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A Review of Artificial Intelligence in Medical field

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Abstract – The concept of AI was first proposed in 1956, and since then, it has revolutionized human medicine through a plethora of technology advancements and fundamentally altered the conventional medical paradigm. The main method for perspectives to explain how artificial intelligence is being applied in the medical domain: machine learning, intelligent robots, image recognition, and expert systems. We also go over current issues and upcoming developments in these fields. Due to consequences of globalization, numerous research institutes worldwide having complete many studies on this topic in recent years. As such, the field of medical artificial intelligence has made significant progress and is aticipated to continue growing in the future.

1.Overview

John McCarthy first used the term artificial intelligence (AI) in 1956 at the Dartmouth Conference, and that is when the field of AI was born.The ability to process external data systematically and learn from it to achieve specific goals and tasks is how Kaplan and Haenlein described artificial lintelligence.[2].Artificial Intelligence (AI) is the process of utilizing machines to mimic intelligent behaviors and human thought processes, such as learning, reasoning, and thinking. Its goal is to deal with challenging isseues that are best left to professionals.[3]. The study of AI a subfield of computer science, focuses mostly on the following topics: machine learning, intelligent robots, neural networks, natural language understanding, language recognition, picture recognition, and expert systems.[4]

The concept of AI in medicine (AIM) first emerged in the early 1970s.[5] It sought to increase the effectiveness of medical diagnosis and treatment through the use of AI systems. Following the 1980s, the development of AIM might be broadly divided into four stages: [1] infancy (1980s): the "decision tree" algorithm was proposed, and artificial neural networks continued to develop; [2] adolescence (1990s): "expert systems" continued to mature because of the emergence of support vector machines; [3] coming-of age (2000s): the concept of "deep learning" was proposed, and machine learning became a prominent theme of AIM; and [4] currently, we are in the "maturation period" (2010s): as the technologies are relatively advanced. However, the ability to communicate with others still requires improvement. Therefore, we are still in the stage of "weak" AI.[6]

2.Application of AIM

2.1.Machine learning

The phrase "machine learning" was first used in 1959 by Arthur Samuel to refer to a class of algorithms and classifier development.[7]. To be able to effectively forecast incoming data, the algorithm automatically learns from the source data and creates a prototype based on it.[8]

The backpropagation technique was first developed in the early 1960s, and numerous more

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significant advancements in machine learning algorithms followed.[9]. Paul implemented the automatic differentiation technique in neural networks in 1982.[10] A popular machine learning method recognised as the "decision tree" was created by Ross Quinlan in 1986. It entails classifying data based on predetermined rules. Tin Kam Ho developed a significant algorithm called as the random forest (double spatial feature extraction algorithm), According to the decision tree-based random subspace method.[11] Vladimir created the support vector machine model in 1995. The profound learning algorithm was given by prominent deep learning expert Geoffrey Hinton in 2006. Convolutional neural networks are among machine learning's representative algorithms, and deep learning is essentially built on them.

CNN-BP, or convolutional recurrent neural network-blood pressure, is a revolutionary blood pressure measuring model developed in 2008 to meet the criteria of the British and Irish Hypertension Society and the Association for the Advancement of Medical Instrumentation. Its goal was to increase the model's precision, address concerns with poor resilience, and extract pulse waveform feature points in conventional medicine.[12]

As assisted diagnosis technology advances, a sizable data bank is created during the illness screening, diagnosis, and treatment processes.[13]For the doctors, organizing and interpreting this data in a short amount of time can be difficult. Consequently, machine learning is being employed more and more in medicine to assist physicians in forecasting patient outcomes and disease states.

