Transformative Data Management Technique: Redefining Artificial Intelligence (AI)

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Abstract

This abstract provides an overview of the evolving landscape of data management, driven by the transformative influence of artificial intelligence (AI). This exploration delves into how AI technologies are reshaping every facet of data management, from collection to analysis, offering unprecedented efficiencies and insights. In the age of massive data proliferation, effective data management has become a cornerstone of organizational success. AI algorithms are revolutionizing data integration by automating the harmonization of diverse data sources, transcending the limitations of structured and unstructured data. Through advanced techniques such as natural language processing, AI enables comprehensive data extraction from text, images, and audio, broadening the scope of information captured. In summary, the amalgamation of AI and data management yields a paradigm shift. From harnessing unstructured data to elevating security measures, AI redefines the data landscape. Through automation, predictive capabilities, and adaptive learning, AI-driven data management propels organizations towards more efficient and informed strategies. This abstract encapsulates the profound transformation of data management facilitated by AI, urging organizations to grasp the vast potential of this synergy for informed, strategic decision-making in a data-centric world.

Introduction

Data quality, a perennial challenge, finds its solution through AI's ability to detect anomalies, outliers, and errors. This ensures data accuracy and consistency, critical for informed decision-making. Furthermore, AI optimizes data storage and accessibility by strategically managing data across storage tiers, enhancing retrieval speeds, and facilitating intuitive categorization. In the realm of security, AI's proficiency shines. Its algorithms excel in identifying patterns indicative of security breaches, bolstering data protection. Encryption and access controls fortified by AI elevate data security to new heights while adhering to data privacy regulations. The integration of AI-driven predictive analytics empowers businesses with foresight, making historical data the foundation for precise forecasts. Meanwhile,

the automation of data cleaning and pre-processing accelerates the data preparation process, a pivotal precursor to analysis. Natural language processing, a subset of AI, enables the extraction of insights from textual data, enabling sentiment analysis, categorization, and translation. AI also underpins data governance and compliance, facilitating adherence to regulations and standardizing data practices.
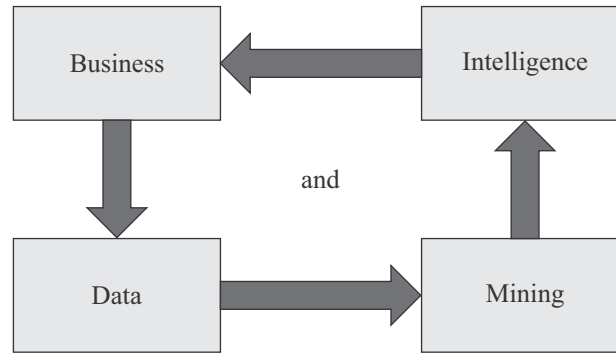
Fig 1: Business intelligence and data mining cycle

As AI learns from interactions and adapts, it uncovers hidden patterns and trends, enriching decision-making processes with previously unnoticed insights. The scalability of AI-driven data management systems ensures consistent performance as data volumes expand. In the era of big data, data management has become increasingly complex and critical for businesses and organizations. The integration of artificial intelligence (AI) in data management has opened new avenues for handling, processing, and deriving insights from vast and diverse datasets. This article explores the ways in which AI is transforming data management practices.

Data Collection and Integration:

AI algorithms can automate the collection of data from various sources, including structured and unstructured data. Natural language processing (NLP) techniques enable AI systems to extract information from text, images, and audio, making data integration more comprehensive and efficient. The integration of AI and NLP in data management provides numerous benefits which are as follows:

- Data Diversity Handling: AI algorithms can collect data from a wide range of sources, including structured databases, unstructured text, images, audio, and more. This capability enables organizations to capture insights from various data formats.

- Efficiency and Speed: AI-driven data collection processes are automated, reducing the need for manual intervention. This significantly speeds up the data gathering process, allowing organizations to access insights more quickly.

