The Eastasouth Journal of Information System and Computer Science
Vol. 3, No. 03, April 2026, pp. 312-322
ISSN: 3025-566X, DOI: 10.58812/esiscs.v3i03

Cloud-Based Information Retrieval for Big Data: A Survey of Architectures and Scalability Challenge

Tanay Chowdhury
Data Science Lead – Gen AI Center of Innovation, Amazon Web Services, Seattle, USA

Article Info

Article history:

Received Mar, 2026
Revised Mar, 2026
Accepted Mar, 2026

Keywords:

Big Data;
Cloud Computing;
Information Retrieval;
Scalability;
Security and Privacy

ABSTRACT

Cloud computing has become a paradigm of managing, storing and retrieving large amounts of data emanating in contemporary digital applications. The mode of information retrieval (IR), which is typically insufficient in large-scale, heterogeneous, and dynamic data settings, has been severely challenged by the issue of big data, namely its high volume, high velocity, high diversity, high veracity, and high value. Cloud retrieval information systems take advantage of the elasticity, scalability and on-demand provisioning of cloud systems to facilitate effective and cost-effective access to data across distributed platforms. This work is a critical overview of the concept of big data and cloud-based IR, with a specific emphasis on the most significant models of cloud service, the specifics of data types, and the prospects of ML and DL to improve the quality of retrieval and relevance. Moreover, the paper logically examines key scalability issues, such as distributed storage management, index maintenance, query processing latency, load balancing and resource provisioning. All critical issues related to security and privacy, including leakage of data, insider threats, and vulnerability of programming interfaces, and multi-tenancy risks are also discussed. This paper, by summarizing the available literature and discovering gaps in the research, offers useful information on how scalable, secure, and intelligent information retrieval systems can be designed, as well as presents future research opportunities so as to facilitate reliable deployment of the system in data-intensive applications.

Corresponding Author:

Name: Tanay Chowdhury
Institution: Data Science Lead – Gen AI Center of Innovation, Amazon Web Services, Seattle, USA
Email: tanayz@outlook.com

1. INTRODUCTION

The notion of big data initially emerged as large-scale datasets that surpass the capabilities of existing technology, methodologies, and theories to display, process, and analyze effectively, as elaborated in the journal Nature. Big data's four primary characteristics are Volume, Variety, Velocity, and Value. These days, the cloud is providing an increasing variety of services, such as office apps like accounting, HR, buying, and CRM, as well as procedures, email, and storage. Cloud computing may be defined in as many ways as the squares on a chessboard [1]. "Cloud computing" describes internet outsourcing that is accessible on an as-needed basis and charged on an as-you-go basis.

Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS) are the three widely recognized cloud service paradigms. These three fundamental models of cloud service delivery may be utilized to create new service models that are known as particular cloud service models. Many companies have started using cloud models for critical services including storage, email, web hosting, OS installation, patch management, and resource upgrades [2]. The three models are characterized by their cost-effectiveness, flexibility, elasticity, and simplicity of use. These qualities are achieved by the pooling of resources among tenants and the swift provisioning through self-service, which includes the addition of additional power and storage when available.

However, complicated data cannot be combined with standard (IR) information retrieval techniques to obtain pertinent information that would improve recommender systems for timely and efficient decision-making [3]. Different information retrieval methods and efficient big data utilization will provide us distinct advantages in large networks [4]. In these benefits, Efficiency includes the ability to retrieve information quickly. Since earlier methods had some issues that were previously described, researchers are still working to develop a more effective method for retrieving information quickly and accurately in response to user queries.

The process of gaining access to data stored in cloud environments is the fundamental definition of cloud-based information retrieval. From scientific research to consumer data analytics and enterprise resource planning, this procedure has grown to be a crucial part of many applications. In cloud computing, secure information retrieval refers to accessing data while maintaining its validity, secrecy, and integrity [5]. These guidelines are essential for guaranteeing that private data is protected both during storage and retrieval. A healthcare company that stores patient records on the cloud, for instance, needs to make sure that these records are unmodified during transmission and are only accessed by authorized individuals. Numerous security measures, including have been developed to achieve these objectives, including as access control, authentication, and encryption.

