

The Role of Artificial Intelligence (AI) in Enhancing Medical Services Environment: Opportunities and Risks.

دور الذكاء الاصطناعي في تحسين بيئة الخدمات الطبية: فرص وأخطار

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Abstract:

Artificial intelligence is the new technology whose objective is to get computers programed with a set of algorithms in order to become able to imitate humans in their mental or physical behavior. It belongs to computer science and aims to provide people with best performance in dealing with complex daily issues. Artificial intelligence applications are numerous and used in every single branch of our socio-economic life. The study aimed to highlight the role of AI technology in changing the future of healthcare and emergent clinical interventions. The research question has been dealt within a descriptive analytic approach.

In healthcare areas, AI tools are widely use and strongly contribute to enhance medical services which; consequently, help patients get better rapidly and efficiently. Indeed, the study results have shown that clinical AI models have several advantages such as Robot-Assisted Surgery, visual patient care, fast disease discovery and ensuring an effective health monitoring. However, those models have disadvantages such as potential AI errors, lack of transparency, privacy and security matters, Risk of bias in medical AI and perpetuation of inequities, and lacunae in AI accountability.

Keywords: artificial intelligence (AI), machine learning, deep learning, healthcare, medical services.

JEL Classification Codes: I11, I18, Q55.

ملخص:

الذكاء الاصطناعي هو تقنية حديثة تهدف إلى برمجة أجهزة الكمبيوتر بمجموعة من الخوارزميات لمحاكاة سلوك البشر العقلي أو البدني. وهو ينتمي إلى علوم الحاسوب، حيث يهدف إلى تزويد الناس بأفضل أداء في التعامل مع القضايا اليومية المعقدة. تطبيقات الذكاء الاصطناعي متعددة، وتستخدم في جميع مناحي حياتنا الاجتماعية-الاقتصادية. هدفت الدراسة إلى تسليط الضوء على دور تقنية الذكاء الاصطناعي في تغيير مستقبل الرعاية الصحية والتدخلات السريرية الناشئة. وقد عولجت مسألة البحث بمنهج وصفي تحليلي.

في مجال الرعاية الصحية، تُستخدم أدوات الذكاء الاصطناعي على نطاق واسع، وتسهم إسهامًا كبيرًا في تحسين الخدمات الطبية، مما يُساعد المرضى على التعافي بسرعة وكفاءة. وقد أظهرت نتائج الدراسة أن نماذج الذكاء الاصطناعي السريرية تتمتع بمزايا عديدة، مثل الجراحة بمساعدة الروبوت، ورعاية المرضى بالعين المجردة، واكتشاف الأمراض بسرعة، وضمان مراقبة صحية فعالة. في غضون ذلك، فإن لهذه النماذج عيوبًا، مثل احتمالية حدوث أخطاء في الذكاء الاصطناعي، ونقص الشفافية، ومسائل الخصوصية والأمان، وخطر التحيز في الذكاء الاصطناعي الطبي، واستمرار عدم المساواة، وضعف المساءلة في مجال الذكاء الاصطناعي.

كلمات مفتاحية: ذكاء اصطناعي، تعلم آلي، تعلم عميق، رعاية صحية، خدمات طبية.

تصنيفات JEL: I11, I18, Q55.

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Introduction:

The life has been completely transformed due to the technological discoveries. Human beings become unable to get rid of technology and guided into a specific system where witnessing new innovation is a daily habit. Technology actually plays a key role in changing the world from its traditional aspects to modern ones throughout offering very interesting opportunities that helps countries to keep growing. Digital transformation, which is a clear result of new technology, brought multiple advantages to economies such as increasing development rates and mitigating deficiencies.

This transformation towards using last forms of technology is essential to make our tasks or jobs faster and much more effective. The reality is now undertaken by what is call artificial intelligence which is considered as a weapon with two sides. However, as AI users, the belief about its deep and strong benefits mitigates its negative face. The entire sectors see that AI is of a great importance in changing the production models, creating magnificent techniques and streamlining administrative chores.