- Comprehensive Insights: NLP techniques empower AI systems to comprehend and process human language, enabling them to extract meaningful information from text data. This enhances the depth and comprehensiveness of insights derived from textual sources.

- Unstructured Data Utilization: Unstructured data, which constitutes a significant portion of digital content, can be challenging to analyze. AI-powered NLP techniques enable the extraction of valuable insights from unstructured data like social media posts, customer reviews, and articles.

- Multimodal Insights: NLP techniques go beyond text and extend to images and audio. AI systems can analyze images to identify objects, sentiments, and even extract textual content from images. Similarly, audio data can be transcribed, analyzed for content, and used for various insights.

- Reduced Human Error: Automation reduces the risk of human errors during data collection and integration. AI algorithms follow predefined rules consistently, enhancing data accuracy.

- Scalability: AI-driven data collection can scale easily to handle large volumes of data from diverse sources, which would be impractical for manual methods.

- Real-time Data Capture: AI algorithms can continuously monitor data sources and collect real-time information, providing organizations with up-to-the-minute insights.

- Enhanced Decision-Making: By rapidly and comprehensively gathering insights from various data sources, organizations can make more informed decisions, enabling them to stay competitive in fast-paced markets.

- Innovation Potential: AI-powered data collection opens up possibilities for innovation, as it enables the analysis of data types that were previously challenging to manage manually.
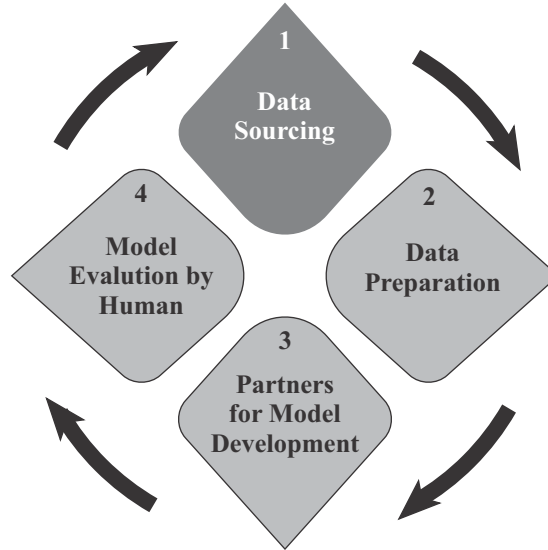
Fig 2: Data and AI Life Cycle

In essence, the combination of AI algorithms and NLP techniques is revolutionizing how organizations collect and integrate data, providing a foundation for advanced analytics, informed decision-making, and strategic planning.

Data Quality Enhancement:

AI can detect and correct errors in datasets, ensuring data accuracy and consistency. Machine learning models can identify outliers, missing values, and anomalies, enhancing the overall quality of the data. Absolutely, you've captured a crucial aspect of how AI can significantly contribute to data quality enhancement.
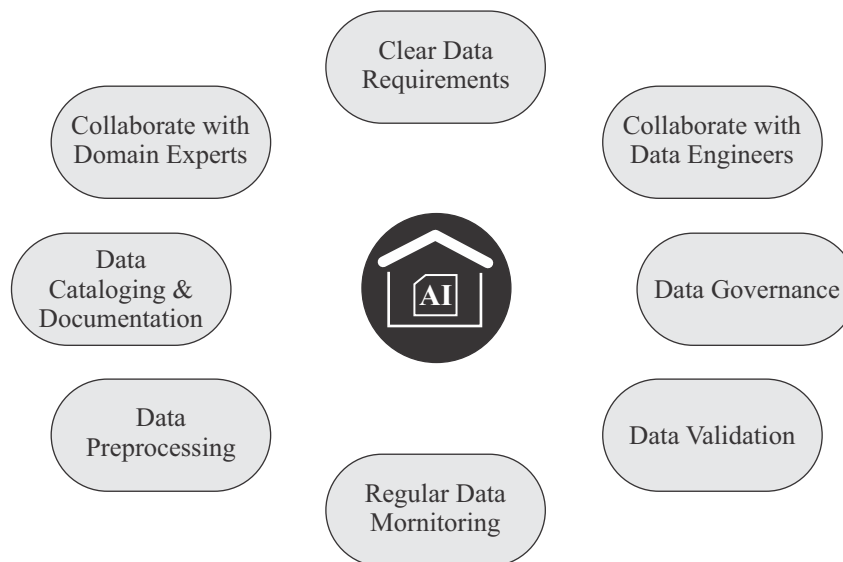