Structure of the Paper

Here is the outline of the paper: Section II lays up the groundwork for retrieving information via the cloud and big data. The difficulties of scaling IR in the cloud are discussed in Section III. The privacy and security of IR in the cloud is discussed in Section IV. Recent research are reviewed in Section V. This research comes to a close at the conclusion of Section VI.

2. FUNDAMENTALS OF BIG DATA AND CLOUD-BASED INFORMATION RETRIEVAL

A technique called "info retrieval" (IR) is used to find specific material inside big files. Info retrieval (IR) in a Big Information context refers to the process of looking through large, heterogeneous files for pertinent information, which may be partially organized, unstructured, or organized. The sheer amount and complexity of data means that modern IR systems need advanced algorithms and models to sort it efficiently and effectively [6]. Particularly with the emergence of Big Information, IR schemes are more important than ever for users to swiftly and simply extract the information they need from massive datasets. Through the use of models to select leaflets according to their relevance to a user's inquiry, these systems are able to identify pertinent information without repeating an excessive quantity of irrelevant data.

2.1 Manage Big Data in Cloud Computing Environments

Cloud computing relies on the use and supply of services to function. There are many subtypes of service-oriented structures. The degree of abstraction that the user may access is a common criterion for categorizing these systems. Three levels are frequently differentiated in this manner: PaaS, SaaS, and IaaS are depicted in Fig. 1.

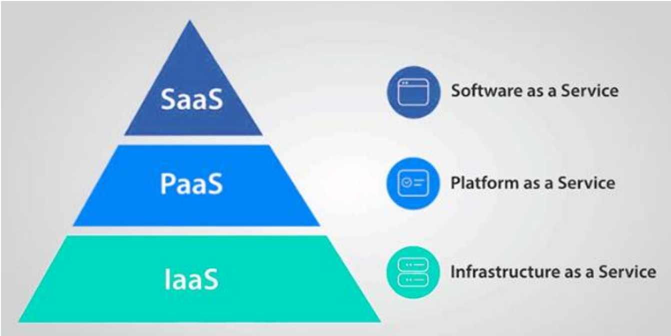

Figure 1. Big Data in Cloud Computing

a. **Software as a Service (SaaS):** Cloud computing services allow users to get data processing frameworks for various needs. Customers may avoid software maintenance by using specified SaaS cloud services to handle massive amounts of data; they can then pay when the operation is completed [7].
b. **Platform as a Service (PaaS):** The platform as a service (PaaS) provides a distributed, scalable, and fault-tolerant development environment for cloud services that handle huge amounts of data.
c. **Infrastructure as a Service (IaaS):** IaaS cloud providers give their customers with virtualized resource pools that include a variety of configurable computer resources, including storage, networks, applications, and I/O devices [8]. It can handle large data operations' efficiency, scalability, dependability, and variability.

2.2 Big Data Characteristics and IR Requirements

The term "big data" describes how traditional data structures cannot manage expanding data sets. Characteristics of data sets at rest, such as volume and variety of data from different domains or types, and data sets in motion, such as velocity (rate of flow) and variability (mainly denoting a change in velocity), motivate a new architecture to attain efficiencies [9]. Data lifecycle procedures may take many different forms or have different sequences depending on which of these elements is used to attain the necessary efficiency. Some of the other often used terms that start with the letter "V" are more closely associated with analytics than large data structures, as seen in Fig. 2 and Table I.

