biomarkers, tongue processing (NLP) and various algorithm helps to attenuate errors and control disease progression. Although there are many instances during which AI can perform healthcare tasks also or better than humans, implementation factors will prevent large-scale automation of healthcare professional jobs for a substantial period. AI is to form computers are useful in solving problematic healthcare challenges and by using computers we will interpret data that's obtained by the diagnosis of varied chronic diseases like Alzheimer's, Diabetes, Cardiovascular diseases and various sorts of cancers like carcinoma , carcinoma , etc.

1. INTRODUCTION

Artificial Intelligence (AI) will help in industry and science and increasingly every aspect of our society including healthcare. AI was invented by McCarthy in 1955 and is defined by "the science and engineering of creating intelligent machine".AI works with minimal human interventions. AI solutions that help battlefront healthcare workers detect and monitor disease efficiency. In Covid-19 pandemic AI will do an excellent job for us like Robots aren't suspected with the virus in order that they are being deployed to finish many tasks like cleaning, delivering food packets in suspected areas, medicine to scale back the human interventions. AI has been applied to several areas like program translation systems and intelligent personal assistants. AI also found many utilized in the medical field along side widespread use of electronic health records (EHRs) and rapid development bioscience including neuroscience. AI will help to detect the patterns, heartbeats, and it'll always detecting our blood heat, pulse.

Literature Review

Artificial Intelligence has been able to correctly diagnose pulmonary lung function in 82% of cases in a study (Topalovic & Das, 2019). In another study, Deep Learning Algorithms were found to be effective for Detection of Lymph Node Metastases in Women with Breast Cancer (Ehtesham, Veta, van Diest, & et al, 2018). A model was devised to detect mental fatigue by using eye-tracking among younger and older adult viewers of videos with improved accuracy of 13.9% (Yamada & Kobayashi, 2018). In another study, AI was used for the early detection of skin cancer. Early detection of carcinoma is extremely important and may prevent some skin cancers, like focal cell carcinoma and melanoma (Zhang, Cai, Wang, Tian, Wang, & Badami, 2020). In another research, it was reported that AI algorithms in digital mammography converted single whole digital images of the breast into automatically extracted quantitative, pixel-level variables that are unrecognizable to the human eye (Trister, Buist, & Lee, 2017). Machine learning and imaging analytics from renal biopsies can help to predict how long a kidney will function adequately in patients with chronic kidney damage, says a study published in Kidney International Reports (Kolachalama, 2018). Roach (2017) looks at a number of **the** applications of AI in Ophthalmology. In one of the most promising application is in the detection of retinal eye diseases, the researchers from the Google Brain project had reported in 2016 that the deep learning AI system had taught itself to accurately detect diabetic retinopathy (DR) and diabetic macular edema in fundus photographs (Roach, 2017). The research used DL algorithms in the diagnoses of tuberculosis (TB) in chest X-ray images and achieved high levels of accuracy (Lakhani & Sundaram, 2017). Researchers compared a traditional state-of-the art in mammography Computer-Aided Detection (CAD) system which relied on a manually designed feature set with a DL Convolutional Neural Network (CNN) algorithm to detect breast cancer lesions. Results showed that CNN outperformed the traditional CAD system (Kooi, et al., 2017). Deep learning in retinal image

analysis provides an accurate means "for the differential detection of retinal fluid types across the foremost prevalent exudative macular diseases and OCT devices" (Schlegl, et al., 2018)

1.1 What is AI?

Artificial intelligence (AI) is a wide-ranging branch of computer science with making a smart machine.AI is similar to humans, machines think like humans and mimic their actions. AI makes it possible for machines to learn from experience, pattern matching, and adjust to new inputs and perform human-like tasks.