Fig 3: Steps to Enhancing Data Quality for AI

In the modern data-driven landscape, ensuring data accuracy and consistency is paramount. AI-driven data quality enhancement brings several advantages:

- Error Detection and Correction: AI algorithms can identify errors, inconsistencies, and inaccuracies in datasets. This could include typos, incorrect values, or contradictory data points. Automated error detection helps maintain the integrity of the data.

- Anomaly Detection: AI can identify anomalies that might be difficult to detect manually. These anomalies might indicate fraudulent activities, unusual patterns, or outliers that require investigation.

- Missing Value Imputation: When dealing with missing data points, AI-powered algorithms can predict and impute missing values based on patterns and correlations present in the dataset. This ensures that data remains complete and usable for analysis.

- De-duplication: Duplicate records can distort analysis and lead to erroneous conclusions. AI can identify and merge or eliminate duplicate entries, ensuring data accuracy.

- Consistency Check: AI algorithms can enforce consistency rules across the dataset. For instance, they can ensure that data entered in different formats adheres to a predefined standard.

- Normalization and Standardization: AI can normalize and standardize data formats, units, and scales across datasets. This enhances data consistency and comparability.

- Identifying Outliers: Machine learning models can recognize outliers that might skew analysis results. These outliers can then be further investigated to understand their impact on the dataset.

- Continuous Monitoring: AI-driven tools can continuously monitor data quality, flagging any deviations from established standards. This real-time monitoring helps maintain data accuracy over time.

- Time Efficiency: Manual data cleaning and validation can be time-consuming. AI accelerates this process, allowing data professionals to focus on more complex tasks.

- Scalability: As datasets grow, maintaining data quality becomes more challenging. AI's scalability ensures that data quality enhancement remains effective even with large volumes of data.

- Improved Decision-Making: High-quality data is the foundation of informed decision-making. By enhancing data accuracy and consistency, AI enables organizations to make more reliable and data-driven choices.

- Audit Trail: AI tools can provide an audit trail of data cleansing and enhancement processes, ensuring transparency and accountability in data management.

In essence, AI's role in data quality enhancement is transformative. By automating error detection, imputing missing values, identifying outliers, and maintaining consistency, AI empowers organizations to harness the full potential of their data for strategic decision-making and innovation.

Data Storage and Accessibility:

AI-powered data management systems optimize data storage by intelligently distributing data across different storage tiers based on usage patterns. AI also facilitates efficient indexing and categorization, making data retrieval faster and more intuitive. Here's an in-depth exploration of how AI transforms data storage and accessibility:

Intelligent Data Distribution:

- AI-driven data management systems leverage algorithms to analyze usage patterns and the characteristics of data. Based on this analysis, data is intelligently distributed across different storage tiers. Frequently accessed and critical data is stored in high-performance storage, while less frequently accessed data is stored in cost-effective, lower-performance storage. This dynamic tiering ensures

that data is stored in the most suitable location, optimizing storage costs while maintaining accessibility.

- Predictive Analysis: AI algorithms can predict future data access patterns based on historical usage data. This enables proactive data movement, ensuring that frequently accessed data is readily available in high-performance storage, enhancing overall system performance.