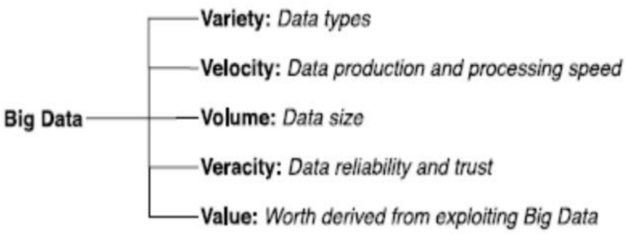

Figure 2. Some Vs'of Big Data

a. Variety

Refers to data created in numerous forms, either unstructured or organized. Structured data may be arranged in a database's columns, including names, phone numbers, addresses, financial information, and more. It's not too difficult to enter, save, query, and evaluate this kind of data [10].

b. Velocity

Refers to the pace at which data is created, delivered, collected, and evaluated. Evaluating data produced at an ever-increasing pace and maintaining instantaneous transmission and access are prerequisites for providing real-time access to several data-dependent applications.

c. Volume

Refers to the remarkable quantity of data generated each second by numerous sources, including social media, mobile devices, automobiles, credit card transactions, M2M sensors, photographs, and videos, facilitating the extraction of patterns and concealed information.

d. Veracity

Refers to the data source's dependability and quality. Its significance is on the context and the meaning it adds to the analysis [11]. Thus, it is simple to comprehend the risks involved with analysis and business choices based on data sets when one is aware of the quality of the data.

e. Value

Refers to the undiscovered value that may be used to inform decisions. Big data may help better understand the consumers, target them appropriately, optimize operations, and enhance machine or company efficiency.

Table 1. Big Data Characteristics (5Vs)

Characteristic	Short Description
Variety	Several forms of data, include organized, unstructured, and semi-structured information.
Velocity	Data generation, transmission, and processing speed in real time.
Volume	Massive quantities of data generated from diverse sources continuously.
Veracity	Accuracy, reliability, and trustworthiness of the data.
Value	Useful insights extracted from data to support decision-making and optimization.

2.3 *Big Data with Machine Learning*

The main objective of ML techniques is the acquisition of knowledge and the facilitation of decision-making. ML is employed in numerous real-world applications, such as autonomous control systems, data mining, recognition technologies, and recommendation engines [12]. Reinforcement learning, supervised learning, and unsupervised learning are the three subfields that make up the ML domain.

1. Data Streaming Learning

Massive datasets are produced by a variety of real-time technologies, including credit card transactions, network traffic, and stock management. Discovering intriguing patterns and extracting values from hidden streams and datasets are crucial tasks for data mining. Big data is tied to dynamic settings, whereas traditional data mining approaches are dedicated to categorization, accuracy, scalability, association rule mining, and clustering.

2. Deep Learning

Deep learning is a fundamental component of ML and pattern recognition. It enables predictive analysis and combines NLP, voice recognition, and computer vision. DL is used to help extract complicated datasets from massive volumes of data and to address problems in data analysis. Because DL takes information from complicated datasets at several levels, it is also known as hierarchical learning. It is very beneficial for tasks involving discriminating (e.g., classification and prediction), information retrieval, data tagging, and analysis of vast amounts of data.

2.4 *Challenges in IR for Big Data*

There are still several obstacles to overcome, even if deep learning has significantly improved the performance of IR systems. The data generated by Big Data systems is too large for traditional IR models to manage, yet scaling IR models to the point where they can analyze and extract pertinent information in real-time is still a fascinating challenge. Similar challenges are emerging for recovery models powered by AI.

Ethical IR applications must ensure that models provide fair and objective outcomes, especially in nuanced domains like healthcare and criminal justice. Big Data, which often includes text, videos, images, and audio, is often unstructured or semi structured, making it difficult to manage and integrate many data types into a single retrieval system. This requires sophisticated approaches and trustworthy algorithms. DL models are quite effective, but they may be computationally costly; optimizing them for real-time retrieval without sacrificing accuracy is the current challenge.

3. SCALABILITY CHALLENGES IN CLOUD-BASED IR

The IR systems on the cloud are meant to handle and retrieve information in very large, heterogeneous, and ever-growing information [13]. Although the cloud platforms provide scalability and elasticity, it is important to note that scalable and efficient IR is a major challenge as the big data workloads and user query patterns are dynamic in nature.

