

Big Data and Robotics in Healthcare

TECHNICAL PAPER PRESENTATION

DATA 603-PLATFORMS FOR BIG DATA PROCESSING

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1.INTRODUCTION

As big data and robotics come together, they are causing big changes in the healthcare business. These new developments have a huge chance of increasing productivity, reduce expenses, while improving patient care. A lot of patient data sets, such as genetic data like DNA and RNA, medical image data like X-rays, and electronic health records (EHRs), are collected, stored, and then analyzed. This is called "big data analysis." This information can help you find patterns and trends that can then be used to make better care plans for each patient.

Robots are used in surgery, healing, and helping people. Robotic surgery helps people get better faster and safer. Robots that are helpful can help people who have nerve problems get back on their feet. Bots that help with rehabilitation help people who have nerve damage walk again.

Together, big data and robotics have the potential to significantly change healthcare. Because of big data analytics, surgeons may personalize robotically assisted surgeries with real-time access to patient anatomical and medical data. Big data enables the personalization of each patient's supported rehabilitation program.

Robotics and big data can help the healthcare industry, but there are still challenges to be solved. Adoption and acceptability, performance and integration, cost and technology, privacy and data security, as well as ethical and legal issues, are a few of the problems.

Scope of the paper

The potential for robotics and big data to change the medical field will be examined in this paper. It covers the advantages and disadvantages of these technologies and gives some examples of how they are being applied to improve the treatment of patients health .The goal of this paper is in depth analysis of how robotics and big data are used together in the medical field, including how it has grown over time, any technological problems, opportunities it gives us and any suggestions for what should be done next .and the This paper will also talk about ethical and legal issues along with how robots and big data can be used in healthcare sector.

Thesis Statement

Big data and robotics have the potential to revolutionize the healthcare industry by improving patient care, reducing costs, and increasing efficiency. However, there are also challenges that need to be addressed before these technologies can be fully realized. By addressing these challenges and ensuring the responsible use of big data and robotics, we can create a more personalized, effective, and accessible healthcare system for all.

Arguments:

Bohg et al.'s (2016) work on the problems and chances that come up when big data and robots come together. The study will also look at how healthcare is changing, as pointed out by Alexandru et al. (2018), focusing on the problems and chances that come with big data becoming more popular. Morgan et al.'s (2022) study will shed light on the many roles robots play in different areas of healthcare by giving real-life examples of how they affect surgeries, patient rehabilitation, and transportation.

Beasley (2012), which gives a thorough overview of medical robots' current systems and research directions, will add to the trip by showing how precise they are and how they have changed healthcare procedures. The 2019 study by Carnevale et al. will also explain how big data analysis improves robotic-assisted gait training. This will show how personalized therapy based on huge datasets could be useful.

The study by Batko and Ślęzak (2022) will give a new look at how big data analytics are used in healthcare, focusing on Poland. It will show how data-driven decisions can completely change how medical facilities work. Wang and Wang's (2021) thorough review of the literature will make the important role robots played during the COVID-19 pandemic stand out, showing how flexible and important robotics can be in times of crisis.

The review by Denecke and Baudoin in 2022 will go into great depth about how AI and robotics are changing health ecosystems, with a focus on the move toward proactive, patient-centered care. Also, W. and Nazir's (2021) research on the important uses of big data and AI in healthcare will show how important these technologies are for finding diseases, treating them, and making healthcare better overall.

Finally, Puauschunder's research (2019) will help us understand the legal and global aspects of AI, robots, and big data. It will stress how important it is to have a complete framework to help us understand the moral and legal effects of these technologies.

The aim of this study is to present a comprehensive overview of the collaborative applications of robotics and big data in the medical domain. In order to add to the continuing conversation about the ways in which the convergence of technologies may alter the way things are now as well as the difficulties that follow these changes, material gathered from a wide variety of scholarly sources will be combined.

2. LITERATURE SURVEY

The combination of big data and robots in healthcare has become an important sector of technological development, with the potential to completely change many aspects of the field of medicine. In this literature review, important studies are looked at in order to show where big data and robotics meet, how they affect healthcare, and the problems and chances they create.

Bohg et al. (2016) talk about how big data and robotics work well together and how important machine learning is for letting robots go beyond rigid models. The authors stress how important it is to have large data sets for robotic handling and talk about how natural language input could improve interactions between humans and robots (Bohg et al., 2016).

A study by Alexandru et al. (2018) looks into how "big data" has changed healthcare by focusing on electronic health records. The study talks about problems and chances, focusing on how big data could change how healthcare information is gathered and decisions are made (Alexandru et al., 2018).

Morgan et al. (2022) do a broad review of the many ways robots help in healthcare, showing how they can be used in surgery, rehabilitation, telepresence, intervention, and operations. The study shows how important robots are for improving accuracy, helping patients get better, and running shipping operations (Morgan et al., 2022).

