

Research Article

A Review of AI-Based Data Governance Frameworks for Enterprise Data Systems

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Abstract

Enterprise data governance is changing as Artificial Intelligence (AI) is implemented that enables automated proactive and scalable management of the data assets throughout their lifecycle. The work showcases how AI can improve modern enterprises' decision-making, security, compliance, and quality. It offers the postulates of the data governance core, e.g. policy management, metadata management, and lineage management, as well as privacy, lifecycle control, and explains how AI technologies, e.g. ML, NLP, anomaly detection, federated learning, differential privacy, and homomorphic encryption are used to improve such functionality. The study also contrasts the traditional forms of governance systems and those of the AI systems and observes that they are more precise, scalable, transparent, and real-time responsive. The architecture of AI-based systems of governance is presented which consists of the ingestion, metadata services, AI analytics, policy enforcement, observability, and access control layers. The paper also addresses the enterprise frameworks, ethical considerations, and risk management strategies. Finally, it identifies crucial problems such as the presence of the data silos, the problems of interoperability, and regulatory constraints and considers the recent developments around the autonomous, privacy-centric, and regulation-based systems of governance.

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Introduction

Enterprise Data Management (EDM) has become an imperative process within modern organizations and refers to the policies, processes, roles and technologies required to treat data as a strategic asset. The rate of digitalization of business processes, the introduction of the clouds, and the rise in the number of sources, volumes, and speed of enterprise data have led to an unprecedented increase in the volume, variety, and pace of enterprise data [1]. Old EDM practices that are dependent on manual systems and rule-based systems are also becoming inadequate to guarantee data quality, consistency, security, and accessibility in such a complex environment.

Data governance has hence become a part and parcel of enterprise information management. It spells out the frameworks, guidelines, norms and functions that govern the process of collecting, storing, processing and using data within an organization [2]. Earlier studies have conceptualized data governance as a firm-wide model of controlling data assets, decision making rights and accountability of data throughout its lifecycle.

Effective governance enhances the credibility of information, adherence to the rules, eradication of business risks and sound analytics. However, conventional governance models are reactive, labour-intensive, and not easy to scale using distributed and dynamic data environments [3][4]. This increasingly complex nature of enterprise systems which includes cloud-native platforms, data lakes and integrated digital services is additional pressure on the need to have automated and responsive solutions to governance. In particular, the problems such as end-to-end data visibility, policies applied in a similar way, privacy protection and heterogeneous data protection require more than traditional approaches. These inefficiencies have seen integration of new technologies in administrative systems.

It is possible to provide revolutionary possibilities in enhancing data governance practices with the advent of Artificial Intelligence (AI) and Machine Learning (ML). The AI-based methods could be applied to classify the data automatically, detect the anomalies, generalize the lineage, track the compliance, and predict the risk

[5]. As the patterns of data keep being learned, the AI-based systems may also facilitate advancing proactive governance, reduce the number of human input, and improve the process of making decisions [6][7]. The features are especially handy in large-scale enterprise environment where real-time monitoring and rapid response is required. Despite the fact that the use of AI in data management is gradually turning into a rather usual phenomenon, the process of creating and introducing effective systems of AI-based governance is a challenging one. Some of the key challenges include the necessity to support transparency and explain ability of AI decisions, privacy safety, control algorithmic bias, governance through heterogeneous infrastructures, and dynamism to regulatory requirements. Furthermore, standardization of architectural design model and evaluation process are not standardized, which is also a barrier to large scale uptake.

Organization of the Paper

This paper is structured as follows: The fundamentals of data governance and how AI might enhance governance potential are covered in Section II. Section III presents the architecture and frameworks of AI-based data governance systems in enterprise environments. Section IV analyzes key challenges, ethical considerations, and emerging trends in enterprise data governance. Finally, Section V and VI reviews recent studies in the field and concludes the study and future research

Artificial Intelligence in Data Governance

Artificial intelligence is changing the landscape of data governance by boosting data quality, data security, data compliance, and data lifecycle processes in organizations through automated and scalable and proactive control. When AI is combined with systems of enterprise governance and infrastructure solutions, it aids in the unified, reliable, and efficient information management to enhance the quality of decisions and compliance with regulations.

Core concepts of Data Governance

Data Governance is an organization-wide effort to maintain consistent, high-quality data by establishing and enforcing policies, procedures, and standards. It aids businesses in making sure their data is consistent, accurate, full, and secure. Aspects including availability, usability, integrity, and security are part of data governance, which is the strategic management of data in corporate systems [8]. Data usage is controlled by corporate norms and standards, which this procedure follows. Ensuring data integrity and dependability while limiting its exploitation is a crucial function of effective data governance [9]. As data privacy standards continue to change and businesses depend more and more on

data analytics to boost operational efficiency and guide strategic choices, this becomes even more important. There are some core capabilities are:

Policy & Stewardship

Defining policies, roles, and ownership; aligning with regulations.

Metadata Management

Business glossary, technical metadata, semantic mapping.

Data Quality

Profiling, rules (validity, completeness, accuracy, consistency, uniqueness).

Lineage

End-to-end tracing across ingestion, transformation, and consumption.

Security & Privacy

Access control, masking, tokenization, encryption, retention.

Lifecycle Management

Classification, retention, archival, deletion, and legal hold.