1. Scalability and storage management of data is a major issue of cloud-based IR systems. The explosive increase in both structured, semi-structured and unstructured data requires distributed storage systems that can scale horizontally. Data locality, fault tolerance and efficient data replication among geographically dispersed data centers are critical issues to maintain. Besides, site selection, storage cost versus performance (especially to frequently used (“hot”) data versus archival data (cold data) data is also a complicated topic in multi-tenant cloud environments.
2. Scalability and maintenance of the indexing is another significant issue since IR systems are highly dependent on huge indexes to retrieve data quicker. With the increasing volumes of data and the continuous need to update the content, indexes have to constantly be rebuilt, or built upon without interrupting the services of queries [14]. Distributed indexing presents the problem of index partitioning, index synchronization and node consistency. Also, tracking real-time updates of indexes can cause a large amount of overhead and storage to be used.
3. The responsiveness of cloud IR systems is directly affected by query processing and latency problems. The queries tend to be executed in parallel in different distributed nodes and hence, the overheads in network communication and higher response time. Elaborate queries, real-time analytics, and concurrency make latency issue even worse. Proximal data placement, intelligent caching, and query optimization are to ensure the low-latency retrieval and process large-scale datasets.
4. Load balancing and resource provisioning is needed to manage changing query loads and heterogeneous workloads [15]. Lack of equal distribution of queries or data partitions may create resource bottlenecks or underutilization or degradation of the system. Dynamical load-sensitive load balancing mechanisms are needed to

balance requests among the compute and storage resources equally. Meanwhile, it is difficult to provide the resources accurately because of user behavior unpredictability and query complexity difference.

4. SECURITY AND PRIVACY ISSUES IN CLOUD-BASED IR

The wide variety of uses for cloud computing has made academics pay more attention to data processing, administration, and storage security [16]. Data security in the cloud brings up new concerns about the privacy and authenticity of stored information. The architecture and scalability of cloud applications and data are boundless when it comes to security. Another significant security issue is that cloud computing enables several tenants to share virtualized resources. Table II outlines the security and privacy concerns associated with cloud-based information retrieval.

4.1 Immoral use and Abuse of Cloud Computing

Cloud computing infrastructure offers a variety of features to consumers, including storage solutions and bandwidth possibilities. Nevertheless, the cloud infrastructure does not provide comprehensive oversight of resource utilization, thereby enabling malicious actors to capitalize on these vulnerabilities. Cloud resources are misused by malevolent individuals who focus on attack points and launch DDoS, Captcha-solving farms, and password-cracking efforts. Because of their high degree of user engagement, these vulnerabilities primarily impact the PaaS and IaaS levels.

4.2 Malicious Insider Attackers

One of the most underappreciated forms of assault that may devastate any part of a cloud infrastructure is an insider threat, which has surprisingly been the most disregarded until recently. High-level access to network components may provide a malevolent insider root privileges, allowing them to alter private and sensitive information [17]. Because firewalls and IDS ignore such suspicious action, treating it as legitimate, this exploit represents a major security concern.

4.3 Vulnerable Programming Interfaces

Publishing APIs for simple software application creation or deployment is a component of cloud services allowing user engagement across all tiers. These APIs provide the cloud architecture an additional layer of complexity. Sadly, these interfaces provide API vulnerabilities that malevolent users may exploit by gaining backdoor access. The cloud architecture's fundamental functions may be compromised by these vulnerabilities.

4.4 Data Leakage and Loss

Data leaking is one of the major issues with cloud computing because of the continuous migration and transfer of data via unreliable networks. Data theft is becoming the largest danger to the IT industry and may result from data loss, costing businesses and customers enormous sums of money in damages. A lack of disaster management measures, faulty data centres, and insufficient authentication and encryption methods are the main causes of data loss.

4.5 Distributed Technology Vulnerabilities

The multi-tenant architecture provides virtualization for shared on-demand services, allowing a single application to be utilized by multiple users, provided they have authorized access. Nevertheless, vulnerabilities within the hypervisor enable malicious actors to seize control of authorized virtual machines. These vulnerabilities may potentially impair the cloud architecture's fundamental processes, disrupting its normal functioning.

4.6 Services and Account Hijacking

This means that a malevolent outsider may trick a web service into visiting a fake website. After gaining access to the genuine site, malicious hackers might reuse credentials and conduct phishing attacks or steal identities.