- Adaptive Data Placement: AI systems adapt to changing usage patterns and automatically move data between storage tiers as patterns evolve. This adaptability ensures that data is always available at the right level of performance, avoiding bottlenecks and delays.

- Efficient Indexing and Categorization: AI algorithms aid in efficient data indexing and categorization. Through natural language processing and machine learning, data is tagged, labelled, and organized in ways that facilitate quick and accurate retrieval. This enhances the user experience and reduces the time spent searching for specific information.

- Contextual Data Retrieval: AI-powered systems can understand the context of data requests. This allows for more intelligent retrieval, where related data is also fetched, anticipating user needs and simplifying the data retrieval process.

- Semantic Search: AI-driven semantic search capabilities enable users to find relevant data using natural language queries. This eliminates the need for complex query languages and enhances accessibility for non-technical users.

- Data Compression and De-duplication: AI can identify redundant or similar data and apply compression or de-duplication techniques to optimize storage capacity. This ensures that storage resources are used efficiently.

- Performance Optimization: AI monitors system performance and identifies potential bottlenecks in data access. It can adapt storage configurations to ensure consistent high performance, particularly during peak usage times.

- Scalability and Future-Proofing: AI-powered data storage systems are designed to scale seamlessly as data volumes grow. This future-proofing capability ensures that accessibility remains efficient even as data sizes expand.

- Enhanced Data Security: AI can contribute to data security by implementing access controls, encryption, and anomaly detection mechanisms. This safeguards data while ensuring authorized users can access it when needed.

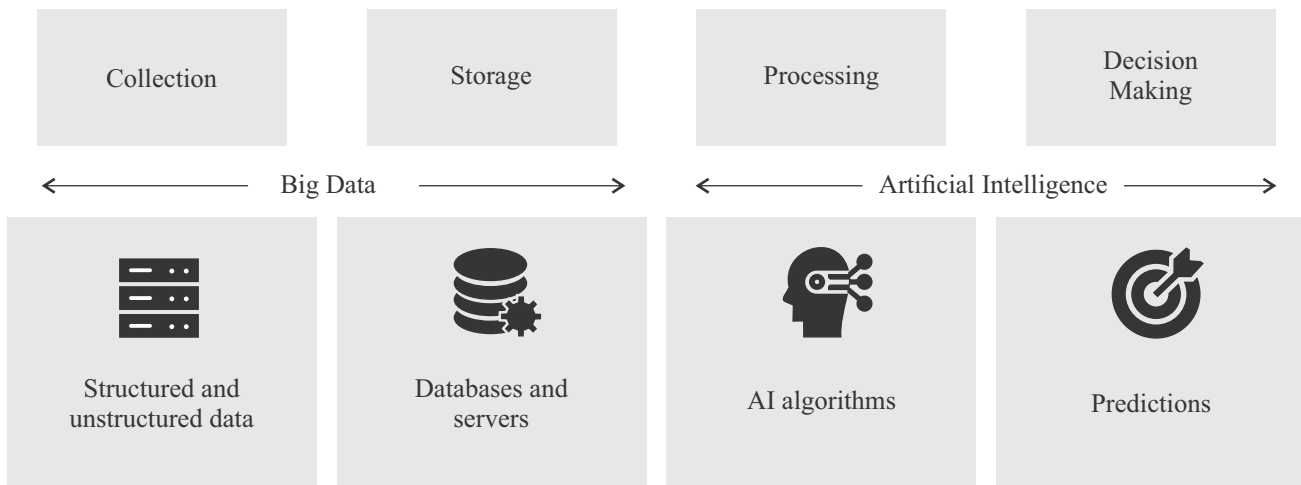| Collection	Storage	Processing	Decision Making
← Big Data →		← Artificial Intelligence →	
Structured and unstructured data	Databases and servers	AI algorithms	Predictions