AI's Role in Advancing Data Governance

Data management systems were also helped from AI-driven trends in improving their efficacy. There is virtually minimal need for human intervention when using machine learning for data discovery, categorization, and policy enforcement. The elimination of the need for interval data intake and the ability for companies to respond to inappropriate account logins or attempted breaks-ins are two further ways in which AI improves the accuracy and speed of data monitoring [10]. Natural language processing (NLP) and optical character recognition (OCR) are two examples of AI technologies that aid in the first stage of evaluating massive volumes of unstructured data to identify which ones contain sensitive information that has to be protected [11]. Furthermore, compliance requirements limit access to big data to just certified and relevant workers, and AI algorithms monitor big data usage to identify trends in data access.

Technological Advancements in AI-Driven Data Governance

The incorporation of AI into data governance has led to several improvements, which are what define privacy and compliance in the modern day. Among the most notable technologies are:

Federated Learning

All the operations in federated learning take place locally, but the parameters of the model are shared

and communicated to a central server for aggregation [12]. This is a kind of machine learning. Industries like healthcare and banking can benefit from this technology since it enhances privacy by ensuring that data is not lost.

Differential Privacy

Employed on datasets, it masks the identity of data points to evade analysts’ prying eyes while enabling enterprises to derive valuable insights. The importance of differential privacy in protecting privacy in large data and enabling useful data analysis is demonstrated in this research.

Homomorphic Encryption

This method of data encryption allows for simultaneous handling of encrypted and unencrypted data, which allows companies to perform calculations on encrypted information without compromising the original data [13]. This method is especially important for protecting sensitive information and paving the way for AI-powered analytics and information.

Table I summarizes key AI technologies for data governance, highlighting their applications in privacy protection, compliance, and risk monitoring, along with associated advantages and implementation challenges

Traditional and AI-Driven Data Governance Approaches

Conventional data governance uses manual, reactive data classification, lineage, quality control, and compliance procedures, which can be very inefficient and lack transparency. By contrast, AI-driven governance allows automated, real time and predictive data asset

management. According to Table II, AI-based methods are more accurate, scalable, and proactive in terms of compliance than the conventional ones

Enterprise Data Governance

Enterprise Data Governance is a high-level organizational strategy of governing the data assets throughout their lifecycle of creation and collection to storage, integration, utilization, archiving, and disposal. Being one of the inseparable elements of any enterprise data management (EDM), it also serves the purpose of making sure that the data is accurate, accessible, secure, and aligned with the business goals, in the time of the skyrocketing data volumes. An enterprise view focuses on integrated data views and infrastructure within the departments with much focus on the data itself and not on the technology itself [14]. Integral to these processes are tasks such as data quality assurance, data architecture, data standards, data governance, and data stewardship.

Enterprise data governance aims at incorporating heterogeneous data sources, justify data quality, create a shared data model, administer metadata, and facilitate analytical and presentation layers in order to establish an organization-wide single version of truth. Through the replacement of the disjointed legacy systems with coordinated enterprise platforms, organizations will be able to facilitate the regular exchange of information among various functions of the enterprise like operations, finance, supply chains, and customer management. But, such vision can still take a great deal of organizational change, including in workflows, roles, training, decision

Table 1: AI Technologies for Data Governance: Applications, Advantages, and Challenges

<i>Technology</i>	<i>Application</i>	<i>Advantages</i>	<i>Challenges</i>
Federated Learning	Training models together across different datasets without exposing any raw data	Preserves data privacy and sovereignty; reduces regulatory and compliance risks	High communication overhead; complex implementation and coordination
Differential Privacy	Injecting statistical noise into data or query results to prevent the identification of individuals	Provides strong mathematical privacy guarantees; relatively easy integration into analytics pipelines	Degrades data utility; trade-off between accuracy and privacy
Homomorphic Encryption	Performing computations directly on encrypted data without decrypting it	Ensures data confidentiality during processing and outsourcing	Computationally expensive; significantly slower processing times
AI-Based Anomaly Detection	Detecting abnormal patterns in data access, usage, or transactions	Enables real-time monitoring; helps prevent data breaches and policy violations	High false-positive rates; requires continuous model tuning and high-quality training data
Natural Language Processing (NLP)	Automated document classification, contract analysis, and regulatory text interpretation	Accelerates compliance workflows; improves classification consistency and scalability	Reduced accuracy for complex legal language; requires domain-specific training

Table 2: Comparison Between Traditional and AI-Driven Data Governance Approaches

Technology	Application	Advantages
Decision Making	Human-centric, based on experience and judgment	Data-driven, supported by algorithms and predictive models
Speed of Response	Slow, dependent on manual processes and approvals	Real-time or near-real-time automated responses
Data Handling	Periodic reporting with limited integration of data sources	Continuous processing of large-scale, multi-source data
Accuracy	Prone to human error and subjective bias	Improved accuracy through analytics, pattern recognition, and learning models
Transparency	Often opaque, document-intensive, and difficult to audit	Enhanced traceability through automated logs and audit trails
Scalability	Difficult to scale with increasing data volume and complexity	Highly scalable using cloud computing and AI infrastructure
Risk Management	Reactive approach with rule-based controls	Proactive risk prediction and mitigation using machine learning
Compliance Monitoring	Manual audits and inspections are conducted periodically	Automated compliance tracking with continuous monitoring and anomaly detection
Adaptability	Slow policy updates and rigid governance frameworks	Adaptive systems that learn from data and evolve over time
Resource Utilization	Labour-intensive and time-consuming processes	Optimised resource allocation through intelligent automation
Personalization	One-size-fits-all governance models	Context-aware and personalised governance strategies
Cost Efficiency	Higher operational overhead due to manual efforts	Reduced long-term costs through automation and efficiency gains

processes, and structural reorganization, since sample standardization of data and centralized governance can transform how information is generated, managed and utilized all over the enterprise.

