International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-12, Special Issue-1, March-2024
https://doi.org/10.55524/CSISTW.2024.12.1.34
Computing for Sustainable Innovation: Shaping Tomorrow's World (CSISTW-2024) on 16th-17th February, 2024
Organized by B.N. College of Engineering and Technology, Lucknow, India

Importance and Challenges of Big Data in Sustainable HealthCare Development

Dr. Rajeev Tripathi[1] and Dr. Simab Hasan Rizvi[2]

[1,2] Assistant Professor, Department of Computer Application and Sciences, School of Management Sciences, Lucknow, India

Correspondence should be addressed to Dr. Rajeev Tripathi: rajeev2363@gmail.com

ABSTRACT- The ageing population, associated disabilities, rising technology use, and rising public expectations are all posing enormous problems to healthcare systems globally. One challenge is achieving cost containment while improving health outcomes. Big Data can now assist healthcare professionals in achieving these objectives in previously unheard-of ways. Big Data's promise in healthcare depends on its capacity to identify trends and transform massive amounts of data into information that decision-makers and precision medicine can use to make informed decisions. Healthcare companies are already generating value and improving patient care in a number of situations thanks to the application of big data in the industry. Nonetheless, this strategy necessitates cooperation and system performance and design adaptation from all pertinent parties. In addition to investing in human capital to lead citizens into this new frontier of human health and well-being, they must construct the technology infrastructure needed to store and aggregate the enormous volume of healthcare data. In order to create new information, enhance clinical treatment, and expedite public health monitoring, the current study provides an overview of best practice projects in the public health and cancer sectors in Europe and Asia that are connected to big data analytics.

KEYWORDS- Big Bata Analytics, Predictive Healthcare, Sustainable Medicine, Prevention.

I. INTRODUCTION

We regularly collect, store, analyse, and analyse enormous volumes of data, which has made the idea of data engrained in our everyday lives. This characteristic is multidisciplinary and applies to machine learning as well as disciplines like economics, medicine, and engineering. Over the past few decades, there has been an increasing amount of enthusiasm voiced on the potential advantages of this massive quantity of data, sometimes known as "Big Data," in terms of revolutionising clinical care, personal care, and public health [1].

a) An overview of Big Data definitions

Despite the fact that the term "big data" is already often used, no consensus has been reached over its definition. According to McKinsey, the term "big data" refers to datasets that are greater than what can be processed, managed, stored, and analysed using conventional database software tools [2]. Gartner provided the generally recognised concept of big data with the "3V": Large-scale, dynamic, and diversified information assets that need innovative, low-cost information processing methods to enhance insight and decision-making are referred to as "big data" [3]. However, other definitions expand the concept of big data to include veracity, which is related to the data's legitimacy, correctness, and "trustworthiness" [4]. Additionally, there is a growing debate that emphasises how "smart" the data is rather than how "big" they are—that is, how much insight the amount of data may legitimately yield [5]. This is an essential component of the health industry. Big Data has huge potential to improve health. Its full potential, though, can only be realised when information is used to inform decisions. And in order to support evidence-based decision making, effective procedures for analysing and converting massive amounts of data into insightful knowledge are required.

The European Commission's Directorate-General for Research and Innovation's Health Directorate put out the following precise definition of big data as it relates to health research: Big Data in health refers to the abundance and diversity of biological, clinical, environmental, and behavioural data gathered from lone people to sizable cohorts on their state of health and well-being at one or more moments in time [6].

b) Big Data analytics for health systems

Combining various electronically acquired information kinds is what makes Big Data analysis so complicated. The number of new platforms, methods, and techniques for organising and storing this kind of data has increased dramatically in recent years, and there has also been a rise in the number of publications on big data and health. Electronic health records, social media, patient summaries, genetic and pharmacological data, clinical trials, telemedicine, mobile applications, sensors, and data on behaviour, socioeconomic indicators, and well-being are just a few of the sources from which we may currently get data. Through better drug targets for precision medicine, improved disease predictions and preventions, and insights into the causes and consequences of disease, starting with the collection of individual data elements and progressing to the fusion of heterogeneous data coming from various sources, these methods can unveil completely new ways to improve health. Given this, there are a plethora of options and possible advantages for patients as well as the healthcare system as a whole.