Like others socio-economic fields, many researches are increasingly carrying out in order to maximize the use of AI tools in healthcare as a key step to high medical prosperity. AI application widely facilitates surgeons and doctors jobs as well as patients' cure at clinics and hospitals. The current research tries to respond to a main question which is:

What is the role of artificial intelligence in enhancing medical services environment?

A set of sub questions may derive from this head question including:

- ✓ How does academic literature define artificial intelligence?
- ✓ What are the main subfields of artificial intelligence?
- ✓ Are there any types of this new technology?
- ✓ How is artificial intelligence improving medical services?
- ✓ What are the negative affectations of artificial intelligence branch?

Research objectives:

The research attempts to achieve the following goals:

- ✓ Identifying the common definitions of artificial intelligence;
- ✓ Determining the main subfields of artificial intelligence;
- ✓ Listing the different types of artificial intelligence;
- ✓ Analyzing the major role of artificial intelligence on healthcare field;
- ✓ Mentioning the potential negative impacts of artificial intelligence on clinical components.

Research methodology:

A descriptive and analytic approach is adopted to deal with the essential ideas and concepts of the research paper. The approach is pretty convenient to this kind of studies with generally produced by reading, analyzing and summarizing the existing literature. AI technology is the vital subject for various writings tackling different relevant topics.

1. An overview about Artificial Intelligence:

Finding a unique definition for Artificial Intelligence is almost impossible due to the variety in how people look at it. However, all descriptions share many common points. AI can be defined as a computing process by which a machine becomes able to think and solve problems the same way human beings do when they are asked to overcome a problem. Based

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on this comparison, that machine may sometimes make mistakes and then learn from them. Over time, the performance of the machine improves and leads to build the manner of self-correction or self-development (Saha, 2021, p. 1).

Some authors attempted to provide definitions of AI through a distinction between humanity and rationality. Each section is also divided into two sub sections. The table on the bottom displays all those definitions.

Table: Some definitions of artificial intelligence, listed into two global approaches

Thinking Humanly “The exciting new effort to make computers think . . . <i>machines with minds</i>, in the full and literal sense.” (Haugeland, 1985) “[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)	Thinking Rationally “The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985) “The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)
Acting Humanly “The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990) “The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)	Acting Rationally “Computational Intelligence is the study of the design of intelligent agents.” (Poole <i>et al.</i>, 1998) “AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)

Source: (Russell & Norvig, 2010, p. 2)

A detailed explanation of each category can be presented as following (Russell & Norvig, 2010, pp. 2-5):

Thinking humanly refers to the cognitive view of AI. It is necessary to explore human minds to see what happens there while thinking. This work can be done whether through introspection, or through trying to watch human thoughts path, or through diagnosing human brain to discover its actions. After understanding the way people think, it would be possible to imagine how to set a computer program for an AI performance.

Acting humanly is the case where an AI action is quite similar to a human one. In other words, when a person gets help from a given place, they cannot be sure whether the assistance comes from a human or robot. To do this, a computer must be able to fulfill four essential roles; the ability to acquire a language and use it to communicate accurately, the ability to memorize what it receive, the ability to exploit all its information to respond or end up with a decision about any matter, and finally the ability to adapt or adopt unexpected situations.

Thinking rationally turns around how to get to a rational conclusion. It means that computer, which acts as a man, must obey the laws of thoughts that are supposed to be planted in mind. Rationality argues that right premises certainly lead to right conclusions. Every behavior that AI device conducts should be logic. AI program is supposed to find solution for

any issue dominated by a logic notation. It is necessary to mention that this approach faces two challenges. First, it is hard to choose informal knowledge and try to look at it in formal logical way. Second, dealing with a problem in principle is different from dealing with it in practice (Russell & Norvig, 2010, p. 4). Various and unlimited problems still constitute a big defiance for computers even in the age of artificial intelligence.

Acting rationally indicates the existence of the rational agent. The latter is the one who acts as best as they can to have great results. Therefore, a computer agent must be rational to do more and more. After a successful program installation, the computer should be ready to do several logical operations to achieve desired goals.