Data Governance Based on AI

AI-driven data governance improves compliance, security, and reliable decision-making across enterprise data systems by automating crucial tasks like data classification, quality monitoring, lineage tracking, risk detection, and policy enforcement at scale using ML, NLP, and graph intelligence.

Architecture of AI-Driven Governance Systems

The data governance systems implemented by AI have a layered architecture, incorporating all data management, artificial intelligence, security controls, and policy enforcement to provide trustful and compliant enterprise data operations. The architecture is composed traditionally of interconnected majorities that include data ingestion, metadata management, AI services, policy control, quality monitoring, access control, coordination, visualization, and scale controls apparatus, as show in Figure 1.

Ingestion and Integration Layer

The ingestion layer is responsible for obtaining data

stored in heterogeneous media and for controlled access to enterprise systems. The contemporary architectures are capable of event-driven ingestion based on streaming technologies like Apache Kafka, Amazon Kinesis, and Google Cloud Pub/Sub. At this governance level, the controls involve schema enforcement or schema-on-read design, data contract between producers and consumers,

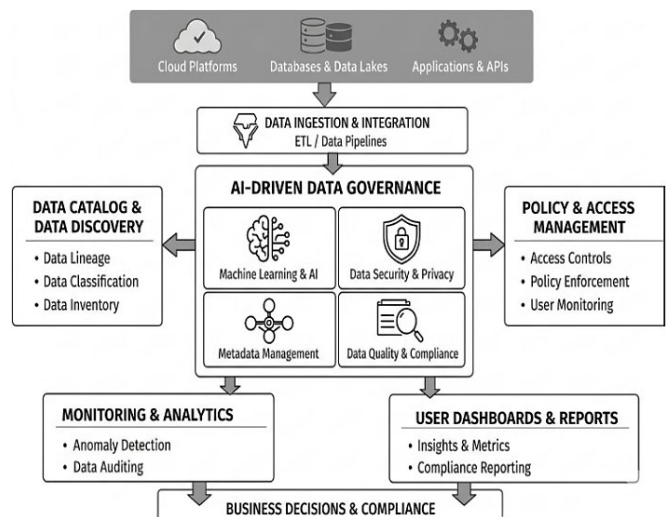


Figure 1 : Architecture of an AI-Driven Data Governance System

and change-data-capture (CDC) pipelines, which provide traceability to support regulatory compliance and lineage tracking.

Metadata and Lineage Services

Metadata services are detailed technical, business and operational descriptions of data resources, usually stored in central catalogs or repositories of lineage graphs [15]. The AI-based governance differentiates passive metadata, metadata that is being maintained manually, with active metadata that is being updated by automated instrumentation of pipelines. Live lineage tracking helps organizations to visualize the data flow between systems and map to regulatory mandates, including risk reporting principles and regulatory mandates.

AI Services Layer

Elements of artificial intelligence avail self-governance. Data classification microservices, entity extraction natural language processing modules, repository of embedded models, and feature stores are typical subservices deployed in anomaly detection in data quality monitoring. Model governance and explainability services require transparency, accountability, and regulatory compliance of AI decisions, which may be especially important in high-stakes areas like finance and healthcare.

Policy Management and Enforcement Engine

The policy layer implements governance policies touching on privacy, security, retention, and data exploitation. The implementation of policies can be based on code using languages like Open Policy Agent and Rego language, which makes it possible to implement policies in an automated and verifiable manner [16]. Controls are masking, tokenization, encryption, retention schedules as well as hierarchical policies at global, domain-specific and local levels. This can be enforced in either real-time when accessing the data or in the batch mode when processing them.

Data Quality and Observability

In order to provide reliability in data, governance architectures have in place monitoring mechanisms that monitor both the data quality and system behavior. These are data profiling, data validation rules, freshness, anomaly detection, and schema drift. Observability tools give organizations a real-time visibility of the performance of their pipelines and enable them to notice problems before they spread to other systems downstream

Identity and Access Management

There is a secured access to controlled data using identity services that facilitate single sign-on, fine-grained authorization, and role/purpose access controls.

Advanced implementations also allow just-in-time approvals and dynamic management of entitlement and therefore, users only access required data to accomplish their tasks but with auditability.

Control Plane and Orchestration

There is a centralized control plane which coordinates workflows of governance within the architecture. Orchestrators Workflow orchestrators like Apache Airflow, Argo Workflows, and Dagster manage tasks like scanning policies, updating lineage, checking compliance [17]. Governance actions can be triggered by event-driven triggers when data has been received or a schema is changed, whereas integration with MLOps pipelines can be used to manage AI models lifecycle. Warnings and up-escalation policies make sure that there is a response to examples of governance breaches in time.

Dashboards and Visualization

Governance dashboards offer stakeholders practical information on data health and compliance levels. Some of the common visualizations are data quality trend analysis, risk heatmap analysis, lineage impact analysis, and audit evidence reports. These tools aid in the decision-making processes by converting complicated governance measures into technical and business comprehensible forms.