Beasley (2012) looks at how medical robots have changed over time and how they have affected medicine, especially surgery. It talks about the da Vinci Surgical System and other robotic tools that show how precision and progress have been made in medical treatments thanks to robotics (Beasley, 2012).

Carnevale et al. (2019) study how big data analytics can be used in robotics therapy. They use data from Lokomat sensors to make treatments more effective for each patient. The study shows that big data has the ability to change the way personalized care is given to patients in neurological therapy (Carnevale et al., 2019).

Batko and Ślęzak's research from 2022 gives us new information about how to use big data analytics in healthcare in Poland. This piece talks about the change from healthcare that is focused on diseases to healthcare that is focused on patients. It also talks about the problems that come up because there are so many electronic medical records and sensor data (Batko & Ślęzak, 2022).

Wang and Wang (2021) do a literature review on how robotics were used during the COVID-19 pandemic. They stress how important robots were for testing, cleaning, tracking, and telepresence. Robotics and information and communication technologies, such as big data, can work together to stop the virus from spreading and make healthcare systems better (Wang & Wang, 2021).

In 2022, Denecke and Baudoin looked at how robots and artificial intelligence (AI) have changed the way healthcare works. An AI or robotic system is put into a group based on its type, how autonomous it is, the care setting, and the place where it can be used. AI is becoming more and more important for managing large and difficult biomedical datasets. This will help doctors find diseases and make better care decisions (Denecke & Baudoin, 2022).

The study that Nazir did in 2021 looks at how AI and big data are used in healthcare to find diseases, treat them, and take care of patients. This article works with big data sets from electronic medical records and lab results by using deep machine learning and complex algorithms (Nazir, 2021).

We are now in 2019 and Puaschunder talks about AI, robots, and big data from a foreign and law point of view. He talks a lot about how important it is to have clear morals, laws, and rules. Three big changes are found in the study: how AI is controlled; the huge benefits of computers and big data; and how the EU can use AI and big data in healthcare (Puaschunder, 2019).

There is a picture of how robots and big data are changing health care at the end of the writing study. Robots and big data need to be fixed before they can be fully used in healthcare, though. Some of these are having too much data, worries about privacy, and moral worries. The more powerful these technologies get, the better healthcare systems around the world will be. To make this happen, people from different fields need to keep learning, work together, and follow moral rules.

3. TECHNICAL DETAILS

Protocols and standards:

Bohg et al. (2016) say that structured records are very important for healthcare robotic systems. The paper stresses how important it is to create protocols that let robots connect with their surroundings in a useful way. It also highlights how important big data is for helping robots learn and make decisions. This fits with the idea that standard protocols make data consistent and interoperable and make it easier for robotic systems to talk to each other and work together (Bohg et al., 2016).

Algorithms and methodology

AI is used in healthcare because it provides many techniques and instruments that can change the field. Intelligent computers can find complicated trends in data without being told to do so. This is called machine learning (ML). Its supervised, unsupervised, and reinforcement learning groups can be used for clinical tasks like classification, regression, grouping, and making decisions. NLP makes it possible for machines to understand and use language that people use. Tone analysis, NER (named entity recognition), and sentiment analysis are all used in the process.

Image processing, also known as artificial intelligence or machine vision, uses math to figure out what something looks like so that decisions can be made. This software helps doctors see and diagnose medical problems by splitting images into groups, finding objects, and recognizing them. A computer program called knowledge-based AI uses human experience to solve hard problems. For the most part, knowledge graphs and expert systems are used. When Data-Driven AI trains models on large datasets, it does so using feature engineering, prediction modeling, which is and machine learning. In the medical field, these methods are used to treat patients, look into new medicines, and study medical images.

Medical events are becoming more realistic with the help of VR and AR. When healthcare workers use these tools, they can learn in real-life settings, see data more clearly, and plan surgeries. Human skills and big data insights can be fully understood and used in healthcare thanks to AI technologies that are both data-driven and knowledge-based. AI has changed healthcare and made study, diagnosis, and patient care better, as this review shows.

4.OBSTACLES

Robotics and big data could totally change healthcare, but there are a lot of issues that need to be fixed first (Alexandru et al., 2018; Morgan et al., 2022).

Protecting patient data is important (Batko & Ślęzak, 2022). In the process of big data analytics, a lot of private data about people is gathered, saved, and studied. People who shouldn't be able to see or use this information should be able to keep it safe. As Puaschunder (2019) says, health care providers need to take strong steps to protect their customers' privacy and stop theft of data.

It's also not good that health data is put together and used together (Denecke & Baudoin, 2022). It's harder to get useful information from health care data that is split up, messy, and not put together in a normal way. They need to make their data better and mix data from different sources to make a record that is more accurate and simple to use.