c) The potential benefits of Big Data for healthcare in the European Union

Big Data is a delicate topic for organisations within the European Union (EU) since it can improve medical and healthcare operations when health-related Big Data is available. The EU is going through a number of changes that might have an impact on how long its healthcare system can last. It is anticipated that life expectancy would continue to rise by 2025, which might lead to more people living longer but perhaps not in a healthy and active state. This is going to severely strain Europe's healthcare budget and economic output.Big Data may provide fresh perspectives on the risk factors that contribute to illness. More personal interaction with each patient is possible, and data from linked equipment or mobile health apps may be imported. Real-time analysis and utilisation of these data may lead to behavioural modifications that lower health risks, limit exposure to hazardous environments, or improve health outcomes. Lastly, Big Data can assist in identifying high-risk and high-cost patients and acting quickly to address them [7]. Hence, efficient data management techniques can support precision medicine by allowing the identification of variation in patient reactions to therapies and customising medical care to meet each patient's unique requirements [8]. Eventually, all of these factors ought to result in a decrease in inefficiencies and an increase in the healthcare system's ability to manage costs. There are already examples of Big Data analytics being used for enhanced clinical treatment, faster public health surveillance, and the creation of new information. A selection of Europe's top cancer and public health practices is presented here.

II. BIG DATA IN PUBLIC HEALTH

It seems that the EU's efforts to increase data accessibility and availability are mostly motivated by socioeconomic concerns. To enhance the quality of prevention and care, however, a lot of emphasis is placed on the necessity of leveraging data and modern information and communication technology (ICT) in public health.

The exponential rise in chronic patients will need European health systems to adapt their response in the coming year, identifying the most effective therapies and realising the full potential of ICT. By facilitating communication between various healthcare providers and experts as well as between patients and healthcare providers, the e-health platforms that several European governments are working to establish can be useful in improving the treatment of chronic patients in the community environment. Additionally, a sizable portion of EU people utilise the internet to search for health-related information and access to medical services.

Furthermore, by enhancing public health surveillance and assessment, big data and predictive analytics can further enhance precision public health. Consequently, from the standpoint of public health, collecting vast amounts of data represents an invaluable resource for epidemiological research, population health needs analysis, population-based intervention evaluation, and well-informed policy making [9].

III. BIG DATA IN ONCOLOGY

The incidence of cancer is on the rise in India. GLOBOCAN 2020 predicts that by 2040, there would be 2.1 million new instances of cancer in India, a 57.5% rise from 2020 [16–18]. Furthermore, there is a lifelong risk of cancer for one in nine Indians [18]. Thirty percent of cancer cases are specifically head and neck cancer (HNC) [19]. Moreover, the Indian population-based cancer registries (PBCRs) in Nagpur for females and Aurangabad, Delhi, Chennai, and Bhopal for males showed a considerable increase in the incidence of HNC [20]. HNC comprises malignancies of the larynx, pharynx, and mouth cavity; these tumours are mostly derived from the mucosal epithelium, however they can also arise from less frequent places such as salivary glands, the nose, sinuses, muscles, and nerves [21]. The majority of HNC patients are squamous cell carcinoma [22]. In India, locally advanced illness is present in almost 65% of HNC patients who visit the hospital [23–25]. Poor survival is a result of late-stage presentation, limited access to cancer care, and treatment discontinuation in HNC patients [26, 27]. To solve this public health concern and to make better infrastructure and policy-related decisions on disease prevention, high-quality data from PBCRs are needed. Less than 15% of people in India, however, are covered by PBCRs [18, 28, 29]. There have been several documented difficulties in setting up PBCRs in nations with little resources, such as India [30, 31].The purpose of this research article is to summarise the incidence of HNC by region using data from the region's registries that have been released.

