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THE ROLE OF AI IN MEDICINE: THE BEGINNING OF NEW ERA

ЖАСАЛМА ИНТЕЛЛЕКТТИН МЕДИЦИНАДАГЫ РОЛУ: ЖАҢЫ ДООРДУН БАШТАЛЫШЫ

РОЛЬ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В МЕДИЦИНЕ: НАЧАЛО НОВОЙ ЭРЫ

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THE ROLE OF AI IN MEDICINE: THE BEGINNING OF NEW ERA

Abstract

Based on advances in computer science, artificial intelligence (AI) has quickly become an integral part of modern healthcare. Questions often arise about how AI can help healthcare professionals in a clinical setting and in the research, they conduct. This scientific article is devoted to the study of the possibilities of using artificial intelligence in medicine and healthcare. The work examines various aspects of the use of AI, such as the diagnosis of diseases, the prognosis of their development, the choice of optimal treatment, the analysis of medical data and much more. There are many examples of the use of artificial intelligence in medicine, but in addition to the potential benefits, the article discusses the potential risks and limitations of using this technology.

Keywords: *artificial intelligence, medicine, diagnosis, Covid-19, analyze, data.*

РОЛЬ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В МЕДИЦИНЕ

Аннотация.
Основываясь на достижениях в области информатики, искусственный интеллект (ИИ) быстро стал неотъемлемой частью современного здравоохранения. Часто возникают вопросы о том, как ИИ может помочь медицинским работникам в клинических условиях и в исследованиях, которые они проводят. Эта научная статья посвящена изучению возможностей использования искусственного интеллекта в медицине и здравоохранении. В труде рассматриваются различные аспекты использования ИИ, такие как диагностика заболеваний, прогноз их развития, выбор оптимального лечения, анализ медицинских данных и многое другое. Существует множество примеров использования искусственного интеллекта в медицине, но, помимо потенциальных преимуществ, в статье обсуждаются потенциальные риски и ограничения использования этой технологии.

Ключевые слова: *искусственный интеллект, медицина, диагностика, Covid-19, анализ, данные.*

МЕДИЦИНАДА ЖАСАЛМА ИНТЕЛЛЕКТТИН РОЛУ

Аннотация.
Информатика жана информатика жаатындагы акыркы жетишкендиктердин аркасында жасалма интеллект (ЖИ) тез арада заманбап саламаттыкты сактоонун ажырагыс бөлүгү болуп калды. ЖИ медициналык адистерге клиникалык шарттарда жана алар жүргүзгөн изилдөөлөрдө кандайча жардам берет деген суроолор көп кездешет. Бул илимий макала жасалма интеллектти медицинада жана саламаттыкты сактоодо колдонуу мүмкүнчүлүктөрүн изилдөөгө арналган. Эмгекте ЖИни колдонуунун ар кандай аспектилери каралат, мисалы, ооруларды аныктоо, алардын өнүгүшүн болжолдоо, оптималдуу дарылоону тандоо, медициналык маалыматтарды талдоо жана башкалар. Жасалма интеллект медицинада колдонулуп келген көптөгөн мисалдар бар, бирок потенциалдуу артыкчылыктардан тышкары, макалада технологияны колдонуунун мүмкүн болгон тобокелдиктери жана чектөөлөрү талкууланат.

Ачкыч сөздөр: *жасалма интеллект, медицина, диагноз, Covid-19, анализдөө, маалыматтар.*

Introduction

Artificial Intelligence (AI) has become a transformative force across industries, and its impact on healthcare is profound. In recent years, AI technologies have revolutionized various aspects of medical practice, from diagnosis and treatment to personalized care and administrative tasks [12, 13]. This article explores the diverse applications of AI in medicine and the promising future it holds for improving patient outcomes and healthcare delivery.

1. Diagnosis and Imaging:

One of the most significant contributions of AI in medicine is in medical imaging and diagnosis. AI algorithms can analyze vast amounts of medical imaging data, such as X-rays, MRIs, and CT scans, with remarkable accuracy and efficiency. These algorithms can assist radiologists in detecting abnormalities, identifying patterns, and making diagnoses that are more accurate [1].

For example, AI-powered systems can detect early signs of diseases like cancer, enabling early intervention and improving patient prognosis.

