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A Study on the Applications and Impact of Big Data Analytics in Biomedicine

Girija Sannellappanava* and **Prerna Sidana**

Glocal School of Technology & Computer Science, Glocal University, Saharanpur, Uttar Pradesh, India

Corresponding author: **Girija Sannellappanava** | E-mail: **girijals2014@gmail.com**

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Abstract

Clinicians' decisions are increasingly evidence-based, indicating that no other field holds as much promise for big data analytics as healthcare. The extensive volume and accessibility of healthcare data have transformed the sector through big data analytics, presenting numerous options. It offers the capability of early detection, prediction, and prevention, as a result, raising living standards. In an effort to prevent enormous amounts of data from potentially improving healthcare for individuals in the future, scientists and medical professionals are exerting significant effort. The primary objective of this study is to investigate the potential advantages of big data analysis for biomedicine. This inquiry makes use of a qualitative methodology. The rapidly growing field of big data analysis has substantially enhanced healthcare procedures and research, per this study.. Part of this is providing tools for handling and storing massive amounts of complex data, whether that data is organized or unstructured. The advent of Big Data has revolutionized healthcare in many ways, including the decrease of treatment costs, the acceleration of illness and cancer detection, and the improvement of quality of life. Pharmaceutical staff management, providing medical care, early illness detection, investigations, patient care, and outreach services have all made use of it recently.

Keywords: *Big Data; Data Analytics; Biomedicine; Health Sector.*

INTRODUCTION

Rapid technological advancement, made possible by the vast amounts of readily available multidimensional data, can have far-reaching consequences for many aspects of our life, including healthcare. A new massive term, "big data," will emerge as a result of the rapidly evolving and exploited data [1, 2]. By giving the company access to data-driven, immediate knowledge, analyses may be an essential tool for executing the company's strategy [3]. The examination of big data has been getting a lot of attention as of late. a great deal of attention, and its potential is most apparent in the healthcare industry. More and more, doctors are basing their judgments on evidence, which implies they aren't depending just on their higher education and vocational views, but rather on large-scale studies and clinical data. When it comes to healthcare, "big data" means large and complex electronic information that are very challenging, if not impossible, to handle using conventional techniques, tools, and tools [2, 4]. The vast amount of data in healthcare is created by heath paperwork, which contain information about patients, hospitals, medications, health management, physicians, assistance in clinical decision-making, feedback from patients, and disease monitoring. Electronic medical records (EMR), genetic and pharmacological data, personal and financial information, imaging, and other clinical data also help create big data [3, 5].

The use of data analytics for big data was prompted by the belief that the creation and management of such massive health information would be very complex. Figure 1 below provides an overview of how big data is being used in the biomedical field.

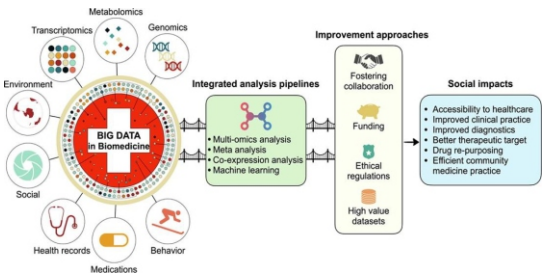

Figure 1: Overview of Biomedicine [6]

The primary objective of this study is to investigate the uses and effects of "big data analytics" in the field of biomedicine. The next part goes into detail on the previous literature that is related to this study.
What follows is a comprehensive Bibliography of the subject of huge-data analytic and its applications and impacts in the biomedical industry.

Table 1: Related works

Authors and years	Methodology	Findings
[7]	Analyze, process, gather, integrate, and manage huge amounts of structured or unstructured healthcare data using various tools.	Showed each discipline's designs, benefits, and repositories to show how healthcare activities are done throughout the pipeline to help patients from numerous perspectives.
[8]	A large amount of research on artificial intelligence and biomedical data analysis has been mapped out using bibliometric research. Finding academic subjects that have made major advances to AI, BDA, and related topics was the goal of the study, which analyzed 711 bibliometric papers from various domains..	"AI, Machine Learning (ML), and supporting BDA are evolving rapidly, creating incredible prospects to improve industries, research, and enterprises."
[9]	A thorough literature survey shows that text generation tasks have advanced beyond "state-of-the-art approaches. In other applications, advancements have been minimal."	Biomedical researchers and healthcare practitioners can get a complete and current understanding of ChatGPT and other LLMs' potential to alter biomedicine and health from this survey.
[3]	Suggested a BiomedRAG architecture that feeds the LLM automatically obtained chunk-based documents.	The suggested framework enhances performance by 9.95% and outperforms baselines by 4.97%. BiomedRAG enables more accurate and adaptive biomedical LLM applications.

Research Gap

In the expanding domain of biomedical research, the utilization of Big Data analytics presents considerable potential, although substantial deficiencies remain in maximizing its efficacy. Contemporary research primarily emphasizes data collecting and analytical methodologies, frequently neglecting the essential using multi-omics data to comprehensively clarify complex disease processes. The use of huge amounts of data in personalised healthcare and management of population health shows great promise, but few studies have examined effective methods for managing, storing, and securing large biomedical datasets, which hinders data-driven clinical practice. These difficulties must be resolved for Big Data analytics in biology.