a) The incidence of Head and Neck Cancer (HNC) in India

The incidence rate of cancer across all sites was 102.4 for females and 103.7 for males per 100,000 people. Males had an ASIR of 25.9 (95% CI 25.7–26.1) and females had an ASIR of 8.0 (95% CI 7.9–8.1) per 100,000 population, respectively, for HNC. Figure 1 lists the incidence of HNC in relation to all-site cancer.

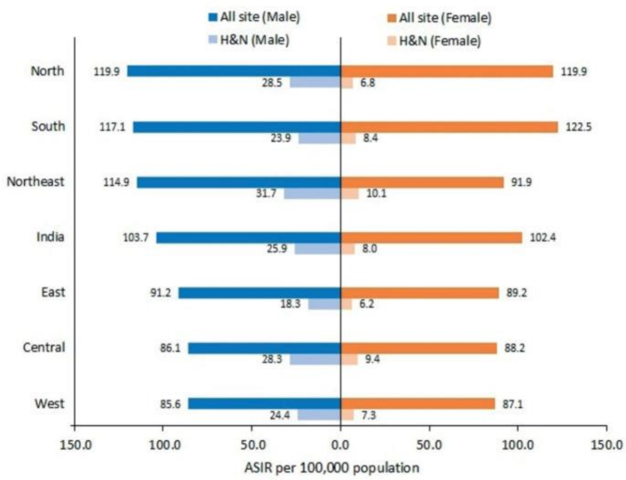

Figure 1: Comparison of all site cancer burden with HNC burden in different regions of India (2012–2019).

b) The HNC burden across different age groups and gender

We noticed that the ASIR for HNC increased with advancing years. In the age range of 0-19 years, the HNC burden was lowest (0.1-0.3 in men and 0.1-0.2 in females per 100,000 population). Males in the central area had the greatest incidence of HNC (15.0 per 100,000 population) among those aged 20 to 39. The illness burden was highest in the central area for females (ASIR 20.8 per 100,000 population) and highest in the northeastern registries for men (ASIR 62.6 per 100,000 population) in the 40–59 age range. For both males and females, the incidence rate for the 40–59 age group was 36.3–62.6 and 12.4–20.8 per 100,000 population, respectively.

Male and female respondents who were 60 years of age or older had greater ASIRs than those in any other age group. The total ASIR for males and females (60 years of age and older) across all registries was 114.9 and 36.9 per 100,000 population, respectively. The northeastern region's registries recorded the highest prevalence in the age group 60+, with men reporting 155.3 and females reporting 46.2 cases per 100,000 population, respectively. Table 1 displays the HNC load by region for the various age groups.

Table 1. HNC burden among different age groups by region and gender (2012–2019).

Age group	Region	Male		Female	
		Number of new cases	ASIR[a]	Number of new cases	ASIR[a]
00–19 (years)	India	184	0.2	90	0.1
	Central	12	0.2	9	0.2
	East	3	0.1	3	0.1
	North	33	0.2	14	0.1
	Northeast	31	0.2	16	0.1
	South	**46**	**0.3**	**25**	**0.2**
	West	60	0.2	22	0.1
20–39 (years)	India	6,642	7.7	1,667	2.0
	Central	**790**	**15.0**	**158**	**3.1**
	East	213	6.3	63	1.9
	North	1,255	8.1	260	1.8
	Northeast	758	5.1	375	2.6
	South	1,206	6.2	317	1.6
	West	2,421	8.8	493	2.0
40–59 (years)	India	25,813	52.6	7,235	15.8
	Central	1,854	58.4	**603**	**20.8**
	East	926	36.3	276	12.4
	North	4,726	57.8	919	12.6
	Northeast	**4,962**	**62.6**	1,477	20.2
	South	5,316	45.0	1,787	15.1
	West	8,030	52.1	2,172	15.4
60+ (years)	India	23,407	114.9	7,805	36.9
	Central	1,406	106.5	513	36.9
	East	943	81.1	293	26.9
	North	4,312	127.2	1,108	33.0
	Northeast	**4,465**	**155.3**	**1,327**	**46.2**
	South	5,723	114.1	2,386	42.8
	West	6,559	99.1	2,177	31.6