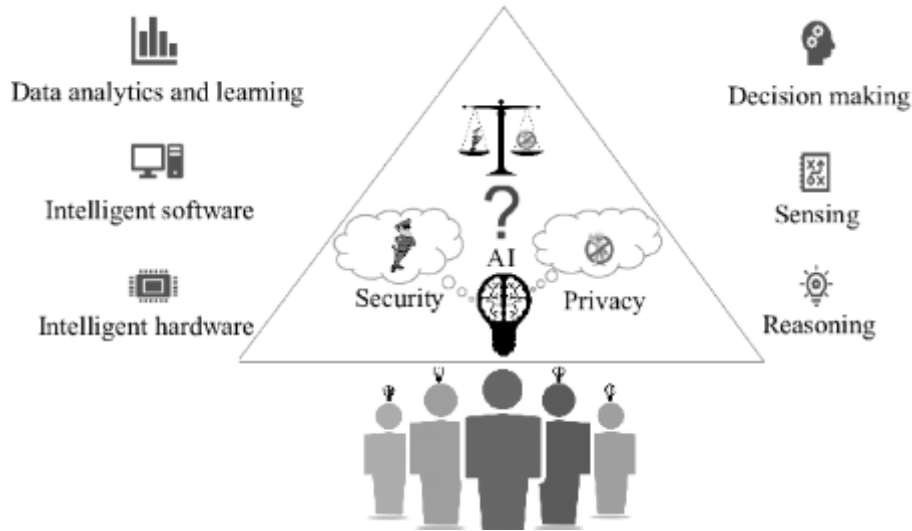**Fig 4: Data Storage and Accessibility in AI**

Fig 5: Data Security and Privacy in Artificial intelligence

Here's an in-depth exploration of how AI technologies are reshaping data security and privacy strategies:

- Anomaly Detection: AI-powered machine learning algorithms excel at recognizing patterns and behaviours within large datasets. By establishing a baseline of normal user activities, AI algorithms can swiftly detect deviations that may indicate a security breach. These anomalies could range from unauthorized access attempts to unusual usage patterns, triggering timely alerts for swift response.

- Behavioural Analysis: AI's ability to analyze user behaviour over time enables the identification of anomalous actions that might not be immediately apparent. It can establish patterns of typical user behaviour and swiftly detect any deviations from these patterns.

- Predictive Threat Analysis: Through continuous learning, AI can predict potential security threats by analyzing historical data and identifying correlations that might point to emerging risks. This proactive approach enables organizations to mitigate potential threats before they escalate.

- Encryption and Data Protection: AI-powered encryption techniques are more robust and adaptive than traditional methods. AI can manage encryption keys, adapt encryption levels based on data sensitivity, and automatically encrypt data in real time as it is generated or transmitted.

- Access Control and Authentication: AI enhances access controls by implementing multi-factor authentication and dynamic authorization protocols. AI systems can analyze contextual information such as user location, device type, and behaviour patterns to grant or deny access.

- Intrusion Detection and Prevention: AI-based intrusion detection systems can detect unauthorized access attempts in real time, trigger immediate alerts, and even take automated actions to prevent breaches. These systems can identify both known and previously unseen threats.

- Identity Verification: AI technologies such as facial recognition and biometric authentication strengthen identity verification processes, reducing the risk of unauthorized access due to stolen credentials.

- Data Masking and De-identification: AI algorithms can anonymize or pseudonymize sensitive data, reducing the risk of data exposure while maintaining its usability for analytics and other legitimate purposes.

- User and Entity Behaviour Analytics (UEBA): UEBA leverages AI to analyze user behaviours, identify deviations, and assess potential threats based on historical data. It aids in early threat detection by identifying actions that deviate from established patterns.

• Real-time Monitoring and Response: AI continuously monitors network traffic, application behaviour, and user activities in real time. This enables immediate response to any unusual activities or breaches, minimizing potential damages.

• Regulatory Compliance: AI can assist in ensuring compliance with data protection regulations by automatically monitoring and reporting on data handling practices.