One of the best machine learning algorithms is Random Forest. Nowadays, random forests are widely used in medicine, especially in disease prediction. People who have had idiopathic bleeding ulcers in the past may be more likely to develop an ulcer. Serious complications such as ulcers can make the patient unsafe. In 2018, an IPUML model was developed using machine learning to accurately predict rebleeding in idiopathic peptic ulcer. [14]

On the other hand, serious complications such as myocarditis and pulmonary edema may develop in a small number of children with serious enterovirus infection and foot and mouth disease. [15] The CatBoost model was developed in 2019 to predict the severity of hand, foot, and mouth disease and was discovered to have better specificity and sensitivity compared to other models such as decision tree and SVM. [16]

Machine learning can also tell the benefit of radiation therapy. For example, people with cancer, especially people with small brain cancers, often receive radiation therapy. However, long-term radiation therapy causees serious side effects, such as radiation pneumonia, which make way to respiratory failure and death. [17] Researchers have used neural networks to develop lung cancer prediction strategies. They also created a network heavily trained on hardware and memory to accurately predict various problems. [18]

The “black box” problem of machine learning needs to be solved. A “black box” neural network includes a recurrent neural network with short-term memory and a CNN for feature extraction. Generally speaking, a neural network consists of ideas, actions, and neural processes. “Black box” refers to the central processing of neural networks. Users cannot see the inner workings of the system. [19] By solving problems in the black box, machine learning can become more accurate, more powerful, and expand its application. This could lead to further advances in treatment.

2.2. Intelligent robots4

The American Robotics Association defined a robot in 1979 as "a reprogrammable, multifunctional manipulator designed to move materials, parts, tools, or other special objects by a variety of programs programmed to do many things." 20 smart robots participated in the surgery. [21] For example, PUMA 560 was used in prostate surgery in 1988, and PUMA 560 was used in neurosurgery in 1985. In 1992, the US Food and Drug Administration (FDA) approved the first intelligent robot called ROBODOC. It is used only in hip treatment in orthopedic surgery.

To date, the FDA has approved three types of robotic surgery: ZUES, da Vinci, and automated endoscopic systems for robotic approval. [22] Smart robots are widely used in fields such as urology, orthopedics, and dentistry due to their accuracy, intelligence, and minimal invasiveness.

Depending on the type of orthopedic surgery performed, robots can be divided into three groups: joint surgery robots, trauma orthopedic robots, and other robots. [24] Femoral neck fractures may develop in elderly people with disabilities, poor function, or hip deformities. The best treatment for these fractures is surgery because they can cause diseases such as nonunion and avascular necrosis of the femoral head. A study was conducted in 2018 investigating ways to reduce bleeding during surgery for femoral neck fractures. After comparing two surgical methods (robotic surgery and manual surgery), they concluded that surgeons cou

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ld define and shrink the surgical area, thus reducing th e bleeding that occurs during surgery. [25]

Smart robots are also widely used in gynecolo gical surgery. For example, patients with early-stage ovarian cancer may experience symptoms such as abdominal pain, torsion of the ovarian pedicle, and ovarian cancer. Treatment of this tumor, which is still in its early stages, is very important. A meta-analysis found that the da Vinci system provides man y benefits, including removing more lymph nodes duri ng surgery and reducing patients' need for additional b lood. Therefore, this surgery is safer than laparoscopic surgery. [26]

Most robots that assist surgeons in clinical set tings are discrete devices without any movement. Ho wever, continuum robots – specialized biomimetic rob ots with evolutionary patterns similar to those of "inve rtebrates" – have recently begun to emerge and will e ventually replace Unique robots due to their flexibility and flexibility. In the future, robots will continue to b e at the forefront of surgery. [27] Although smart robo ts are widely used in the field of orthopedics, they hav e limitations such as high cost, size and narrow applic ation area. [21] Future surgeries will require smart rob ots to gradually adapt to the medical environment in a fast and intelligent manner. [twenty three]

2.3. Image recognition technology

The evolution of image recognition technolog y consists of three stages: object recognition, image re cognition and text. [28] The analysis process consists of five steps: concept creation, image preproduction, i mage acquisition, design, and production. [29] This te chnology can be used to process image files quickly a nd efficiently. For example, one study found that a me chanical map was more effective than an electronic de vice at identifying bones most likely to break. [30] Th ey found that the patient's age and gender affected the area of
the broken line. [30] The application of image recogni tion technology in the diagnosis and treatment of inter trochanteric fractures is very important. It is also wide ly used in pain analysis, diagnosis and prognosis. [31]

Imaging technology is now widely used in me dicine. One of the four leading causes of death in wo men is breast cancer (ranked 32nd), most commonly c aused by human papillomavirus infection. In the early stages, patients do not have obvious symptoms. However
symptoms such as cachexia and anemia may appear la ter. Cervical cancer patients have access to a variety o f treatments, including surgery, radiation therapy and chemotherapy; however, the prognosis for these indivi duals often depends on early diagnosis of the disease. The accuracy of cervical face recognition based on de ep learning is almost 90%, which can help doctors det ect cancer early. [33]

A 2017 study explored how imaging technolo gy could improve the accuracy of fungal keratitis. [34] After analyzing experimental data using light micros copy, researchers concluded that images based on ima ge recognition are more accurate and specific than bo ne smears when diagnosing fungal keratitis. Additiona lly, knowledge of imaging technology can help uninfo rmed doctors detect diseases accurately.