One of the main health issues facing our society is cancer, a condition that is expected to get worse on a worldwide scale as the population ages and rises. Cancer is acknowledged as one of the main causes of early mortality in the EU, according the State of Health in the EU reports. It also affects the economy by lowering productivity and labour market participation. Cancer researchers now have strong new methods to extract value from a variety of data sources thanks to developments in big data analytics. A tonne of information about a single patient is available from these many sources. The gathering of various different types of omics data can provide a unique molecular profile for each patient and greatly assist oncologists in their effort for personalised therapy approaches, as cancer is a molecularly highly complex disease with enormous intra- and intertumoral heterogeneity among different cancer types and even patients [10]. Comprehensive Cancer Centres (CCCs) use this strategy of merging data from many sources[13]. The National Centre of Tumour Diseases, one of Germany's 13 CCCs, is home to the Molecularly Aided Stratification for Tumour Eradication Research (MASTER) experiment, which focuses on sector 1, 2, and 3. This experiment was used as an example of a very effective programme that addressed molecular profiling in cancer patients in a recent review paper. Whole exome or whole genome sequencing as well as RNA sequencing are used in the MASTER study to gather data pertinent to the diagnostic information of young patients with advanced-stage cancer disorders. The data is then examined and debated.The individualised treatment FOr Relapsed Malignancies in children (INFORM) registry, which focuses mostly on sector 1, 2 and 3, is another instance of a success story included in the review. Its objective is to treat relapses of high-risk tumours in paediatric patients. To find treatment targets that are particular to each patient, information from whole-exome, low-coverage whole-genome, RNA sequencing, and microarray-based DNA methylation profiling is used. Eight European nations as well as Australia have joined the INFORM register, which began as a national initiative in Germany.Collaborations are crucial, particularly when it comes to paediatric or other uncommon cancers, where data on a single patient can be enormous, but too few patients are available for a single centre to obtain statistical power high enough to produce meaningful results. The ability to access the vast amounts of data and interpret it effectively is one of the primary problems of these collaborations. Only when they have simple, intuitive access to their own or their partners' data can medical professionals, researchers, and informatics specialists profit from gathered data and expert knowledge. Tools are created, for instance, at the German Cancer Research Centre to provide access to and analysis of partner data in addition to internal data.Moreover, The

Cancer Genome Atlas (TCGA) and the International Cancer Genome Consortium (ICGC), which give researchers access to thousands of sequenced individuals with various cancer types, are internationally exceptional ways to data sharing among partners or the public. The availability of this data in conjunction with data from other partners has made it feasible to conduct extensive meta-analyses and machine learning algorithms, integrating various cancer types and resulting in the discovery of novel cancer driver genes that are associated with certain pathways and may be targets for future therapies. Moreover, a variety of publicly accessible databases, like the Catalogue of Somatic Mutations in Cancer (COSMIC), offer access to catalogues of mutations linked to cancer.The integration of various information sources, together with the creation and assistance of CCCs around Europe, presents an opportunity to expand the pool of patients who may receive personalised treatment plans based on Big Data analysis and molecular profiling.