1.1.1 Applications of AI in Healthcare

The development of latest technologies is involved in every sector of our activity. How does the utilization of AI algorithms and large data will help in taking care of our health? Apple Heart study is that the most impressive study of practical use of AI in medicine and healthcare. The aim of this study is to access the effectiveness of arrhythmia detection in overall populations by automatic monitoring of the human pulse using sensors installed within the watch. The method of testing is extremely simple-its enough for the participant to wear an apple await the acceptable amount of your time . An application developed on the idea of collected information detects the info, results, and identifies the probability of getting heart defects. The normal thanks to access pulse is to form an ECG record supported different electronic medical appliances with help of that count the guts rate. just in case of Apple watch to calculate the guts rate, sleep cycle, breathing rate, activity level, vital sign this all activity detects with the sensor installed within the watch uses green LED flashing hundred's times per seconds, while photosensitive photodiodes detect the quantity of blood flowing in our wrist. The apples watch will keep a record by 24*7 and predict the info and provides signals to the owner. The info will analyze by deep learning algorithms and Machine Learning and predicts. The optical structure of the sensor collects signals from our four signals various points of wrist and after combining complex software algorithms, the Apple watch separated the unnecessary data(noise). Heartbeat sensors can also use infrared to detect the beats. It'll prove that the apple watch saves the person's life, the watch gives repeatedly warning about her vital sign and heartbeat rate. When the guts rate will increase the watch gives warning to the persons. Watch monitor all things in our body our daily activity

and collects the info with help of that it gives a warning.

1.1.2 Artificial Intelligence in breast cancer

Breast Cancer may be a major explanation for concern worldwide. It's the foremost frequently diagnosed cancer in women and men also. Carcinoma occurs when cells are growing and multiply uncontrolled, which produce in physical body tumor or neoplasm.
In women with carcinoma who are younger than 50 years aged. There's a variety of growing carcinoma patients within the whole world and there's a requirement for brand spanking new techniques to diagnose carcinoma like sort of patients and predictions this will cause a decrease within the death rate.

Early-stage cancer can detect with the assistance of screening tests. The foremost effective tool for detecting carcinoma is Mammography. The detection of other pathologies and should suggest the character of like normal, benign, or malignant. AI developed the system to interpret mammogram data, that translate patient charts into diagnostic which predicts the cancer risks. The techniques that depend upon the intelligent system like neural networks, nearest neighbor method, CAD (CAD) algorithm, symbolic logic approach, decision trees, and applied mathematics method. Currently, tongue processing (NLP), Curemetrix algorithm, Genes to systems carcinoma database, and triple-negative carcinoma database intelligent system are used for detecting carcinoma. The existence of screening programs worldwide, the interpretation of mammograms is suffering from a false negative and false positive. False-negative is that the "Scan appears normal albeit cancer is present" and false positive is that the "Scan looks abnormal albeit no cancer is present". Computer-aided diagnosis is employed to detect the irregularity of mammograms and this result's employed by a radiologist and for diagnosis which plays a crucial role. The CAD performance can change from one condition because some lesions harder to detect than others because they need similar characteristics to normal mammary tissue. Higher breast rates usually indicate higher possibilities for the presence of malignant tissues. A person's observer can detect structures alright without information on the general brightness. In automatic breast classification, it's important to make a decision which parameter, which section gives the simplest division to offer the simplest categories. Artificial Neural Network (ANN) is one among the simplest AI techniques for common

data processing tasks nonlinear statistical data modeling tools. ANN helps to detect the cancerous and noncancerous image. ANN will learn from historical data like non-linear data, handle impressive information enabling application models to independent data has made them very attractive analytical tools in healthcare.

Symbolic logic is employed to survival the share inpatient of carcinoma.

1.1.3 Artificial Intelligence in Lung Cancer

Lung cancer is the leading cause of death from cancer from the US and around the world. Lung cancer accurate diagnosis is very difficult in treatment selection and planning for each cancer patient. The microscopic examination of tissues of cancer slide remains an essential step in cancer diagnosis. It requires the pathologist to recognize the histopathological patterns in high in the highly complex tissue. This process is very time consuming, subjective, generates considerable inter and intra-observe variation. Pathology inspection of tissue slides is a crucial step in carcinoma diagnosis. For example, the tumor, node, and metastasis staging the node stage (regional lymph node involvement) is determined by examining whether the tumor has invented the lymph nodes, based on pathology slides.