Although knowledge of imaging technology c an help doctors diagnose the condition, it cannot repla ce doctors technical knowledge. The final diagnosis w ill affect some resolution of the images obtained, and t his resolution will vary depending on the equipment u sed in different hospitals[31]. The use of image recog nition technology brings many challenges. For illustra tion, in multilayer neural convolution, further effort must be done to improve the efficiency of the calculat ion as the training model requires more data. Addition ally, the use of high-
performance supercomputers is still rare. Therefore, m ore research is needed in the coming days to overcome the problems related to hardware, o ptimization and technology integration.

2.4. Expert system

A system of experts is a computer program designed to mimic the decision
making process of human experts.[36]. As one of the most effective of intellectual skills, it uses existing kn owledge to think through and solve many complex pr oblems. [37]

The professional development phase can be divided in to the initial phase (1965-
1971), the initial phase (1972-
1977) and the developmental phase (1978-
1978). [38] The first expert, the Deckard system, was developed in the early 1960s. The AAPHelp system w as developed by the University of Leeds in 1972 to he lp diagnose abdominal pain. [39] The INTERNIST-I system was developed by the University of Pittsburg h in 1974 and is mainly used in the identification of cl inical diseases. MYCIN, an intelligent diagnostic mac hine, was developed by Stanford University in 1976 a nd has the ability to help treat infectious diseases. It is not used in medicine for many reasons, including ethi cal issues. [40]

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Research shows that first aid effectiveness ca n be greatly increased by using personal digital assista nts (PDAs) to provide training from professionals to n on-
professionals. After examining the data, it was determ ined that the use of professional technology could stre ngthen the weak link in the chain of survival while als o improving the quality of first aid provided by agents . [41]

Another study used expert criteria to diagnose different types of headaches, including tension-
type, migraine, and drug-
induced migraine. The Computerized Headache Asses sment Tool (CHAT) correctly diagnosed 93.4% of dai ly symptoms and 94.4% of migraines. The average ac curacy rate is 98%. Therefore, guidance from CHAT e xperts can help doctors diagnose the correct
origin of the headache, which is very important. [42] Fuzzy experts were used to analyze the MIT-
BIH arrhythmia database to distinguish between ische mic heartbeats and arrhythmias. The outcome of the st udy showed an average specificity of 99% and sensiti vity of 96%. [43]

Professionals have demonstrated to be useful i n detecting and diagnosing disease and can make stro ng medical decisions. However, according to the doct or's experts, the precision of the system needs to be in creased and the patient's medical history should be int egrated with the system. Additionally, medical knowl edge and research must be constantly updated in order to provide doctors with the most advanced diagnoses and treatments. [44]

3. Conclusion

Future advances in artificial intelligence shoul d present more challenges: in data mining and machin e learning, researchers must develop predictive mo dels to solve “black box” problems and create continu ous integration between 5G and the IoT. Robots; Trai ning models in image recognition technology must be come more effective, and professionals must continua lly increase their knowledge base so that people seeki ng medical services can receive more information.

The concept of AI has made significant progr ess in the last decade. International collaboration betw een research institutions is exemplary in achieving the se findings. Knowledge about intelligence is growing rapidly as researchers from many countries make prog ress in this field.

With the help of the high speed transmission of 5G network realtime remote gui dance has been implemented to ensure longdistance c ooperation to ensure the safety, trust and safety of sur gery. It reduces the risk of surgery by allowing profes sionals to provide immediate and surgical intervention to the patient..

Artificial Intelligence (AI) has changed the tra ditional medical model, improving the quality of treat ment and providing many guarantees for human healt h. The future development of medical intelligence is e xpected to be greater.

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