Visualization and Reporting Dashboards

Governance systems based on AI start to work in distributed data spaces, including data fabrics and data meshes. In those, domain teams retain the ownership of their data products with the compliance with federated standards of governance in metadata tags, lineage documentation and access controls [18]. Services that are shared such as automated classification and policy enforcement, are centrally provided but called locally by individual domains.

Scalability and Integration Framework

Massive data volumes and mass throughput are architectures required in enterprise-scale deployments. Workload partitioning spreads classification work across compute resources and policy enforcement and monitoring can be performed in almost real time using stream processing techniques. Caching of embeddings, batching of low-risk analysis and prioritization of high-risk data assets are performance optimization strategies. Mechanisms of cost governance also guarantee optimal usage of resources through the dynamism of scaling the infrastructure according to demand.

AI in Data Governance Frameworks

Privacy, compliance, and basic administration might be beneficial for many data governance systems. Automation of compliance monitoring through the use of AI enhances

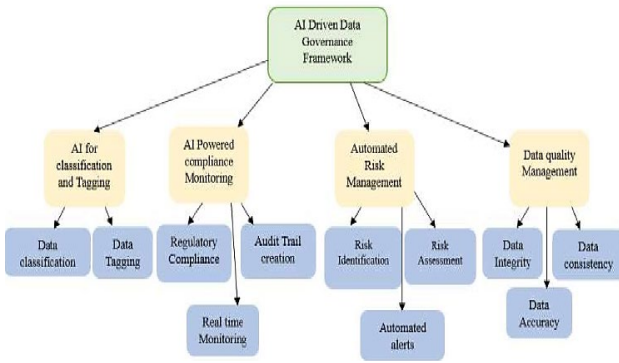


Figure 2 :AI Driven Data Governance Framework

data governance. Data monitoring and analysis solutions powered by AI might help organizations quickly achieve compliance with regulations like GDPR, CCPA, and HIPAA, without the need for labour-intensive and error-prone human processes. Anomalies can be detected and compliance concerns reported by these AI systems after they sort through massive amounts of data. Improve the precision, punctuality, and manual effort of compliance reporting. Monitoring compliance, categorization, and access control using AI all work together to better manage data privacy [19]. As a privacy measure, AI systems may sort data according to how sensitive it is and how relevant it is. Figure 2 shows how AI may categorize data according to its sensitivity and then restrict access to only approved persons. Data quality for decision-making and compliance may be enhanced using AI-driven systems that detect and fix mistakes, inconsistencies, and duplication. Machine learning algorithms aid in the reduction of data inaccuracies by analyzing historical data for patterns and outliers. By preserving data quality, AI guarantees that governance frameworks are built on trustworthy and precise data.

Risk Management

Management, minimization, and detection of data governance risks are areas where AI really shines. AI is quite good at predicting and evaluating risks. In order to predict potential dangers, AI systems may examine historical data for patterns and outliers. For instance, AI has the potential to monitor data access patterns and identify questionable actions that might indicate an insider threat. Risks can be reduced by the automation of threat response by systems driven by AI. When artificial intelligence identifies a data breach or non-compliance issue, it can notify relevant parties, initiate remediation, or take remedial action [20]. Activating the response protocols is another option. Automation shortens the time it takes to find and fix problems, which simplifies risk management. Artificial intelligence improves risk management through constant

monitoring. Unlike risk management evaluations, which are conducted at set intervals, data governance operations may be monitored constantly by artificial intelligence. To evaluate governance and risk effectiveness, AI continuously monitors data access, usage patterns, and compliance indicators. Businesses can adapt governance policies in response to emerging dangers by using real-time monitoring.

Ethical Considerations

While artificial intelligence (AI) has several potential uses in data governance, there are significant ethical questions that need to be answered before it can be used in a fair and ethical manner. Algorithms used to track compliance with regulations may unjustly target some groups if they are trained on biased data. To fix this, better data selection, more thoughtful algorithm design, and more thorough checks for bias. Another ethical concern with AI-driven decision-making is the lack of openness and accountability. The complexity of AI decision-making makes it difficult for stakeholders to understand. Supportive ethical governance and trust in AI systems are helpful [21]. When considering the right way to regulate data with AI, privacy is important. Data privacy problems might be amplified by ineffective AI implementation. To secure personal information, businesses using AI should implement stringent data protection procedures and obtain customers' explicit consent before doing so. Factors such as data governance, ethics, and risk management are susceptible to transformation by AI-powered governance models. Automation of compliance monitoring, increase of data quality, and proactive risk management are three ways in which AI simplifies data governance.

Challenges and Future Trends in Enterprise Data Systems

Enterprise AI adoption is hindered by challenges such as data silos, poor data quality, interoperability issues, and regulatory concerns. Future governance will focus on autonomous, privacy-preserving, and regulation-compliant systems for secure and trustworthy data management.