c) Ethical and legal issues for the effective use of Big Data in healthcare

Due to the sensitive nature of the data, using big data in healthcare presents significant moral and legal issues. The potential for privacy and individual liberty to be violated, as well as the impact on public expectations of justice, openness, and trust when utilising big data, provide ethical and legal problems [11]. The following crucial technological and infrastructural challenges have surfaced as potential threats to a Big-Data-driven healthcare system: data heterogeneity, data protection, analytical fluxes in data analysis, and inadequate infrastructures for data storage.Skovgaard et al. [12] recently investigated EU citizens' opinions about the reuse of health data. According to the review, people are in favour of using health data for non-treatment reasons as long as those uses are anticipated to advance the common good [32]. In this regard, the public responds favourably to the recent demand for the unfettered use of public genetic data published in Science by several distinguished scientists from around the world [18]. Data security, data commercialization, and data use that goes against the interests of the data providers are some of the growing concerns. The recently enacted EU Data Protection Regulation (GDPR) attempts to strike a compromise between protecting patients' privacy and allowing data to be shared for medical and scientific reasons. The first document on privacy and big data, "Guidelines on the protection of individuals with regard to the processing of personal data in a world of Big Data," was adopted on January 23, 2017, by the Consultative Committee of the Council of Europe's data protection convention. [13] It offers suggested measures to prevent any potential harm that the use of big data may cause to human rights and freedoms. In order to safeguard individual health data in terms of confidentiality, privacy, and security, any government using Big Data in the health sector must also ensure that scientific advancements can benefit from the open use of data for the benefit of the community.

IV. CONCLUSION

Big Data is starting to transform healthcare in Europe and Asia since it provides avenues and solutions to enhance both the performance and results of healthcare systems as well as the health of individual patients. Precision medicine adoption still depends on collecting large amounts of data and analysing it quickly to find the best foundation for customising health optimisation for each patient's illness diagnosis, prevention, and treatment. To realise the full innovative potential of information and innovation technology on health in the EU and Asia, stakeholders must work together to achieve effective and proportionate governance of health-related data. This will be necessary for the development of future healthcare systems. In this regard, it is appropriate for EU member states to reach consensus on international technical standards while also considering openness, which is seen as the fundamental paradigm for the digital transition. Furthermore, innovative methods for converting the massive volume of data into useful information for medical practitioners must be discovered. More has to be done to improve the accessibility and comprehensibility of information for medical practitioners.

In conclusion, a lot is happening quickly these days, especially in the field of healthcare innovation. More sustainable and individualised health services are desperately needed, and science and technology are providing a plethora of potentially priceless new instruments to help provide them. In order to guide citizens into this new frontier of human health and well-being, where data are increasingly becoming a significant corporate asset, a vital economic input, and the foundation of new business models, cooperation at the EU level is required to facilitate investments in both new technology and human capital.

CONFLICTS OF INTEREST

Declaration

The author declares no conflict of interest.

ACKNOWLEDGMENT

We gratefully acknowledge the support of the Innovation Center for School of Management Sciences. We also thank the faculty who helped us.

REFERENCES

[1] Vayena E, Dzenowagis J, Brownstein J, Sheikh A. “Policy implications of big data in the health sector. Bull World Health” Organ201; 96:668.

[2] Manyika J, Chui M, Brown B, et al. “Big data: The next frontier for innovation, competition, and productivity”. 2011. www.mckinsey.com/mgi (12 September 2019, date last accessed).

[3] Beyer M, Laney D. “The Importance of ‘Big Data’: A Definition. Gartner Report”. 2012, 1–9.

[4] McAfee A, Brynjolfsson E. “Big data: the management revolution”. Harv Bus Rev2012;90:60–66, 68, 128.