AI's contribution to data security and privacy is profound and multifaceted. By employing advanced algorithms for anomaly detection, encryption, access control, and real-time monitoring, organizations can proactively safeguard sensitive data, fortify defences, and maintain compliance with evolving privacy regulations. The integration of AI empowers businesses to navigate the complex landscape of data protection, ensuring that data remains an asset rather than a liability.

Predictive Analytics:

AI-powered predictive analytics leverages historical data to make accurate forecasts and predictions. These insights assist businesses in making informed decisions and strategies for the future. Here's a comprehensive exploration of the transformative role of AI-powered predictive analytics:

• Historical Data Analysis: AI-driven predictive analytics begins by analyzing vast sets of historical data. This data encompasses past trends, behaviors, and outcomes, forming the foundation for generating meaningful insights.

• Pattern Recognition: AI algorithms are adept at identifying intricate patterns and correlations within historical data. By detecting recurring relationships between variables, these algorithms can establish predictive models.

• Accurate Forecasting: Predictive analytics goes beyond traditional methods by providing accurate forecasts and predictions. AI algorithms refine predictive models over time, enhancing their accuracy and reliability.

• Business Insights: Predictive analytics doesn't merely predict outcomes—it also provides insights into the factors influencing those outcomes. Businesses gain a deeper understanding of variables that impact their operations.

• Risk Assessment and Mitigation: Predictive analytics helps in assessing and mitigating risks. By analyzing historical data and identifying potential threats, businesses can proactively take measures to mitigate risks and uncertainties.

• Demand Forecasting: In industries like retail and supply chain management, predictive analytics assists in accurately forecasting demand, optimizing inventory management, and minimizing stockouts or overstocking.

• Customer Behavior Prediction: AI-powered predictive models can anticipate customer behavior, helping businesses tailor marketing strategies, improve customer engagement, and enhance retention efforts.

• Financial Planning: Predictive analytics aids in financial planning by forecasting revenues, costs, and market trends. This enables businesses to allocate resources more effectively.

• Healthcare and Medical Diagnosis: In healthcare, predictive analytics assists in diagnosing diseases and health conditions. AI algorithms analyze patient data to predict disease progression and suggest personalized treatments.

• Fraud Detection: Predictive analytics plays a pivotal role in fraud detection. By identifying unusual patterns in transactions, it helps financial institutions and businesses detect fraudulent activities.

• Marketing Campaign Optimization: AI-driven predictive models optimize marketing campaigns by identifying the most effective channels, timing, and messaging, ensuring higher conversion rates.

• Real-time Decision Support: AI-powered predictive analytics can provide real-time insights, enabling businesses to make agile decisions based on the most

current data.

- Continuous Learning and Improvement: Predictive models powered by AI continuously learn from new data, improving their accuracy over time. This adaptive learning ensures that predictions remain relevant as circumstances evolve.

Figure 6: Predictive Analytics in Artificial intelligence

AI-powered predictive analytics unlocks the potential of historical data, transforming it into a strategic asset. By accurately forecasting outcomes, identifying trends, and revealing insights, businesses are empowered to make informed decisions that drive growth, minimize risks, and enhance operational efficiency. The synergy between AI and predictive analytics marks a pivotal advancement in the realm of data-driven decision-making.

Data Cleaning and Pre-processing:

AI automates data cleaning tasks by identifying and rectifying inconsistencies, duplications, and inaccuracies. This step is crucial for preparing data for analysis. Here's a comprehensive exploration of how AI is revolutionizing data cleaning and pre-processing:

- Data Inconsistency Detection: AI algorithms excel in recognizing inconsistencies within datasets. They compare data points across variables and sources, identifying disparities that might indicate errors or anomalies.

- De-duplication and Duplicate Removal: AI-powered algorithms identify and remove duplicate records, ensuring that data accuracy is maintained. By recognizing similar entries, AI prevents skewed analysis results caused by redundant data.