2. Types of Artificial Intelligence:

There are two ways to identify the types of Artificial Intelligence. The first one is the classification base on capability, and the second one is the classification referring to functionality of the machine (Ghosh & Thirugnanam, 2021, pp. 25-26).

2.1. Capacities angle:

According to abilities of AI, the first kind is called weak AI. It describes the AI tool that can be trained to implement one thing, but much more efficient than individuals. It is almost the only model that exists today. Some examples of this type are ChatGPT, Apples's Siri, and Alexa. The second type is called General AI. It can fulfill any tasks exactly as what human do. This intelligence is also known as strong AI.

Nowadays, General AI does not exist. There no machine that can completely replace human, especially at mental level. The last type is scientifically presented as super AI. It describes the machine that can deal with any order better than human do. It surpasses cognitive capacity of humans.

2.2. Functionalities angle:

According to functionalities of AI, there are four common categories, firstly, we have reactive machine AI which means that a machine can be established to perform tasks without any previous memorization. It does not to store data; instead, it utilizes the available data. The famous example that functions this way is IBM's chess. Secondly, there is limited memory AI. It is the opposite aspect of reactive AI. It depends on past data or outcomes to take position over a specific event. It is limited because the machine store information for limited time, which means that its memory is temporary not permanent. For instance, self-driving cars are would be a great example.

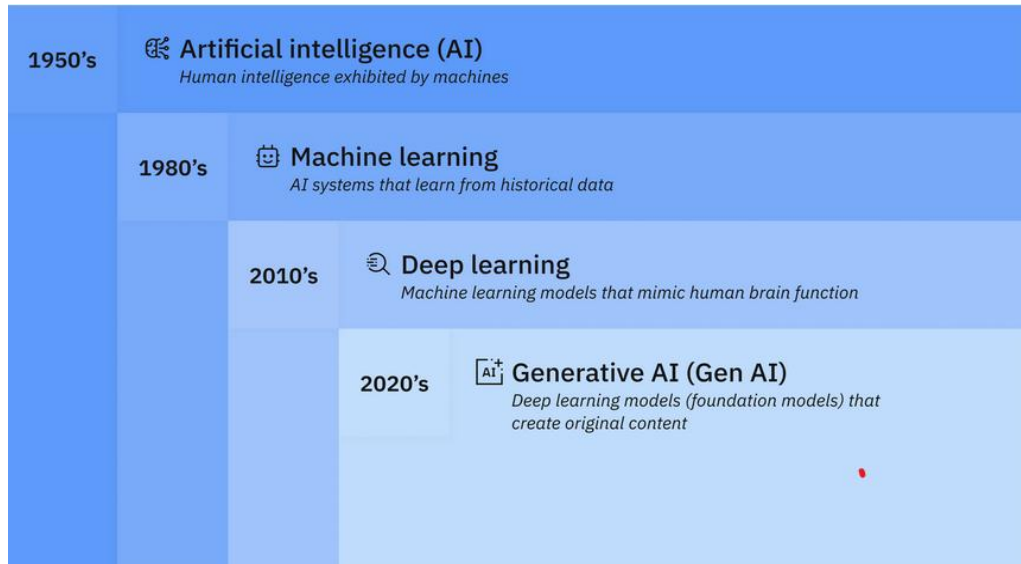
Thirdly, we have got theory mind of AI. Here the machine is supposed to react based on what it perceives from human beings. The focus is on the psychological and emotional side of people. Scientists have not yet reached such wonderful machines; however, researches are consistently driven in this domain. The final type is self-aware AI. It is just a hypothetical category that states the machines will be able to function consciously. It has also self-awareness and expresses its psychological conditions the way human beings show how they feel and separate bad thing from good one.

3. Machine learning ML:

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Before reaching the last version of AI, there was a chain of discovers that had almost the same role as AI and helped people to solve problems. Those inventions covered a period of 70 years and they are displayed into the following image.

Figure: a sort evolution of AI



Source: (Stryker & Kavlakoglu, 2024)

Machine learning refers to a system in which an algorithm is designed through a way of test and examination to make models. This system will be the thing that helps computer to acquire and utilize data without the need for a particular program. Machine learning has multiple categories such as decision trees, random forest; support vector machines (SVMs), logistic regression, and so on. Every type is allocated to deal with specific issues (Stryker & Kavlakoglu, 2024).