4.7 *Anonymous Profile Threat*

The use of cloud services has the potential to reduce the need for software and hardware maintenance. On the other hand, this might compromise internal security controls, audits, patching, logging, and security compliance. A major danger to an organization's confidentiality is the possibility of exposure due to an anonymous profile threat.

Table 2. Security and Privacy Issues in Cloud-Based Information Retrieval (IR)

No.	Security / Privacy Issue	Description	Impact on Cloud-Based IR Systems
1	Immoral use and abuse of cloud computing	Malicious users exploit cloud resources such as storage, compute power, and bandwidth to launch attacks including DDoS, password cracking, and CAPTCHA-solving farms, particularly targeting PaaS and IaaS layers.	Service disruption, degraded IR performance, increased latency, and denial of legitimate user access.
2	Malicious insider attackers	Authorized insiders with elevated privileges misuse access to manipulate, steal, or destroy sensitive data, often bypassing IDS and firewalls as activities appear legitimate.	Compromise of indexed data integrity, leakage of sensitive search data, and loss of trust in IR services.
3	Vulnerable programming interfaces	Insecure or poorly designed APIs used for cloud service interaction introduce backdoors and exploitation points for attackers.	Unauthorized access to IR services, manipulation of search indices, and disruption of query processing pipelines.
4	Data leakage and loss	Continuous data migration and transmission over untrusted channels, combined with weak encryption or authentication, lead to data exposure or permanent loss.	Confidential information disclosure, loss of indexed datasets, reduced availability, and financial and reputational damage.
5	Distributed technology vulnerabilities	Weaknesses in virtualization and hypervisors allow attackers to escape virtual machines and interfere with co-resident tenants.	Cross-tenant data breaches, corrupted IR indices, and compromised isolation between users.
6	Services and account hijacking	Attackers gain control of service accounts or redirect services to malicious endpoints using stolen credentials or phishing techniques.	Unauthorized queries, manipulation of retrieval results, identity theft, and misuse of IR services.
7	Anonymous profile threat	Limited visibility into underlying infrastructure reduces control over auditing, patching, logging, and compliance, enabling anonymous misuse.	Increased risk of confidential data exposure, non-compliance with regulations, and weakened accountability in IR operations.

5. LITERATURE REVIEW

Recent studies on Cloud-Based Information Retrieval for Big Data. Table III reviews the Comparative Analysis on Cloud Computing and Information Retrieval, broken down by study, approaches, key findings, challenges, and suggested future research topics.

Wang, Wang and Xue (2021) provides an overview of the principles, characteristics, and state-of-the-art technologies involved in large data blockchain computing. Concerns about data quality-related privacy and security are thoroughly addressed, along with data access, isolation, integrity, deletion, transmission, and sharing. Finally, a virtualization architecture and related strategies are proposed as a way to increase data security and counter assaults in a big data cloud context [18].

Kimm and Ortiz (2021) paper presents a suggested information retrieval tool with multi-level security incorporated in Linux that incorporates suitable access control using Security-Enhanced Linux (SELinux). This integration addresses dynamic and susceptible cloud security risks by allowing data categorization based on changing sensitivity levels and security measure changes. The SELinux system is used as a testbed to gather data and track the history of the obtained data in order to implement the proposed MLS framework [19].

Tang (2020) proliferation of new technologies may be attributed to the lightning-fast progress made in Internet technology. Particularly helpful in making data storage and administration more efficient are technologies like cloud computing and big data, which are undergoing fast growth. However, there are problems with data security when it comes to big data cloud computing. To improve the security of people's data when processing and integrating [20].

Li et al. (2020) in order to overcome these difficulties, they suggest an MPAN for point cloud data-based three-dimensional model retrieval. Initially, they partition the 3-D structure into several components utilizing a pretrained PointNet++ segmentation framework. They use a new self-attention method to investigate interconnections after they extract local properties from them. In the meanwhile, the redundant representation of 3D forms is eliminated while the useful information is used by taking into account their structural importance. Lastly, shape descriptors that are both discriminative and informative are created for the 3D shape retrieval task, taking into account both spatial correlations and local properties [21].