The National Institute for Health and Care Research (NIHR) supports AI innovation and technology from concept to NHS adoption and rollout, through prototype development and real world testing in health and social care settings.

Researchers at The Institute of Cancer Research in London, funded by the NIHR, have created a prototype test that can predict which drug combinations are likely to work for cancer patients in as little as 24-48 hours[2].

They use AI to analyze large-scale data from tumour samples and can predict patients' response to drugs more accurately than current methods.

Analyzing the genetic makeup of tumors can reveal the mutations that encourage growth, and some of these can be targeted with treatment. This alone is not enough to select drug combinations and the new test examines molecular changes in the tumour, and how they interact with each other in response to treatments.

The AI works in two stages, first by predicting how cells are to individual cancer drugs, looking in particular at three genetic markers, and then predicting how they will respond to combinations of two drugs.

It can process information quickly, turning around results in just two days, and has the potential to guide doctors on which treatments are most likely to benefit individual cancer patients.

At the University of Oxford, a tool has been developed, that can rule out COVID-19 infection within an hour of people arriving at a hospital.

It is far quicker than the 24 hours required for a PCR test, and more reliable than lateral flow tests. Better yet, it uses only the data that is already collected within a patient's first hour in hospital. When people arrive in hospital their body temperature, blood pressure and heart rate are measured and blood is taken. The AI tool was trained using this information from 115,000 patients along with their PCR test results to say whether they had COVID-19 or not.

Its performance was then evaluated by estimating the COVID-19 status of all patients arriving at two hospitals over a two-week period [3].

Of over 3,300 patients arriving in the emergency department and 1,715 patients who were admitted, the AI agreed with the PCR test nine out of ten times, and was 98%accurate at ruling out COVID-19[3].

Dr Jenna Tugwell Allsup is a research radiographer at Betsi Cadwaladr University Health Board in North Wales, who has long championed research as a way to help patients. Her past work revealed that giving patients a video clip to watch with information explaining what an MRI scan involves, what noise to expect, and the importance of staying still. She found that this video was more effective in reducing patients' anxiety than providing written information.

Her current research focus is on AI including the MIDI trial, which is investigating whether an AI tool can identify abnormalities on MRI head scans. The AI tool is being developed and tested on patient head scans as well as healthy volunteers' scans to teach it to identify abnormalities more quickly so that these can be prioritized for assessment by a clinician.

She has also received funding to conduct a study to determine if an AI algorithm can reduce time to diagnosis of lung, cancer by retrospectively assessing the chest x-rays of known lung cancer patients.

Jenna has set up a local AI Working Group within Radiology and will be collaborating with other similar groups to streamline the process of working with AIs [4].

2. Develop drug faster

The drug discovery and development process is lengthy, complex, and costly. AI offers innovative solutions to streamline this process and accelerate the discovery of new drugs. AI algorithms can analyze biological data, predict the properties of potential drug candidates, and identify promising drug targets [5].

Additionally, AI-powered platforms can facilitate the repurposing of existing drugs for new indications, reducing the time and resources required for development. These advancements have the potential to bring new treatments to market more quickly and address unmet medical needs.

One pharmaceutical company, Insilco Medicine, which is jointly headquartered in New York City and Hong Kong, announced last February that it had progressed to phase I clinical trials with an AI-designed drug candidate.

The molecule targets idiopathic pulmonary fibrosis, a serious disease that leads to untreatable lung scarring [5].

The drug candidate had completed the discovery and preclinical stages in just 30 months. In June, the company began phase II trials, which study how well a candidate works in more detail.

These are noteworthy developments, and they will no doubt drive investment. Although the technology is still relatively young, the 20 AI-intensive companies in BCG's 2022 analysis already

had 158 drug candidates in discovery and preclinical development. That compared with 333 at the world's 20 biggest pharma companies as measured by revenue.

However, these claims have come from the companies themselves. Until they can be independently verified, some caution is in order. The findings need to be published in the peer-reviewed literature and authenticated by researchers unaffiliated with the companies involved [5].

3. Improve gene editing

Gene editing holds immense potential for treating diseases, improving agriculture, and even potentially modifying human traits.