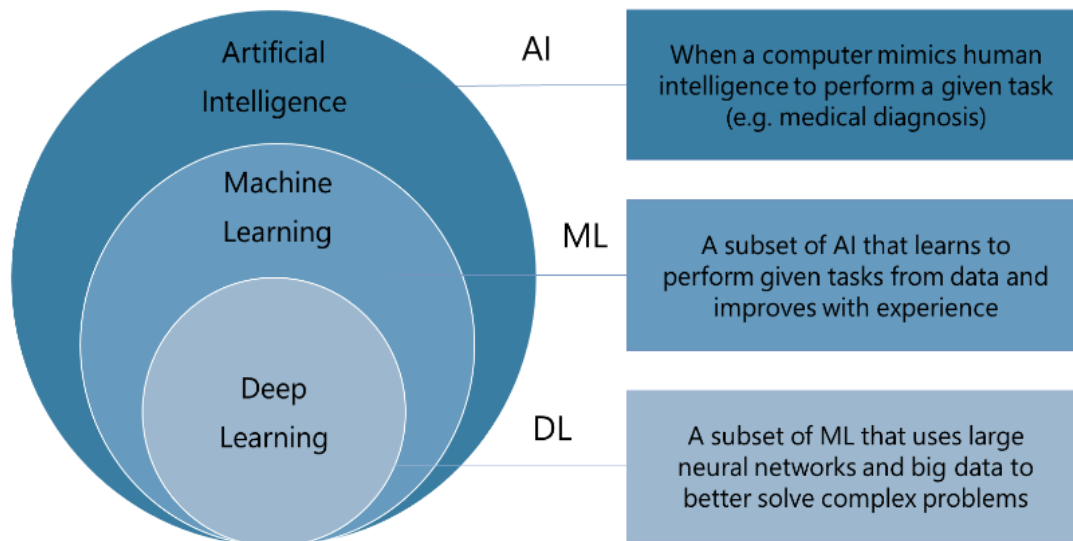
They are not of the same value, which means that some types of machine learning are more important than others in terms of frequent or common usage. Taking as a simple illustration, the well-known model of machine learning is called artificial neural network which relies on human brain's mechanism and does tasks including difficult structure and huge lists of information. Whereas, the basic form of machine learning is named supervised learning whose function is to prepare algorithm in order to select data and deduce results properly (Stryker & Kavlakoglu, 2024).

Supervised learning is simply the case where programmed machines can learn taking into consideration the increase of classified data. The method is clear. It can be briefly explained by the process that the machine should be trained to absorb an enormous amount of data, and then investigate it for making that machine able to achieve complex tasks later (Saha, 2021, p. 4).

4. Deep learning DL:

It is one of machine learning techniques that cover a lot of levels of representation and abstraction, and has the power to operate data in another format, besides the ability to determine the necessary representations for selection and arrangement in automated design. The most popular use of modern term of deep learning comes originally from artificial neural networks (Antonopoulos & All, 2020, p. 13). There is strong and reciprocal relationship between AI, ML, and DL as it is shown in the image below.

Figure: The rapport between AI, ML, and DL



Source: (Lekadir, Quaglio, Tselioudis, & Gallin, 2022, p. 3)

5. Critical issues about AI from economic viewpoint:

AI invades every sector or branch at the same time that those places reduce its need for human beings. Everybody believes that machines are more productive and efficient than people. Many employees are losing their jobs because of increased use of automation. Studies stated that spread-out of machines have resulted a loss of 85 million jobs this year (Saha, 2021, p. 6). For instance, studies expected that 35% of UK occupations could be disappeared to AI affectation during a period of twenty years (British Medical Association, 2024, p. 11).

Another dilemma that people are afraid of is the use of AI in weapons industry. Having a weapon that is capable to chase individuals, identify them and eliminate them based on AI procedure is really scary. AI will increase the profits in weapon markets, but many innocent people will pay the cost. In addition, AI field contain various risks which can classified into regulatory, deliberate, technical and unknown risks. The last ones are remain unreached and require detailed analyses to overcome their complexity (Troubia & Larabi, 2024).