Robots and big data need to be trained, bought, and used together in healthcare, which costs a lot of money (W. & Nazir, 2021). Healthcare professionals are the ones who need to set up the tools and money for them to work. To do their jobs well, people who work in healthcare also need to learn how to use robots and big data.

People who work in healthcare and patients should also be asked how they feel about robots and big data (Beasley, 2012). People who work in healthcare might not want to use new technology that could get in the way of their job or need more training. People who use these devices may also be worried about their safety and privacy. To make sure that big data and robots are accepted and used in healthcare, people who work in healthcare need to teach and talk about these issues.

There are many ways that big data and robots could make healthcare better, but there are still some problems that need to be fixed first. By fixing these problems, doctors and nurses may help create a healthcare system that is easy to access, works well, and fits each person's needs. These worries can help the study paper give a thorough look at the problems and factors connected to using robots and big data in healthcare.

5.PROMISE

The Hope of Robotics and Big Data in Health Care

Big data and robotics could change the medical sector by making it more efficient, reducing costs, while offering better care for patients (Alexandru et al., 2018; Morgan et al., 2022).

Here are some exact things that these technologies promise:

Individualized health care

There are patterns and trends in medical data that can be found with big data analytics.

Treatment plans can then be made based on this knowledge (Batko & Ślęzak, 2022). This might help people do better and make treatments work better.

Better Health Care and Medical Diagnoses

Patients can heal faster and with fewer problems when minimally invasive treatments are done by robots (Beasley, 2012). Physical rehab can also be done by robots, which can help people get better as well as cut down on the need for long-term care.

Less expensive health care

Big data analytics can be used to find healthcare system excess and get rid of it (Denecke & Baudoin, 2022). One more thing that robots can do is automate chores. This lets healthcare professionals work on more difficult tasks.

Better efficiency

Analytics for big data can be used to improve how patients are scheduled and how resources are used (W. & Nazir, 2021). Also, robots can be used to do boring jobs over and over again, which frees up healthcare workers to care for patients.

Better Access to Care: Big data analytics can be used to find and fix differences in how people can get care (Puaschunder, 2019). Robots can also be used to help people who live in remote places get medical care.

Overall, big data and robotics could change the healthcare business by making it more efficient, lowering costs, and providing better care for patients. We can make a more personalized, effective, and easy-to-use healthcare system for everyone by using the power of these tools.

6.SUGGESTED COURSE OF ACTION

1. The government should allocate more resources towards the development of big data and robotics research by funding to development of new big data analytics methods and robotic systems in the healthcare industry. This could involve providing financial support for academic research, and encouraging the public and private sectors to work together. (Bohg et al., 2016; Alexandru et al., 2018)

2.The organisations should use similar data types and protocols so that the communications and analysing the data across different healthcare industriescan be easy .(Beasley, 2012)

3.The data security should be verified so organizations will ensure information about patients protection and prevent unapproved access that could lead to personal harm. (Batko & Ślęzak, 2022)

4. Healthcare professionals need to understand the high opportunity that robotics and big data provide. This will let them use these technologies efficiently and provide better care for patients.(Wang & Wang, 2021)

5. They should encourage doctors , technology companies, and researchers to work together so that it will help the development of big data and robotics methods for healthcare to make more efficient. (Denecke & Baudoin, 2022)

6.Make investments in the education and training of employees with skills in robotics and big data for healthcare. By doing this, it will be ensured sure that there are sufficient skilled workers helping with the introduction and implementation of these technologies. (2019, Puaschunder)

7. CONCLUSION

Robotics and big data will eventually change the healthcare business by making it easier to make decisions, care for patients, and do surgeries correctly. A study says that these tools are necessary to change people's views, spark new ideas, and improve healthcare outcomes.

The study says that combining big data is allowing healthcare to change from focusing on diseases to focusing on patients. Healthcare workers can use big datasets to predict health trends, adjust their care to each patient, and make decisions based on data.

Even though invention has benefits, study shows that it also has problems. If you want to use big data and robotics in healthcare in an honest and responsible way, you should think about data protection, privacy, and the morality of technology. Social problems and technological progress must coexist in the development of healthcare technology in order for it to move forward in a way that is fair and good for the environment.

This study shows how important it is to encourage collaboration between different areas and to bring people from different fields together. As robotics and big data become more connected, laws and rules need to change to keep up with the times in a way that is moral and patient-centered.

When used together, big data and robotics could completely change the healthcare business. With the help of new technology, healthcare could be totally changed and become more accurate, easy to get to, and tailored to each person's needs. The healthcare field will benefit most from robotics and big data if people work together, care about ethics, and never stop learning. This will be good for patients and make the healthcare system better and more flexible.

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