Challenges in Enterprise Data Governance for AI

The availability, quality, usability and integrity of organizational data is the key to successfully deploying AI in an enterprise setting. To move past pre-processing and training stages, AI models need large amounts of high-quality datasets to operate on [22]. When it comes to the enterprise settings, the ultimate power of AI can usually be achieved through the incorporation of an array of various data sources both internal and external, and this comes with a fair degree of governance issues. In the modern enterprise, large quantities of data are produced by the finance, operations, customer management,

Table 2: Literature Review Table: Artificial Intelligence in Data Governance

<i>Authors (Year)</i>	<i>Study On</i>	<i>Approaches</i>	<i>Key Findings</i>	<i>Limitations</i>	<i>Future work</i>
A. Nagilla (2025)	AI governance frameworks with focus on generative AI adoption	Cross-sector analysis of 245 organizations across 57 countries; evaluation of governance maturity	Structured governance yields 73% higher deployment success and 32.4% higher ROI; highlights complexities of generative AI governance	Rapidly evolving generative AI landscape; limited long-term empirical validation	Develop adaptive governance models for emerging generative AI systems and continuous monitoring mechanisms
A. Potdar (2024)	AI-based big data governance framework	Multi-layered framework using ML, NLP, deep learning; simulation-based validation	Significant improvement in compliance adherence, security, automated classification, anomaly detection	Simulation-based results may not fully reflect real-world deployments	Real-world implementation studies and scalability evaluation across industries
S. Krishna & C. Tulli (2023)	Role of AI/ML in data governance practices	PRISMA-based systematic literature review	AI improves data quality, scalability, security, and proactive compliance	Ethical concerns, bias, transparency issues, integration challenges	Research on explainable AI, bias mitigation, and interoperable governance solutions
A. Agarwal et al. (2023)	AI integration in data management and security	ML, NLP, predictive analytics, anomaly detection for governance automation	Enhances data classification, risk detection, compliance auditing, real-time monitoring	Potential false positives; dependence on high-quality training data	Advanced adaptive models and context-aware anomaly detection techniques
A. Duzha et al. (2023)	Data Governance as a Service (DGaaS)	Novel service-based governance framework adaptable to sectors	Flexible governance aligned with organizational goals; reduces costs and risks	Implementation complexity; dependency on infrastructure readiness	Development of standardized DGaaS platforms and cross-sector interoperability
J. Morley et al. (2022)	AI and health data governance across GDHP countries	Scoping review, policy analysis, interviews, focus groups	Identifies best practices, gaps, and policy commonalities in healthcare AI governance	Focus limited to GDHP member countries; sector-specific insights	Broader global studies and frameworks applicable across domains

supply chains, and digital platforms department [23][24]. Nevertheless, such data resources are often distributed among siloed applications, legacy platforms and series of repositories. This type of fragmentation diminishes the ability to see what data has been captured and where that data is located and its reliability or currency. As a result, organizations usually find it hard to find, retrieve and make good use of their own data resources.

The vast problem is that not all enterprise systems have standardized technical formats and common semantic definitions. The interoperability and integration of heterogeneous technologies is hampered by inconsistent schemas, incompatible data models, and heterogeneous technologies. Moreover, legal and compliance limitations, including privacy laws, contracts and data ownership issues, bring about confusion on what data can be distributed, accessed, or amalgamated within the business units or partner organizations [25]. There is also a lack of qualified individuals with the capacity to deal with complicated data pipelines, quality of data,

and create datasets to be used in AI applications [26][27]. Historically, the departments have ended up maximizing data practices to local purposes instead of enterprise-wide use hence it has been hard to work across functions. This has made it a constant challenge to have unified governance across organizational boundaries [28]. Although there might be technically sufficient datasets, AI systems have to be functioning in a manner that goes in line with ethical considerations, legal mandates, and other stakeholder expectations. The questions of fairness, accountability, transparency, and privacy are especially problematic in case AI models are used to make business-level decisions involving customers, employees, or partners.

Future Trends in AI -driven Enterprise Data Governance

Some of the problems that impede the implementation of Enterprise AI include data silos, low data quality, interoperability and regulatory requirements. The

development of the future governance will aim at autonomous, privacy-sensitive and regulation-sensitive systems to manage data safely and in a trustworthy manner.

Autonomous Governance Agents

AI-enabled, policy-aware agents will continuously monitor enterprise data pipelines, detect governance violations, and initiate real-time remediation actions, subject to human oversight and approval to ensure accountability and trust.

Generative AI for Compliance Management

Generative AI systems will assist organizations in drafting governance policies, translating regulatory requirements into technical controls, and automatically generating audit reports and compliance documentation from operational data.

Privacy-First Governance Architectures

Future enterprise frameworks will embed privacy by design through technologies such as differential privacy, advanced homomorphic encryption, and confidential computing, ensuring secure data utilization without exposing sensitive information.

Regulatory-Aligned AI Governance

As the global AI regulations are developing, companies will have governance strategies in place regarding data and AI models as they do in financial regulation frameworks, model risk management, transparency documentation, validation, and constant monitoring.

Operationalization of Data Contracts

Governance platforms based on artificial intelligence will impose machine-readable data contracts within organizations, execute schema validation automatically, service-level agreements (SLAs), data quality regulations, and semantic congruity to ensure trusted exchange of data.

Literature Review

This study serves as the review of the recent studies of AI-driven data governance that explores various frameworks and approaches and sector-specific applications aimed at comprehending their efficiency and limitations. A comparative overview of these works is provided in Table III, which identifies the major methods, results, weaknesses, and prospects of the further development of safe, compliant and scalable governance systems.