However, the complexity of genomes presents a challenge. This is where Artificial Intelligence (AI) steps in, acting as a powerful companion to unlock the full potential of gene editing. [6]

AI's Role in Supercharging Gene Editing

AI, particularly machine learning (ML), offers several key benefits to gene editing:

Designing Precise Tools: CRISPR, a popular gene editing technique, relies on guide RNAs (gRNAs) to target specific locations in the genome. AI can analyze vast datasets to design highly effective gRNAs with minimal off-target effects, reducing the risk of unintended edits. Tools like Deep CRISPR and CRISTA leverage this approach [7].

Optimizing Delivery Methods: Delivering the gene-editing machinery (CRISPR-Cas system) into cells is crucial. AI can analyze data on various delivery vectors, like viruses or nanoparticles, to predict the most efficient and safe methods for specific cell types [8].

Predicting Outcomes: Gene editing can have unintended consequences. AI algorithms can analyze genetic data to predict potential off-target edits and their downstream effects. This allows researchers to refine their approach for better safety [8].

Personalized Medicine: AI can analyze a patient's specific genetic makeup to identify disease-causing mutations. This allows for the development of personalized gene therapies tailored to each individual's needs [8].

Faster Discovery: The vast amount of data generated by gene editing experiments can be overwhelming. AI can analyze this data to identify patterns and trends, accelerating the pace of discovery and development of new therapies [8].

By combining CRISPR technology with a protein designed with artificial intelligence, it is possible to awaken individual dormant genes by disabling the chemical "off switches" that silence them. Researchers from the University Of Washington School Of Medicine in Seattle describe this finding in the journal Cell Reports. The approach will allow researchers to understand the role individual genes play in normal cell growth and development, in aging, and in such diseases as cancer, said Shiri Levy, a postdoctoral fellow in UW Institute for Stem Cell and Regenerative Medicine (ISCRM) and the lead author of the paper. "The beauty of this approach is we can safely upregulate specific genes to affect cell activity without permanently changing the genome and cause unintended mistakes," Levy said [8].

Dr. Hannele Ruohola-Baker, professor of biochemistry and associate director of ISCRM led the project. The AI-designed protein was developed at the UW Medicine Institute for Protein Design (IPD) under the leadership of David Baker, also a professor of biochemistry and head of the IPD [9].

The new technique controls gene activity without altering the DNA sequence of the genome by targeting chemical modifications that help package genes in our chromosomes and regulate their activity. Because these modifications occur not in, but on top of genes, they are called epigenetic, from the Greek epi “over” or “above” the genes. The chemical modifications that regulate gene activity are called epigenetic markers [10].

The researchers at NYU Grossman School of Medicine and the University of Toronto who designed the tool say it promises to accelerate the development of gene therapies on a large scale. Illnesses including cystic fibrosis, Tay-Sachs disease, and sickle cell anemia are caused by errors in the order of DNA letters that encode the operating instructions for every human cell. Scientists can in some cases correct these mistakes with gene-editing methods that rearrange these letters [11].

Conclusion

Humans reap the benefits of artificially intelligent systems every day.

AI has the potential to help fix many of healthcare's biggest problems but we are still far from making this a reality. One big problem and barrier from making this a reality is data.

We can invent all the promising technologies and machine learning algorithms but without sufficient and well-represented data, we cannot realize the full potential of AI in healthcare.

The healthcare industry needs to digitize medical records, it needs to come together to agree on the standardization of the data infrastructure, it needs to create an ironclad system to protect the confidentiality and handle consent of data from patients.

It is important that primary care physicians get well versed with the future AI advances and the new unknown territory the world of medicine is heading toward.

The goal should be to strike a delicate mutually beneficial balance between effective use of automation and AI and the human strengths and judgment of trained primary care physicians.

This is essential because AI completely replacing humans in the field of medicine is a concern, which might otherwise hamper the benefits, which can be derived from it.

This article aimed to present various aspects of AI as it pertains to the medical sciences.

The article mainly focuses on past and present day applications in the medical sciences and showcase companies that currently use artificially intelligent systems in the healthcare industry.

Furthermore, this article conclude by highlighting the critical importance of interdisciplinary collaboration resulting in the creation of ethical, unbiased artificially intelligent systems.

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