- Data Imputation and Missing Value Handling: When data is incomplete due to missing values, AI models can predict and impute these values based on existing patterns and correlations, ensuring data completeness for analysis.

- Anomaly Detection: AI can identify anomalous data points that deviate significantly from the norm. This aids in identifying errors, outliers, or potential data breaches.

- Pattern Recognition: AI algorithms recognize patterns that might be indicative of data quality issues. By comparing data against established patterns, AI flags irregularities for further examination.

- Format Standardization: AI ensures data consistency by standardizing formats, units, and scales across variables, enabling accurate and meaningful comparisons.

- Data Validation: AI automates data validation by cross-referencing data against predefined rules or ranges, identifying data that falls outside expected parameters.

- Text Data Normalization: For unstructured text data, AI-powered natural language processing (NLP) techniques normalize text by standardizing formats, removing special characters, and resolving synonyms, enhancing the accuracy of textual analysis.

- Continuous Learning and Improvement: AI-driven data cleaning systems adapt over time as they encounter new data. This continual learning ensures that data quality is consistently maintained even as new data is added.

- Efficient Handling of Large Volumes: AI's automation capabilities allow for efficient data cleaning even with massive datasets, which would be cumbersome and time-consuming if done manually.

- Streamlined Data Preparation: AI automates data cleaning and pre-processing, enabling data professionals to focus on higher-level analysis and strategic tasks.

- Enhanced Accuracy of Analysis: Clean and accurate data forms the foundation of meaningful analysis. By automating data cleaning, AI ensures that insights and conclusions drawn from the data are reliable.

- Time and Cost Savings: Manual data cleaning is labour-intensive and time-consuming. AI-driven automation significantly reduces the time and resources required for this crucial step.
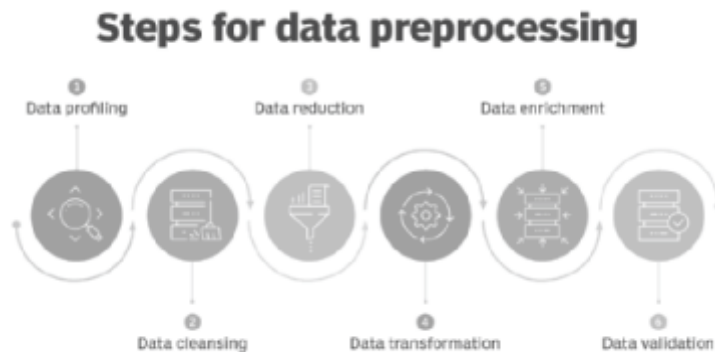

Fig 7: Data Cleaning and Pre-processing in Artificial intelligence

AI's involvement in data cleaning and pre-processing transforms a necessary but often time-consuming task into an efficient and effective process. By automating error detection, duplicate removal, and anomaly identification, AI ensures that data is primed for accurate analysis, driving informed decision-making and strategic insights. The synergy of AI and data cleaning marks a significant advancement in data preparation, allowing businesses to harness the true potential of their data.

Data Governance and Compliance:

AI assists in maintaining data governance standards and regulatory compliance. Automated tracking and auditing of data usage help organizations adhere to data protection regulations.

Fig 8: Data Governance and Compliance in Artificial Intelligence

Here's a comprehensive exploration of how AI is reshaping data governance and compliance:

- Automated Monitoring and Tracking: AI-driven systems continuously monitor data usage, access, and changes across various platforms. Any deviations from established norms trigger alerts, enabling swift intervention to address potential breaches.

- Real-time Compliance Alerts: AI technologies detect activities that violate data protection regulations in real time. Organizations receive immediate alerts, allowing them to take proactive measures to rectify compliance issues.

- Data Classification and Tagging: AI can automatically classify and tag data based on sensitivity levels. This ensures that data is appropriately handled and protected in accordance with its classification.