[5] George G, Haas MR, Pentland A. Big Data and management. AMJ201;57:321–6.Google Scholar Crossref WorldCat

[6] Auffray C, Balling R, Barroso I, et al. Making sense of big data in health research: towards an EU action pla. Genome Med2016;8:71.Google Scholar Crossref PubMed WorldCat

[7] Batesc D W., Saria S, Ohno-Machado L, et al. “Big Data in health care: using analytics to identify and manage

high-risk and high-cost patients. Health" Aff2014;3:1123–31.Google scholar CrossrefWorldCat

[8] Hopp W J, Li J, Wang G." Big Data and the precision medicine revolution". Prod OperManag2018;27:1647–64.Google Scholar Crossref WorldCat

[9] Jameson J L, Longo D L. "Precision medicine—personalized, problematic, and promising". N Engl J Med2015;372:2229–34.Google Scholar CrossrefPub MedWorldCat

[10] Harten W. H. "Comprehensive cancer centres based on a network: the OECI point of view". Ecancer medical science2014;8:ed43.Google Scholar Crossref PubMed WorldCat

[11] Joos S, Nettelbeck D M, Reil-HeldA, et al. German Cancer Consortium (DKTK) - a national consortium for translational cancer research. Mol Oncol2019;13:535–42. Google ScholarCrossref PubMedWorldCat

[12] Eggermont A M M, Apolone G, Baumann M, et al. Cancer core Europe: a translational research infrastructure for a European mission on cancer. Mol Oncol 2019;13:521–7.

[13] Ienca M, Ferretti A, Hurst S, et al. Considerations for ethics review of big data health research: a scoping review. PLoS One2018;13:e0204937.Google Scholar Crossref PubMedWorldCat

[14] Skovgaard L L, Wadmann S, Hoeyer K. A review of attitudes towards the reuse of health data among people in the European Union: the primacy of purpose and the common good. Health Policy2019;123:564–71.Google Scholar Crossref PubMed WorldCat

[15] Amann R I, Baichoo S, Blencowe B J, et al. Toward unrestricted use of public genomic data.Science2019;363:350–.Google Scholar Crossref PubMed World Cat

[16] Ferlay J, Ervik M, Lam F, et al. Global Cancer Observatory. Lyon: International Agency for Research on Cancer; 2020. [07/06/23]. [https://gco.iarc.fr/] [Google Scholar]

[17] World Health Organization. WHO Report on Cancer: Setting Priorities, Investing Wisely and Providing Care for All. Geneva: WHO; 2020. [Google Scholar]

[18] Sathishkumar K, Chaturvedi M, Das P, et al. Cancer incidence estimates for 2022 & projection for 2025: result from National Cancer Registry Programme, India. Indian J Med Res. 2022;156:598–607. [PMC free article] [PubMed] [Google Scholar]

[19] Kulkarni MR. Head and neck cancer burden in India. Int J Head Neck Surg. 2013;3(4):29–35. doi: 10.5005/jp-journals-10001-1132. [CrossRef] [Google Scholar]

[20] ICMR National Centre for Disease Informatics and Research. National Cancer Registry Programme Report Bengaluru, India. Bengaluru: ICMR National Centre for Disease Informatics and Research; 2020. [07/06/23]. https://ncdirindia.org/All_Reports/PBCR_Annexures/Default.aspx] [Google Scholar]

[21] National Cancer Institute. Head and Neck Cancer. United states National Cancer Institute, National Institute of Health; 2018. [07/06/23]. [https://www.cancer.gov/types/head-and-neck/head-neck-fact-sheet] [Google Scholar]

[22] Pindborg J J, Reichart PA, Smith CJ. Histological Typing of Cancer and Precancer of the Oral Mucosa. Geneva: WHO; [07/06/23].[https://apps.who.int/iris/handle/10665/43552] [Google Scholar]

[23] Mathur P, Sathishkumar K, Chaturvedi M, et al. Cancer statistics, 2020: report from National Cancer Registry Programme, India. JCO Glob Oncol. 2020;6:1063–1075. doi: 10.1200/GO.20.00122. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[24] ICMR National Centre for Disease Informatics and Research. Report of the Hospital Based Cancer Registries. Bengaluru: ICMR National Centre for Disease Informatics and Research; 2021. [07/06/23]. [https://ncdirindia.org/All_Reports/HBCR_2021/] [Google Scholar]