6. Common applications of AI in medical fields and healthcare:

The main purpose for using AI applications is to increase efficiency and productivity. All of economic sectors relay on machines programed to provide new work systems and raise the production volume. In some sectors, the role of AI machines is to handle very difficult problems or offer very sophisticated solution for complex cases like some dangerous diseases. Medical field witness an important improvement thanks to AI applications. Generally, there are four major contributions of AI in healthcare including 1) Robot-Assisted Surgery, 2) Virtual Patient Care, 3) Health Monitoring, and 4) Disease Detection (Bhagat, Wankhede, Kopawar, & Sananse, 2024).

6.1. Robot-Assisted Surgery:

Robot-assisted surgery includes sophisticated computer instructions and robots to assist medical staff to deal with complex surgeries. Those robots and machines investigate, diagnose,

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and explore bodies through incisions. Those AI devices read patients data carefully and may suggest best ways to perform surgical operations fast and successful. Patients with rare and dangerous illnesses spend less time to get better at the hospital. In addition, multiple deadly diseases can be treated by using AI tools today.

6.2. Virtual Patient Care:

With the criterion of Virtual Patient Care, patients can describe their status and get advice far away from doctors through AI visual technology. Patients no longer need to leave their homes and move to medical areas for help. Virtual care involves the whole various methods of taking care of sick people a distance. Some people suffer here for attending clinics. So, the AI visual system is their saver to help them improve their health. Besides, health care services become easy, smart, powerful, fast and cheaper. A person has not to pay their stay at hospitals which is high expensive in most countries.

On the other hand, reducing cost can be also from medical staff side. Innovations in healthcare present an opportunity to make cost-saving, which might constitute a considerable funds to be reinvested later. Furthermore, visualizing meeting between doctors and patient would allow a lot of staff to get more free time to handle other tasks. In 2018, the official authority announced that 12.5 million pounds could be saved per year by freeing up staff time thanks to AI devices. Statistics confirm that clinics would earn 400000 hours of emergency section consultation time if they succeeded to save at least one minute per patient via technology (British Medical Association, 2024, pp. 12-13).

6.3. Health Monitoring:

Health Monitoring is quite important today. What is worrying for patient is to find a perfect health monitoring which is programed to pay attention to their health and ready to react accurately in case of any unexpected healthy problems. The system is able to precisely observe different parts of patient's body in order in ensure if they function well constantly or not. Health Monitoring is also an AI technology that detects if there is any possible chronic disease to take necessary procedures to stop it or mitigate its negative effects.

6.4. Disease Detection:

Many people die because of diseases which have been hard to detect or were detected very late. This kind of situations happens due to the lack of appropriate equipment or the weakness of it. Disease detection mostly contains a CNN-bases brain tumor diagnosis system which is of a great importance in diagnosing brain cancer in its first stages. This guarantees a rapid protocol to fight against this diabolic illness. In this respect, AI devices can provide advanced images for tumor to help expert to understand the evolution of abnormal organs, the data collected, the origin and extension of tumor, and eventually the final decision about the protocol.

AI application can construct an experience by developing a deep understanding of diseases and more efficient medicines and process. This can be done through dealing with a sample of people and gathering a sufficient amount of personal, medical, clinical and social data. Afterward, all information will be at the disposition of official and legal users in healthcare (British Medical Association, 2024, p. 8).

7. Critical issues about AI from medical and clinical viewpoint:

As we mentioned in introduction, above, AI technology has two major sides; positive and negative one. This new technology plays a significant role in enhancing medical services and changing the future of healthcare in the world. However, it is necessary to highlight the dark face of that technology by listing some risks or AI in healthcare including: 1) Patient hurt because of AI errors, 2) Lack of transparency, 3) Privacy and security matters, 4) Misuse of medical AI models, 5) Risk of bias in medical AI and perpetuation of inequities, 6) Gaps in AI accountability, and 7) Complications to implementation in real-world healthcare (Lekadir, Quaglio, Tselioudis, & Gallin, 2022, pp. 15-29).