A. Nagilla (2025) looks into AI governance systems and how they are used in various industries, particularly generative AI, which has seen a 28–40% growth in use in the past year. This study takes a look at the evolution of data governance both generally and in relation to artificial

intelligence, the difficulties and potential solutions associated with overseeing contemporary AI systems, and the quirks of regulating generative AI models. The research demonstrates that systematic governance methods may increase returns on AI investments by 32.4% and success rates in AI deployments by 73% through a thorough analysis of international practices applied by 245 firms in 57 countries [29].

A. Potdar (2024) presents a thorough examination of the AI-driven big data governance architecture that aids in guaranteeing the safe and legal processing of big data. The article discusses how data governance procedures have included deep learning, NLP, and machine learning ML techniques. Finally, the article proposes a multi-layered AI-based system that can automate data classification, policy compliance, anomaly detection, and dynamic data access regulation. A literature assessment is conducted to identify the various pre-2020 conventional methods, the reasons for their inadequacy, and the need for intelligent governance models. Results show a significant increase in compliance adherence and security measures after using simulation to evaluate the proposed technique [30]. S. Krishna and C. Tulli (2023) explore how artificial intelligence and machine learning might improve data governance processes. Specifically, they highlight how these technologies can boost operational efficiency, data accuracy, and compliance. Using a PRISMA-based methodology, this study examines the use of AI to data quality management, privacy, security, and compliance monitoring by reviewing current academic works. The findings demonstrate that governance systems powered by AI significantly cut down on data mistakes, increase scalability, and permit proactive compliance control. Integrating systems, addressing ethical concerns, and preventing data bias are all ongoing difficulties. Overall, the research shows that AI-based data governance is becoming more important for companies to have a solid foundation for safe, compliant, and dependable data management [31].

A. Agarwal, S. Kumar, P. Chilakapati, and S. Abhichandani (2023) talk about how businesses may use AI as a tool for automation, anomaly detection, and security enhancement in data management strategies. Using ML, NLP and predictive analytics, AI data management identifies major challenges for businesses. These innovations lay the groundwork for businesses to detect threats, monitor consumption patterns in real time, and automatically classify and index data. Additionally, AI enhances data security by allowing anomaly detection models to concurrently identify threats like illegal access or other malicious activities. After that, the research delves deeper into the ways AI improves compliance by examining auditing, data quality, and other compliance criteria. Users are prevented from exceeding their permissible data consumption through

AI-enabled automated policies, and penalties or breaches may result from sharing data in ways prohibited by the organization's policies [32].

A. Duzha, E. Alexakis, D. Kyriazis, et.al. (2023) provides an overview of the existing literature and current state-of-the-art in the domain of data processing and governance aiming to evaluate existing approaches and to investigate their limitations. To this extent, this study introduces a novel approach for data governance as a service (DGaaS), which provides a framework for (private or public) organizations that facilitates alignment with their vision, goals and legal requirements. It is flexible and adaptable to the needs of the different sectors, and aims at increasing the value of data and minimize data processing related costs and risks[33].

J. Morley, L. Murphy, A. Mishra, I. Joshi, and K. Karpathakis (2022) examine health data and AI governance mechanisms in place or under implementation in countries that are part of the Global Digital Health Partnership (GDHP). Information was gathered through a scoping study of scholarly works and a thematic analysis of policy papers issued by selected GDHP member nations. The data conducts semi-structured interviews with senior policymakers from GDHP member countries to learn about their countries' experiences with AI-driven health care technologies and related governance. They focus group with experts in international health and technology to discuss the themes and make policy recommendations [34].

Conclusion and Future Work

The concept of Artificial Intelligence is also redefining the area of enterprise data governance by converting the historically manual and reactive systems to automated, scalable and proactive systems. With the implementation of ML, NLP, anomaly detection, and privacy-preserving strategies, AI will increase the quality, security, compliance, and lifecycle management of the complex organizational environment. The paper shows that the use of AI in governance enhances decision making by providing real-time monitoring, predictive risk management, and intelligent policy enforcement in addition to providing accountability and transparency. The suggested architecture draws attention to the significance of the synchronized layers such as ingestion, metadata management, AI services, policy control, observability, and access management to cover trusted data operations. However, in spite of these advantages, the issue of data silos, interoperability, regulatory issues, ethical issues, and shortages of skills are still serious. On the whole, AI-powered governance offers a solid basis to handle the increasing data volumes and complexity to allow organizations to have reliable, secure, and regulation-conformable data ecosystems to enable sustainable digital transformation.

Future studies need to aim at creating autonomous agents of governance, explainable AI models, and privacy-sensitive methods that are practical in distributed data situations. This will involve exploring standardized data contract, regulatory-consistent model governance, and human-AI collaboration systems in order to achieve trustworthy, scalable, and ethically accountable enterprise data governance operations in progressively more complicated digital ecosystems.