Gao, Han and Wan (2020) describe and get insight from a deluge of data in many formats (structured, unstructured, and semi-structured). Diversification of big data, prompted by the explosion of data, has accelerated the creation of big data technologies. The literature on big data and associated technologies, including Hadoop and Map Reduce, is reviewed in this work. Furthermore, it addresses the big data life cycle, which encompasses data preparation, storage, analysis, and gathering. The representative use of big data is then explained. Lastly, this report provides a summary of the evolution of big data based on the aforementioned studies [22].

Das et al. (2019) researchers are now developing a novel approach known as semantic-based solution to address this limitation. The data kept in these clouds also seems to operate on a plan that not everyone can decipher at times. Before consumers ever see the enormous data stored in these clouds, it undergoes automated processing. By incorporating a semantic search engine into the cloud database, this study suggests a general approach to retrieving user-relevant content using semantic technologies. It also want to describe how the semantic search works using the Big Data correlation and the processing it undergoes [23].

Reddy, (2018) big data frequently describes ever-increasing data sets that are challenging to store, retrieve, and manage using traditional database methods. Big data, however, is inherently unstructured and defies conventional wisdom when it comes to storage and retrieval methods. The difficulties include storing information in a cloud, processing it, and creating a meaningful format that will benefit consumers, companies, and the government [24].

Table 3. Comparative Analysis of Big Data Cloud Computing and Information Retrieval Studies

References	Study On	Approach	Key Findings	Challenges	Future Work
Wang, Wang and Xue (2021)	Big data cloud computing security	Analysis of big data cloud concepts and security issues; proposal of a virtualization-based security architecture	Identified critical security concerns related to data access, isolation, integrity, transmission, sharing, and destruction; proposed virtualization strategies to enhance data security	Ensuring data privacy and integrity in multi-tenant cloud environments	Development of more adaptive and intelligent security architectures for large-scale big data clouds
Kimm and Ortiz (2021)	Secure informatio n retrieval in cloud environme nts	Multilevel Security (MLS) framework integrated with SELinux-based access control	Demonstrated dynamic data classification and secure information retrieval using SELinux as a testbed	Managing dynamic changes in data sensitivity and evolving cloud security threats	Extending MLS frameworks to heterogeneous cloud platforms and large-scale deployments
Tang (2020)	Data security in big data cloud computing	Conceptual analysis of big data and cloud computing integration with focus on security risks	Highlighted inherent security vulnerabilities in big data cloud systems during data processing and integration	Protecting user information throughout the data lifecycle	Designing robust security mechanisms for secure data integration and processing
Li et al. (2020)	3D model retrieval using big data techniques	Multi-Part Attention Network (MPAN) leveraging PointNet++ and self-attention mechanisms	Improved 3D shape retrieval accuracy by capturing local features and spatial correlations while reducing redundancy	High computational complexity and scalability of attention-based models	Optimization of attention mechanisms and extension to large-scale 3D datasets
Gao, Han and Wan (2020)	Big data technologie s and lifecycle	Literature review of big data concepts, Hadoop, MapReduce, and data lifecycle stages	Provided a comprehensive overview of big data acquisition, preprocessing, storage, analysis, and applications	Handling data heterogeneity and scalability across the big data lifecycle	Integration of emerging big data frameworks and real-time analytics platforms
Das et al. (2019)	Semantic-based informatio n retrieval in cloud databases	Proposed a semantic search algorithm using semantic technologies for cloud-based big data	Enhanced relevance and understanding of retrieved information through semantic search	Complexity of semantic modeling and processing large-scale cloud data	Improving semantic accuracy and reducing processing overhead in cloud environments
Reddy (2018)	Big data challenges and cloud storage	Conceptual discussion on big data characteristics and cloud-based storage	Identified limitations of traditional databases and emphasized the role of cloud computing	Efficient storage, retrieval, and processing of unstructured and real-time data	Development of scalable, cost-effective cloud solutions for real-time big data analytics