Figure
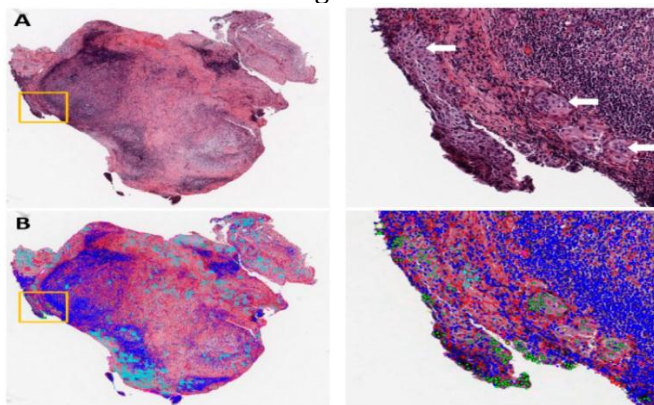
In this figure A,) Computer-aided automatic detection of tumor cells in lymph nodes would greatly reduce the false-negative rate, which would allow for better early detection and treatment of lung cancer, improve the accuracy of TNM staging, speed up the examination process and reduce the workload for pathologies.

Figure B) Histological classification of tumor subtypes is another application of pathology image analysis in lung cancer diagnosis. Lung cancer can be divided into non-small cell lung cancer and cell lung cancer.

1.1.4 Management of diabetic complications using Artificial Intelligence

Diabetic is a chronic metabolic disorder characterized by high glucose in our blood level. Blood glucose is increased is observed due to together the destruction of pancreatic beta (Type-1) or cell resistance to insulin(Type-2). This disease leads to serious micro vascular and macro vascular complications namely neuropathy, retinopathy and cardiomyopathy. The management of diabetic is very difficult actually this is a very tough job as there are several factors to control our blood pressure. The application of AI in monitoring and diagnosis of diabetics and its complication is to improve the patient's life. The computer-assisted diagnosis, decision network, implementation of software may assist the physician to attenuate the inter and intra-observe variability. Foot amputations are one of the advanced stages of neuropathy. The sense contains many sensors that collect the knowledge about pressure, incorrect posture, ill-fitting shoes –the variable liable for foot ulcers. The decline in kidney function is different in diabetic patients; it very hard to predicts the determinant of diabetic nephropathy. Co-workers are applied various machine learning techniques such as feature selection method and support vector machine and developed the new visualization system which uses a nomogram approach. The proposed method onset predicts the nephropathy about 2-3 months before the actual diagnosis. The Sanchez and co-workers' evaluation is the performance of a comprehensive computer-aided diagnosis system for diabetic retinopathy screening, using the publicly available datasets of retinal images and compare to humans experts. They applied previously CAD developed a system to 1200 digital color fundus photographs. The help of those photographs can diagnose the diabetics.

1.2 Artificial Intelligence in Medicine

Artificial Intelligence (AI) medicine refers to the use of AI technology /automated processes in the diagnosis and treatment of patients who require care. There are some virtual nurses, this virtual nurse will monitor the thing, and give the medicine on time, prepare a report of patients, give medicine to patients all this thing is

done, virtual nurses. There is some example of how it works: processing and analysis, using multiple sources of data to come to an accurate diagnosis, patient monitoring, etc.

There is an incredible amount of technology use in medicine whether we realize or not –medical records, online appointments can be scheduled, medical records are digitized, many patients are check online clinics using their phones or computers. For example

-Decision support system: when given a set of symptoms, that time it will come up with the list of possible diagnoses.
 -Robotic Surgical system: The da Vinci robotic surgical system, with robotic arms, precise movement, and magnetized vision.
-Reducing human error: Babylon is an online application where patients in the UK can book the online appointment, and routine test, check for symptoms and get advice, monitor their health and order kits.