References

- P. Neelakrishnan, "Redefining Enterprise Data Management with AI-Powered Automation," *Int. J. Innov. Sci. Res. Technol.*, vol. 9, no. 7, pp. 660–668, Jul. 2024, doi: 10.38124/ijisrt/IJISRT24JUL005.
- B. M. V. Bernardo, H. S. Mamede, J. M. P. Barroso, and V. M. P. D. dos Santos, "Data governance & quality management—Innovation and breakthroughs across different fields," *J. Innov. Knowl.*, vol. 9, no. 4, p. 100598, Oct. 2024, doi: 10.1016/j.jik.2024.100598.
- N. Chukwurah, A. Bolatito Ige, and V. I. Adebayo, "Ethical Considerations in Data Governance: Balancing Privacy, Security, and Transparency in Data Management," *Int. J. Eng. Res. Dev.*, vol. 20, no. 7, pp. 462–468, 2024.
- A. Parupalli, "Business Intelligence in ERP ML-Based Comparative Study for Financial Forecasting," *ESP Int. J. Commun. Eng. Electron. Technol.*, vol. 2, no. 4, pp. 17–26, 2024, doi: 10.56472/25839217/IJCEET-V2I4P103.
- V. Sanka, "Integrating Artificial Intelligence into Enterprise Data Governance Frameworks: A Comprehensive Approach for Automated Compliance and Risk Management," *Int. J. Sci. Res. Sci. Eng. Technol.*, vol. 12, no. 1, pp. 337–345, Feb. 2025, doi: 10.32628/IJSRSET25121185.
- I. A. Bimonthly, S. Journal, and M. Rajasekar, "AI Driven Cyber Resilient Cloud Native Enterprise Architecture for Secure Financial Systems IoT Networks and Intelligent Data Governance," *Int. J. Futur. Innov. Sci. Technol.*, vol. 6, no. 5, pp. 11333–11344, 2023, doi: 10.15662/IJFIST.2023.0605003.
- S. K. Biswal, N. Somasundaram, S. S. Jain, S. Phalke, and S. K. Ulaganathan, "Methods and apparatus for datacenter monitoring," US11966280B2, 2024
- P. Gupta, "The Role of AI in Crafting a Modern Data Governance," *Int. Res. J. Mod. Eng. Technol. Sci.*, vol. 06, no. 01, pp. 266–271, Jan. 2023, doi: 10.56726/IRJMETS47962.
- E. Servou, F. Behrendt, and M. Horst, "Data, AI and governance in MaaS – Leading to sustainable mobility?," *Transp. Res. Interdiscip. Perspect.*, vol. 19, p. 100806, May 2023, doi: 10.1016/j.trip.2023.100806.
- M. A. Camilleri, "Artificial intelligence governance: Ethical considerations and implications for social responsibility," *Expert Syst.*, vol. 41, no. 7, Jul. 2024, doi: 10.1111/exsy.13406.
- N. Devarasetty, "AI-Driven Data Governance Frameworks for Enhanced Privacy and Compliance," *Int. J. Sci. Res. Manag.*, vol. 11, no. 02, pp. 983–1006, Feb. 2023, doi: 10.18535/ijrsm/v11i02.ec4.
- H. B. Dama, "Designing Highly Available Multi-Cloud Database Architectures for Global Financial Services," *Int. J. Res. Appl. Innov.*, vol. 6, no. 1, pp. 8329–8336, 2023, doi: 10.15662/IJRAI.2023.0601008.