References	Study On	Approach	Key Findings	Challenges	Future Work
		and processing	in big data management		

6. CONCLUSION AND FUTURE WORK

The increased digital information in spheres of healthcare, finance, social media, and enterprise systems has placed big data fueled by cloud-based IR as the backbone to the current data-intensive applications. The cost-effectiveness, scalability, and flexibility of cloud computing make it ideal for storing and retrieving massive volumes of diverse data, which is essential for efficient decision-making and the providing of relevant information as needed. The characteristics of the IR system have significantly enhanced with the merger of big data technologies and cloud systems, particularly with respect to distributed storage, parallel processing, and intelligent indexing systems. In spite of these developments, this paper shows that the conventional methods of IR are inadequate in solving the complexity, speed and diversity of the modern big data landscapes. Although machine learning and deep learning systems have enhanced accuracy and relevance in retrieval, the systems present issues to do with the computation of overhead, real-time responsiveness and scalability. Besides, cloud-based IR systems are still experiencing serious problems in the distributed storage management, index maintenance, query latency, load balancing, and dynamic resource provisioning. Such security and privacy issues as insider threats with malicious intent, data leaks, open APIs, and multi-tenancy risks also make the reliable usage of cloud-based IR, particularly in sensitive application areas, more complex.

Further development needs to be done on coming up with adaptive and smart IR architectures that can use AI to drive resource provisioning and query processing. Trust and compliance can be improved by the inclusion of privacy-saving methods such as federated learning, secure retrieval mechanisms, etc. Besides, it will be necessary to develop lightweight, explainable deep learning models and benchmarks in evaluation in order to come up with scalable, secure, and efficient cloud-based information retrieval systems.

REFERENCES

[1] S. Balasubramaniam and V. Kavitha, “A Survey on Data Retrieval Techniques in Cloud Computing,” vol. 8, no. November, pp. 15–24, 2013.

[2] V. M. L. G. Nerella, “Architecting secure, automated multi-cloud database platforms strategies for scalable compliance,” *Int. J. Intell. Syst. Appl. Eng.*, vol. 9, no. 1, pp. 128–138, 2021.

[3] I. Haneef, E. U. Munir, G. Qaiser, H. Gulfam, and A. Umar, “Big Data Retrieval : Taxonomy , Techniques and Feature Analysis Techniques for Big Data,” *Int. J. Comput. Sci. Netw. Secur.*, vol. 18, no. 11, 2018.

[4] G. Sarraf and V. Pal, “Privacy-Preserving Data Processing in Cloud : From Homomorphic Encryption to Federated Analytics,” *Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol.*, vol. 8, no. 2, pp. 735–706, 2022.

[5] S. B. V. Naga, K. C. Sunkara, S. Thangavel, and R. Sundaram, “Secure and Scalable Data Replication Strategies in Distributed Storage Networks,” *Int. J. AI, BigData, Comput. Manag. Stud.*, vol. 2, no. 2, pp. 18–27, 2021, doi: 10.63282/3050-9416.IJAIBDCMS-V2I2P103.

[6] P. Karthikeyan, J. Amudhavel, A. Abraham, D. Sathian, R. S. Raghav, and P. Dhavachelvan, “A Comprehensive Survey on Variants And Its Extensions Of Big Data In Cloud Environment,” in *Proceedings of the 2015 International Conference on Advanced Research in Computer Science Engineering & Technology (ICARCSET 2015)*, Mar. 2015, vol. 06-07-Marc, no. January, pp. 1–5. doi: 10.1145/2743065.2743097.

[7] J. Wang, Y. Yang, T. Wang, R. Simon Sherratt, and J. Zhang, “Big data service architecture: A survey,” *J. Internet Technol.*, vol. 21, no. 2, pp. 393–405, 2020, doi: 10.3966/160792642020032102008.