7.1. Patient hurt because of AI errors:

The reasons behind the AI errors are numerous; however, experts in healthcare confirm the most common reasons might be deficiency in AI medical input and testing, imperfect transformation between guided data and original one, and unexpected troubles while diagnosing or treating. Those errors may lead to undesirable severe consequences at different levels such as misunderstanding diagnosis. Making inappropriate decision about required treatments or scheduled examinations, and writing incorrect prescription of medicines.

7.2. Lack of transparency:

This disadvantage is very importance in AI sciences. An insufficient transparency may be noticed in terms of developing, designing, revealing and evaluating of AI means. AI transparency must take into consideration two main conditions which are traceability and explainability. The first one means that the technology should ensure the transparency of AI growth and utilization phases. The second one points to transparency that must be guaranteed by AI models at the decisions time. All decisions should be clear and easy to interpret.

Lack of transparency may open doors for several dangers in healthcare and creates harmed medical services by AI tools themselves. In other words, when the transparency is insufficient, clinical scientists risk misunderstanding collected data about disease detection. As a result, all coming procedures may be inadequate. Moreover, that problem sometimes causes difficult situations in which clinical staff still unable to identify the source of AI errors or find right ways to fix those errors. Transparency is always a key factor for any successful project.

7.3. Privacy and security matters:

The development of advanced and complex technologies happens hand in hand with the rise of different types of security issues like cyber-attacks and hackers threats. A lot of individuals see that their privacy is lost due to new technologies, which have badly impacted their life. Hence, using AI applications in healthcare, have shown many problems of privacy issues such as the possibility of sharing patients' data without their permission, the attempt to destroy personal data or replace it with incorrect one, and the attacks on hospital's AI system and dysfunction its entire mechanisms.

7.4. Misuse of medical AI models:

The impact of any technology is largely dependent on how individual use them. Here, we are talking about the efficiency and effectiveness of the AI machines themselves, but the speech is strictly on human practices while operating those machines. In this respect,

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individuals refer to whole people that belong to healthcare environment regardless their roles. They may be doctors, surgeons, nurses, administrative staff, and even patients.

Misuse of medical AI tools has several negative consequences on both professionals and patients. Despite its efficiency, AI misuse may cause wrong assessment and inaccurate decisions; consequently, patients healing will be hurt.

7.5. Risk of bias in medical AI and perpetuation of inequities:

AI techniques may face potential human bias based on different factors such as gender, age, ethnicity, previous sicknesses, social position, communities and so on. In healthcare, the most popular AI biases emerged from biased information which generally owing to whether structural preference, or unequal choices, or losing access to devices and numerical technologies. Sometimes, the bias origin may come from limitation of AI tools used.

7.6. Gaps in AI accountability:

Dealing with AI models in medical domains requires a continuous and regular accountability. The difficulty is often at the level of outputs generated by AI. A set of AI machines are so hard for a user to guide because they can be ambiguous and create issues about outputs trustworthy or incapability to monitor errors in data (Nuffield Council, 2018, p. 4).

It is a significant element of validity and effectiveness of AI means in healthcare. It may happen to find gaps at the level of accountability which is generally linked to who is responsible for mistakes and errors made by AI systems. It is very hard to that responsibility due to the variety of factors that might be involved in committing those errors. The situation is complex and makes all clinical professionals quite worry about the AI tools operated inside clinics.

7.7. Complications to implementation in real-world healthcare:

AI models are modern technologies and know a consistent development over time. This situation constitutes a real challenge for clinicians to adapt with these models and be able to use it smoothly. The situation is one of the obstacles that create some problems like limited data quality and lower connection among concerning branches at the hospitals.

Conclusion:

To sum up, artificial intelligence largely contributes to improve clinical professionals' tasks by providing them with very sophisticated tools and advanced machines. AI devices can be noticed in several medical aspects including disease detection, surgical interventions, suitable decision-making and health controlling. Even though AI may affect healthcare world badly, medical services enable patients to feel better quickly and effectively. Scientific researches about how to maximize AI benefits in healthcare, and minimize its problems.

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