- A. Zuiderwijk, Y.-C. Chen, and F. Salem, "Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda," *Gov. Inf. Q.*, vol. 38, no. 3, p. 101577, Jul. 2021, doi: 10.1016/j.giq.2021.101577.
- S. Singamsetty, "Efficacy of Data Governance a Cutting Edge Approach to Ensuring Data Quality in Machine Learning for Banking Industry," in *2024 2nd International Conference on Signal Processing, Communication, Power and Embedded System (SCOPEs)*, IEEE, Dec. 2024, pp. 1–7. doi: 10.1109/SCOPEs64467.2024.10991944.
- S. Singamsetty, "AI-Based Data Governance: Empowering Trust and Compliance in Complex Data Ecosystems," *Int. J. Comput. Math. Ideas*, vol. 13, no. 03, pp. 1007–1017, 2021, doi: 10.70153/IJCM/2021.13301.
- K. B. Tenneti, S. Pandula, and S. Pandula, "Comparative Analysis of Traditional and AI-Driven Data Governance: A Systematic Review and Future Directions in IT," *Int. J. Comput. Trends Technol.*, vol. 72, no. 11, pp. 150–158, Nov. 2024, doi: 10.14445/22312803/IJCTT-V72I11P116.
- K. Bližňák, M. Munk, and A. Pilková, "A Systematic Review of Recent Literature on Data Governance (2017–2023)," *IEEE Access*, vol. 12, pp. 149875–149888, 2024, doi: 10.1109/ACCESS.2024.3476373.
- [18] R. S. T. Palanichamy, "AI and Data Governance: Enhancing Security, Privacy, and Accountability," *Int. J. Sci. Technol.*, vol. 14, no. 1, pp. 1–5, Jan. 2023, doi: 10.71097/IJSAT.v14.i1.2807.
- D. Parmar and P. Gupta, "Sustainable data management and governance using AI," *World J. Adv. Eng. Technol. Sci.*, vol. 13, no. 2, pp. 264–274, Nov. 2024, doi: 10.30574/wjaets.2024.13.2.0551.
- S. T. Boppiniti, "Data Ethics in AI: Addressing Challenges in Machine Learning and Data Governance for Responsible Data Science," *Int. Sci. J. Res.*, vol. 5, no. 5, 2023.
- J. W. Sajja and N. Kolli, "Towards a Unified Framework for Enterprise Data Transformation: Cloud Architecture, Governance, and Intelligent Automation," *J. Inf. Syst. Eng. Manag.*, vol. 2024, no. 4, pp. 2468–4376, 2024.
- D. Bauer *et al.*, "Building and Operating a Large-Scale Enterprise Data Analytics Platform," *Big Data Res.*, vol. 23, p. 100181, Feb. 2021, doi: 10.1016/j.bdr.2020.100181.
- Z. N. Jawad and V. Balázs, "Machine learning-driven optimization of enterprise resource planning (ERP) systems: a comprehensive review," *Beni-Suef Univ. J. Basic Appl. Sci.*, vol. 13, no. 1, p. 4, Jan. 2024, doi: 10.1186/s43088-023-00460-y.
- W. Yu Chung Wang, D. Pauleen, and N. Taskin, "Enterprise systems, emerging technologies, and the data-driven knowledge organisation," *Knowl. Manag. Res. Pract.*, vol. 20, no. 1, pp. 1–13, Jan. 2022, doi: 10.1080/14778238.2022.2039571.
- L. F. Luna-Reyes and T. M. Harrison, "A Systems View of Enterprise Data Governance for Artificial Intelligence Applications in Government," in *DG.O 2022: The 23rd Annual International Conference on Digital Government Research*, 2022, pp. 206–213. doi: 10.1145/3543434.3543450.
- T. R. Champion, C. K. Craven, D. A. Dorr, E. V. Bernstam, and B. M. Knosp, "Understanding enterprise data warehouses to support clinical and translational research: impact, sustainability, demand management, and accessibility," *J. Am. Med. Informatics Assoc.*, vol. 31, no. 7, pp. 1522–1528, Jun. 2024, doi: 10.1093/jamia/ocae111.
- J. W. Sajja and A. Nerella, "Enterprise Finance Reimagined: Harnessing ERP and Data Innovation for Next-Generation Value Creation," *Comput. Fraud Secur.*, vol. 2024, no. 4, p. 10, Apr. 2024, doi: 10.52710/cfs.743.
- E. Papagiannidis, I. M. Enholm, C. Dremel, P. Mikalef, and J. Krogstie, "Toward AI Governance: Identifying Best Practices and Potential Barriers and Outcomes," *Inf. Syst. Front.*, vol. 25, no. 1, pp. 123–141, Feb. 2023, doi: 10.1007/s10796-022-10251-y.
- Sannapureddy, R., Nadella, V. M., & Nelavelli, S. (2024). Edge–Cloud Continuums for Latency-Sensitive Tasks. *International Journal of AI, BigData, Computational and Management Studies*, 5(4), 189-201.
- A. Nagilla, "Robust Data Governance Framework for Artificial Intelligence Applications," *Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol.*, vol. 11, no. 1, pp. 2512–2524, Feb. 2025, doi: 10.32628/CSEIT251112267.
- A. Potdar, "AI - Based Big Data Governance Frameworks for Secure and Compliant Data Processing," *Int. J. Artif. Intell. Data Sci. Mach. Learn.*, vol. 5, no. 4, pp. 72–80, 2024.
- S. Krishna and C. Tulli, "AI-Driven Data Governance Frameworks : Enhancing Data Accuracy , Compliance , and Operational Efficiency," *An Int. Peer Rev. J.*, vol. 10, no. 2, pp. 11–18, 2024.
- Nadella, V. M. (2025). AI/ML-Driven Service Assurance: 2024 breakthroughs transforming telecom operations. *Journal of Computer Science and Technology Studies*, 7(4), 01-07.
- A. Agarwal, S. Kumar, P. Chilakapati, and S. Abhichandani, "Artificial Intelligence in Data Governance Enhancing Security and Compliance in Enterprise Environments," *Artif. Intell. Data Governance... Anant Agarwal al.* 236 *Nanotechnol. Perceptions*, vol. 19, no. S1, pp. 235–252, 2023.
- Nadella, V. M. (2024). AI-Native 6G Network Management. *American International Journal of Computer Science and Technology*, 6(1), 23-37.
- A. Duzha, E. Alexakis, D. Kyriazis, L. F. Sahi, and M. A. Kandi, "From Data Governance by design to Data Governance as a Service: A transformative human-centric data governance framework," in *Proceedings of the 2023 7th International Conference on Cloud and Big Data Computing*, 2023, pp. 10–20. doi: 10.1145/3616131.3616145.
- Nadella, V. M. (2025). The backbone of modern society: How telecom technologies drive societal transformation. *World Journal of Advanced Research and Reviews*, 26(2), 1425-1434.
- J. Morley, L. Murphy, A. Mishra, I. Joshi, and K. Karpathakis, "Governing Data and Artificial Intelligence for Health Care: Developing an International Understanding," *JMIR Form. Res.*, vol. 6, no. 1, p. e31623, Jan. 2022, doi: 10.2196/31623.
- Arigela, A. K., Brahmareddy, A., Sreenivas, T. S., Selvan, M. P., Venu, N., & Lal, D. K. (2024, December). Optimizing Energy Efficiency and Latency in IoT Devices Through AI-Based Adaptive Protocols in Fog-Edge Computing Environments. In *Congress on Smart Computing Technologies* (pp. 595-607). Singapore: Springer Nature Singapore.
- Nadella, N. V. M. (2025a). Evolution of fault management in telecommunications: From reactive response to AI-driven predictive analytics. *World Journal of Advanced Engineering Technology and Sciences*, 15(2), 1338– 1344. <https://doi.org/10.30574/wjaets.2025.15.2.0671>