1.2.1 Top Applications of Medicine in AI

Diagnosis Disease

Correctly diagnosis disease takes many years of medical training. Diagnosis is a very hard and time-consuming process for humans. In many fields demands for experts far exceed the available supply. This puts doctors under strain and often delays life-saving patients diagnostics.
Machine learning algorithms see the patterns of the diseases similar to the way the doctor see them. A key difference is that algorithms need a lot of concrete examples for that, thousand –in order to learn. And all of this example are neatly digitized and a way to understand the machine because the machine can't understand the textbooks. Some examples are already defined by doctors digitized that
-Detecting lung cancer or strokes based on CT scans.
-Assessing the risk of sudden cardiac death or other heart disease based on electrocardiogram and cardiac MRI machines.
-Finding indicators of diabetic retinopathy in eye image.
 -Classifying skin lesion in skin image.
Since there is more data available in these cases, algorithms are just as good as diagnostic experts.
The main part in algorithms can draw the conclusion in a fraction of seconds, and it can be reproduced inexpensively all over the world

Gene Editing with AI

Gene editing is a technique in which two genes are combined in one. In editing there are many things comes under that like humans genes, animal, trees, insects every living thing we can do the gene editing. During gene editing with CRISPER technology, the CAS9 cut the DNA home in the right spot to snip the help of guide RNA. The way the genetics material stitched back together afterward isn't it terrible precise, though; in fact, the scientist thinks that without template this is impossible. If we do the gene-editing sometimes the other diseases are coming like HIV, cancer. When two person gene is combined that time they are matched and sometimes they caught an error in new genes that time this error gene is removed and put the new gene in that with CRISPER(CAS9) technology.
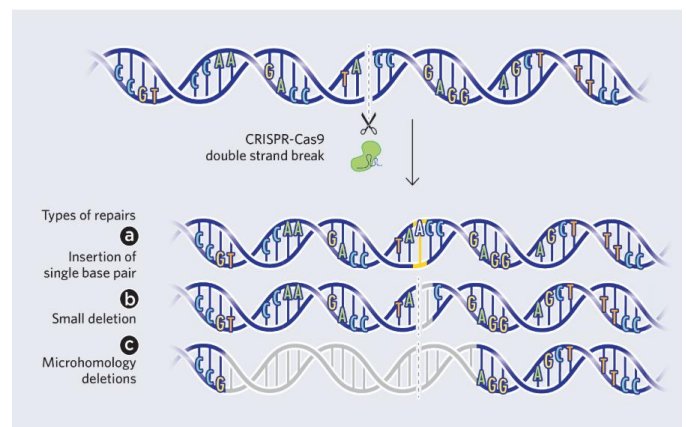
CRISPR guide RNA target specific spot in the genome for the cas9 enzyme cut, forming a double-strand break. An algorithm predicts which type of repairs made at a site targeted by specific guide RNA.

a) a small deletion b)or a larger change known as Microhomology
Some companies are working with gene-editing by making DNA at the cellular level. The CRISPR gene-editing technology is the collaboration between computer scientists and biologists. The positive outcomes are "editing-out" that might be cause disease and "editing in" genes that create high loose, drop resistance crops, but create moral, ethical complex implications. Many of the people are "optimizing" the benefits of the gene mutated and some people are harm when gene editing is done on them. Editing DNA can lead to changes in physical traits, eye color, and disease risk.

The first genome editing technologies were developed in late 1900. A new genome-editing tool called CRISPR 2009 has made it easier. The gene editing is simple, cheaper, faster, and more accurate than the old system.

Conclusion

Early detection of chronic disease use AI treatments gives better improves the quality of diagnosing and give treatments on it. AI will improve the patient's quality of life, further life living chances. It is very important to the development of these methods which gives the accuracy in the research of chronic disease.AI has been recently promoted as one of the leading features in healthcare. With the help of AI, machines give very accurate results than humans. The result of relatively simple tasks, such as tumor detection, lung cancer detection is very satisfactory, with AUC around 0.9 while the more result is challenging 2task like mutations transcription status prediction are less satisfactory. AI can save much life, with the help of AI we can produce the drugs. AI is a very important thing in humans life because it will accuracy in every part of life in medical, healthcare. In healthcare, AI will do a great job.

References:

1. Ontario HQ. Cancer screening with digital mammography for women at average risk for breast cancer, magnetic resonance imaging (MRI) for women at high risk: An evidence-based analysis. Ont Health Technol Assess Ser. 2010;10(3):1-55.

2. Early Breast Cancer Trialists' Collaborative Group (EBCTCG). Effects of chemotherapy and hormonal therapy for early breast cancer on recurrence and 15-yr survival: An overview of the randomised trials. Lancet. 2005;365(9472):1687-1717.