Methodology

The qualitative analysis utilizes secondary data sourced from IEEE Xplore, PubMed, and Scopus. This methodology analyses peer-reviewed articles, conference proceedings, and reports to assess and use Big Data analytics in biomedicine. The methodology utilizes several case studies and research findings to elucidate industry trends, challenges, and possibilities, demonstrating the transformative effect of "Big Data analytics" on biomedical research and healthcare practices.

Results and Discussion

The research shows that Big Data analytics has become a transformational force in biomedicine, leading to substantial improvements in the fields of disease detection, drug discovery, and personalized healthcare. Secondary data analysis emphasizes the importance of Big Data in combining different types of datasets, like as genetic, proteomic, imaging, and electronic health records, which allows for a more complete knowledge of complicated disease causes. It is worth mentioning that there has been significant progress in the use of Big Data applications in personalized medicine. Machine learning algorithms and prediction models have been used to categorize patients based on their risk factors, genetic predispositions, and reactions to therapy. These methods have resulted in medications that are more targeted, fewer negative side effects, and better clinical outcomes. On the other hand, the research also points out significant obstacles that hinder the broad use of "Big Data analytics in the field of biomedicine."

The absence of established formats and protocols makes it difficult to combine and analyse different datasets, which means that data heterogeneity continues to be a major obstacle. Concerns about privacy and security involving sensitive patient information make it even more difficult for institutions to share data and work together. Furthermore, the restricted availability of computational resources and experience inhibits the scalability and efficiency of Big Data applications in healthcare settings.

The conversation points out that, in spite of these obstacles, new developments in cloud computing, federated learning, and block chain technology present encouraging solutions to the problems of data storage, privacy, and interoperability [8, 9, 10]. In order to create standardized data governance frameworks and ethical principles that guarantee the responsible use of Big Data in biomedicine, it is crucial for researchers, doctors, and policymakers to cooperate together. In addition, investing more in training programs for healthcare professionals and data scientists can help close the skills gap, which will allow for the smooth integration of analytics into biomedical research and practice. In summary, Big Data analytics has already made tremendous progress in altering biomedicine, but it is essential to overcome existing barriers in order to unlock its full potential, which will ultimately lead to innovation and improvements in healthcare outcomes around the world.

Conclusion

Big Data analytics is transforming biomedicine by improving the diagnosis of diseases, the development of individualized treatments, and the management of healthcare. Nonetheless, issues like as data heterogeneity, privacy concerns, and resource restrictions continue to be present. By addressing these issues through standardized frameworks, ethical norms, and technical developments, this will be able to harness its full potential, promote innovation, and improve healthcare results around the world.

References

1. Borges do Nascimento, I. J., Marcolino, M. S., Abdulazeem, H. M., Weerasekara, I., Azzopardi-Muscat, N., Gonçalves, M. A., & Novillo-Ortiz, D. (2021). Impact of big data analytics on people's health: Overview of systematic reviews and recommendations for future studies. *Journal of Medical Internet Research*, 23(4), e27275.

2. Alsunaidi, S. J., Almuhaideb, A. M., Ibrahim, N. M., Shaikh, F. S., Alqudaihi, K. S., Alhaidari, F. A., ... & Alshahrani, M. S. (2021). Applications of big data analytics to control COVID-19 pandemic. *Sensors*, 21(7), 2282.
3. Secinaro, S., Calandra, D., Secinaro, A., Muthurangu, V., & Biancone, P. (2021). The role of artificial intelligence in healthcare: a structured literature review. *BMC Medical Informatics and Decision Making*, 21, 1-23.
4. Palanisamy, V., & Thirunavukarasu, R. (2019). Implications of big data analytics in developing healthcare frameworks–A review. *Journal of King Saud University-Computer and Information Sciences*, 31(4), 415-425.
5. Ristevski, B., & Chen, M. (2018). Big data analytics in medicine and healthcare. *Journal of Integrative Bioinformatics*, 15(3), 20170030.
6. Cremin, C. J., Dash, S., & Huang, X. (2022). Big data: historic advances and emerging trends in biomedical research. *Current Research in Biotechnology*, 4, 138-151.
7. Rehman, A., Naz, S., & Razzak, I. (2022). Leveraging big data analytics in healthcare enhancement: trends, challenges and opportunities. *Multimedia Systems*, 28(4), 1339-1371.
8. Thayyib, P. V., Mamilla, R., Khan, M., Fatima, H., Asim, M., Anwar, I., ... & Khan, M. A. (2023). State-of-the-art of artificial intelligence and big data analytics reviews in five different domains: a bibliometric summary. *Sustainability*, 15(5), 4026.
9. Tian, S., Jin, Q., Yeganova, L., Lai, P. T., Zhu, Q., Chen, X., ... & Lu, Z. (2024). Opportunities and challenges for ChatGPT and large language models in biomedicine and health. *Briefings in Bioinformatics*, 25(1), bbad493.