[8] S. A. El-Seoud, H. F. El-Sofany, M. Abdelfattah, and R. Mohamed, “Big data and cloud computing: Trends and

challenges," *Int. J. Interact. Mob. Technol.*, 2017, doi: 10.3991/ijim.v11i2.6561.
[9] S. Garg, "Predictive Analytics and Auto Remediation using Artificial Inteligence and Machine learning in Cloud Computing Operations," *Int. J. Innov. Res. Eng. Multidiscip. Phys. Sci.*, vol. 7, no. 2, 2019.
[10] M. Muniswamaiah, T. Agerwala, and C. Tappert, "Big Data in Cloud Computing Review and Opportunities," *Int. J. Comput. Sci. Inf. Technol.*, 2019, doi: 10.5121/ijcsit.2019.11404.
[11] M. D. Assunção, R. N. Calheiros, S. Bianchi, M. A. S. Netto, and R. Buyya, "Big Data computing and clouds: Trends and future directions," *J. Parallel Distrib. Comput.*, 2015, doi: 10.1016/j.jpdc.2014.08.003.
[12] A. K. Sandhu, "Big data with cloud computing: Discussions and challenges," *Big Data Min. Anal.*, vol. 5, no. 1, pp. 32–40, 2021.
[13] A. Alexandrescu, "Optimization and Security in Information Retrieval, Extraction, Processing, and Presentation on a Cloud Platform," *Information*, vol. 10, no. 6, p. 200, Jun. 2019, doi: 10.3390/info10060200.
[14] A. Kushwaha, P. Pathak, and S. Gupta, "Review of optimize load balancing algorithms in cloud," *Int. J. Distrib. Cloud Comput.*, vol. 4, no. 2, pp. 1–9, 2016.
[15] A. V N Reddy, A. A. Kumar, N. Venu, and R. V. K. Reddy, "On optimization efficiency of scalability and availability of cloud-based software services using scale rate limiting algorithm," *Meas. Sensors*, vol. 24, no. January, p. 100468, Dec. 2022, doi: 10.1016/j.measen.2022.100468.
[16] Y. S. Abdulsalam and M. Hedabou, "Security and Privacy in Cloud Computing: Technical Review," *Futur. Internet*, vol. 14, no. 1, Dec. 2021, doi: 10.3390/fi14010011.
[17] S. V. Manikanta and K. Varaprasad, "A Secure Privacy Preserving Information Retrieval Model in Cloud Computing," *Int. J. Comput. Organ. Trends (IJCOT)*, vol. 9, no. 1, pp. 16–19, 2019.
[18] F. Wang, H. Wang, and L. Xue, "Research on Data Security in Big Data Cloud Computing Environment," in *2021 IEEE 5th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC)*, 2021, pp. 1446–1450. doi: 10.1109/IAEAC50856.2021.9391025.
[19] H. Kimm and J. Ortiz, "Multilevel Security Embedded Information Retrieval and Tracking on Cloud Environments," in *2021 IEEE Cloud Summit (Cloud Summit)*, Oct. 2021, pp. 25–28. doi: 10.1109/IEEECloudSummit52029.2021.00012.
[20] Z. Tang, "A Preliminary Study on Data Security Technology in Big Data Cloud Computing Environment," 2020. doi: 10.1109/ICBASE51474.2020.00013.
[21] Z. Li, J. Xu, Y. Zhao, W. Li, and W. Nie, "MPAN: Multi-Part Attention Network for Point Cloud Based 3D Shape Retrieval," *IEEE Access*, vol. 8, pp. 157322–157332, 2020, doi: 10.1109/ACCESS.2020.3018696.
[22] P. Gao, Z. Han, and F. Wan, "Big Data Processing and Application Research," in *2020 2nd International Conference on Artificial Intelligence and Advanced Manufacture (AIAM)*, Oct. 2020, pp. 125–128. doi: 10.1109/AIAM50918.2020.00031.
[23] N. N. Das, M. Chowdhary, R. Luthra, Maisera, and S. Garg, "Semantic Big Data Searching In Cloud Storage," in *2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon)*, Feb. 2019, pp. 351–355. doi: 10.1109/COMITCon.2019.8862188.
[24] Y. B. Reddy, "Big Data Security in Cloud Environment," 2018. doi: 10.1109/BDS/HPSC/IDS18.2018.00033.