3. Gotzsche PC, Jorgensen KJ. Screening for breast cancer with mammography. Cochrane Database Syst Rev. 2013;6:CD001877.

4. Fujita H, Uchiyama Y, Nakagawa T, et al. Computer-aided diagnosis: The emerging of three CAD systems induced by Japanese health care needs.

5. Jara-Lazaro A.R., Thamboo T.P., Teh M., Tan P.H. Digital pathology: Exploring its applications in diagnostic surgical pathology practice. Pathology. 2010;42:512–518. doi: 10.3109/00313025.2010.508787. [PubMed] [CrossRef] [Google Scholar]

6. Goldstraw P., Chansky K., Crowley J., Rami-Porta R., Asamura H., Eberhardt W.E., Nicholson A.G., Groome P., Mitchell A., Bolejack V., et al. The IASLC Lung Cancer Staging Project: Proposals for Revision of the TNM Stage Groupings in the Forthcoming (Eighth) Edition of the TNM Classification for Lung Cancer. J. Thorac. Oncol. 2016;11:39–51. doi: 10.1016/j.jtho.2015.09.009. [PubMed] [CrossRef] [Google Scholar]

7. Travis W.D., Brambilla E., Noguchi M., Nicholson A.G., Geisinger K.R., Yatabe Y., Beer D.G., Powell C.A., Riely G.J., Van Schil P.E., et al. International Association for the Study of Lung Cancer/American Thoracic Society/European Respiratory Society International Multidisciplinary Classification of Lung Adenocarcinoma. J. Thorac. Oncol. 2011;6:244–285. doi: 10.1097/JTO.0b013e318206a221. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

8. M.W. Shen et al., "Predictable and precise template-free CRISPR editing of pathogenic variants," Nature, 563:646–51, 2018.

9. F. Allen et al., "Predicting the mutations generated by repair of Cas9-induced double-strand breaks," Nat Biotechnol, 37:64–72, 2019.

10. Forbes paper

11. National Human Genome Research Institue

12. Ehtesham, B. B., Veta, M., van Diest, J. P., & et al. (2018). Diagnostic Assessment of Deep Learning Algorithms for Detection of Lymph Node Metastases in Women With Breast Cancer. JAMA, 2199–2210.

13. Kolachalama, V. B. (2018). Association of Pathological Fibrosis With Renal Survival Using Deep Neural Networks. Kidney International Reports, 464 - 475.

14. Kooi, T., Litjens, G., van Ginneken, B., Gubern-Mérida, A., Sánchez, C., Mann, R., et al. (2017). Large scale deep learning for computer aided detection of mammographic lesions. Med Image Anal, 303-312.

15. Lakhani, P., & Sundaram, B. (2017). Deep Learning at Chest Radiography: Automated Classification of Pulmonary Tuberculosis by Using Convolutional Neural Networks. Radiology, 574-582.

16. Roach, M. (2017). Applications of AI in Ophthalmology. Eyenet Magazine, 77-83.

17. Schlegl, T., Waldstein, S., Bogunovic, H., Endstraßer, F., Sadeghipour, A., Philip, A., et al. (2018). Fully Automated Detection and Quantification of Macular Fluid in OCT Using Deep Learning. Ophthalmology, 549-558.

18. Topalovic, M., & Das, N. (2019). Artificial Intelligence has been able to correctly diagnose pulmonary lung function in 82% cases in a study (; Das, N). European Respiratory Journal.

19. Trister, A. D., Buist, D., & Lee, C. I. (2017). Will Machine Learning Tip the Balance in Breast Cancer Screening? JAMA Oncol, 1463-1464.

20. Yamada, Y., & Kobayashi, M. (2018). Detecting mental fatigue from eye-tracking data gathered while watching video: Evaluation in younger and older adults. Artif Intell Med, 39-48.

21. Zhang, N., Cai, Y. X., Wang, Y. Y., Tian, Y. T., Wang, X. L., & Badami, B. (2020). Skin cancer diagnosis based on optimized convolutional neural network. Artif Intell Med.