[25] Homi Bhabha Cancer Hospital. Hospital Based Cancer Registry Annual Report. Sangrur: Homi Bhabha Cancer Hospital; 2018. [07/06/23]. [https://tmc.gov.in/tmh/pdf/Reports/HBCR%20Sangrur%20Report-2018%2008-03-2021.pdf] [Google Scholar]

[26] Sankaranarayanan R, Swaminathan R. Cancer Survival in Africa, Asia, the Caribbean and Central America. Lyon: International Agency for Research on Cancer, World Health Organization; 2011. [07/06/23]. [https://publications.iarc.fr/Book-And-Report-Series/Iarc-Scientific-Publications/Cancer-Survival-In-Africa-Asia-The-Caribbean-And-Central-America-2011] [Google Scholar]

[27] Budukh AM, Chaudhary D, Sancheti S, et al. Determinants of completion of cancer directed treatment: an experience from a rural cancer centre, Sangrur, Punjab state, India. Ecancer medical science. 2021;15:1313. doi: 10.3332/ecancer.2021.1313. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[28] Bhatia A, Victora C G, Beckfield J, et al. "Registries are not only a tool for data collection, they are for action": cancer registration and gaps in data for health equity in six population-based registries in India. Int J Cancer. 2021;148:2171–2183. doi: 10.1002/ijc.33391. [PubMed] [CrossRef] [Google Scholar]

[29] Budukh A, Bagal S, Thakur JS, et al. Pediatric cancer burden in different regions of India: analysis of published data from 33 population-based cancer registries. Indian Pediatr. 2023;60(7):541–545. doi: 10.1007/s13312-023-2931-0. [PubMed] [CrossRef] [Google Scholar]

[30] Parkin D, Sanghvi L. Cancer Registration: Principles and Methods. 95. Lyon: IARC Scientific Publication; 1991. [07/06/23]. Chapter 14: cancer registration in developing countries; pp. 185–198. [https://publications.iarc.fr/Book-And-Report-Series/Iarc-Scientific-Publications/Cancer-Registration-Principles-And-Methods-1991] [PubMed] [Google Scholar]

[31] Budukh AM, Pradhan S, Singh VB, et al. Cancer pattern in Varanasi district from Uttar Pradesh state of India, a foundation for cancer control based on the first report of the population-based cancer registry. Indian J Cancer. 2023. [ahead of print] [PubMed]

[32] Tripathi R, "Emerging Technologies with SDG 9: Industry, Innovation, and Infrastructure, SDG9: Industry Innovation and Infrastructure", ISBN: 978-81-962299-1-7

ABOUT THE AUTHORS

Dr. Rajeev Tripathi is a computer science professor of Department of Computer Application and Sciences in SMS, Lucknow. He has completed his PhD in 2015 on the topic Improvisation of Page Ranking Method through Text mining. He has done MCA, M. Tech., MPhil. he has completed Bachelor of Science in Computer Science from University of Lucknow, Lucknow. He has more 17 years teaching experience. He has published 20+ research papers. His research interested areas are Text Analytics, IoT, ML, deep Learning.

Dr. Simab Hasan Rizvi has joined as an Assistant Professor-I in Department of Management, SMS ,Lucknow on 1st November,2023.He has completed his PhD in 2013 on the topic Model of augmenting utilization of Object Based Content Addressable Storage at Department of Computer Science from Sainath University, Ranchi, Jharkhand. He has also completed his MPhil(Computer Science) in 2009 from Madurai Kamaraj University, Madurai on the topic of Role of Data Warehouse in diversity field of I.T. He has done MCA and M.Sc.(Computer Science).Prior to masters degrees, he has completed Bachelor of Science in Computer Science from University of Lucknow, Lucknow. He has more 15 years teaching experience. He has published 4 research papers.H is research interested areas are data warehouse, networking.