- Privacy Policy Enforcement: AI monitors the usage of data and ensures that it aligns with the organization's privacy policies and terms of use. It can flag actions that deviate from established guidelines.

- Regulatory Framework Adaptation: AI-driven systems can be trained to adapt to changing regulatory requirements. They can evolve alongside updates to data protection laws and adjust compliance protocols accordingly.

- Auditing and Reporting: AI automates the auditing process by tracking data usage, access, and modifications. This streamlined auditing process generates comprehensive reports that demonstrate compliance to regulators.

- Data Retention Management: AI assists in managing data retention policies by automating the identification of data that needs to be archived or deleted based on regulatory timelines.

- Consent Management: AI-powered systems can manage consent records by tracking user consent for data collection and usage. This ensures that data is only used as permitted by the user.

- Data Masking and Anonymization: AI-driven techniques can automatically mask or anonymize sensitive data, reducing the risk of unauthorized access or exposure.

- Regulatory Reporting and Documentation: AI automates the preparation of documentation required for regulatory reporting. This includes compiling relevant data and generating compliance reports efficiently.

- Proactive Risk Mitigation: AI can identify potential compliance risks by analyzing data usage patterns and identifying areas where violations are more likely to occur.

- Reducing Human Error: AI minimizes the chances of human error in compliance monitoring and

reporting, ensuring accuracy and consistency in adherence to regulations.

- Transparent Governance: AI's automated processes provide transparency in data governance practices, aiding organizations in demonstrating their commitment to compliance during audits.

Conclusion

AI's role in data governance and compliance is transformative. By automating monitoring, tracking, and auditing processes, AI ensures that organizations maintain regulatory adherence and uphold data protection standards. The synergy between AI and data governance enhances both operational efficiency and trust, enabling organizations to navigate the complex landscape of data regulations while safeguarding sensitive information. In conclusion, the integration of artificial intelligence in data management is revolutionizing how businesses handle, process, and derive value from their data. From data collection to analysis and insights, AI technologies are streamlining processes, enhancing data quality, and enabling organizations to make more informed decisions in the data-driven landscape.

References

Elfving, J., & Lemoine, K. (2012). Exploring the concept of Customer Relationship Management: emphasizing social. In.

Foshay, N., Taylor, A., & Mukherjee, A. (2014). Winning the hearts and minds of business intelligence users: The role of metadata. Information systems management, 31 (2), 167-180.

Gupta, S. L., Kishor, N., Mishra, N., Mathur, S., & Gupta, U. (Eds.). (2021). *Transforming higher education through digitalization: Insights, tools, and techniques*. CRC Press.

Khan, R. A., & Quadri, S. (2012). Business intelligence: an integrated approach. Business Intelligence Journal, 5 (1), 64-70.

Krishna, C., & Rohit, H. (2018). A review of Artificial Intelligence methods for data science and data analytics: Applications and Research Challenges. 2018 2nd International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC) I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2018 2nd International Conference

Kudyba, S., & Hoptroff, R. (2001). Data mining and business intelligence: A guide to productivity. Igi Global.

MacGillivray, A. E. (2001). Using Business Intelligence (information Technology) Tools to Facilitate Front-line Priority-setting in a Public Sector Organisation. National Library of Canada= Bibliothèque nationale du Canada, Ottawa.

Moolayil, J., Moolayil, J., & John, S. (2019). Learn Keras for deep neural networks. Springer.

Nelke, M., & Håkansson, C. (2015). Competitive intelligence for information professionals. Chandos Publishing.

Ren, Z., & Wang, D. (2008). Building a Business Intelligence Application with Oracle e-Business Suits 12. 2008 4th International Conference on Wireless Communications, Networking and Mobile Computing,

Reshi, Y. S., & Khan, R. A. (2014). Creating business intelligence through machine learning: An Effective business decision making tool. Information and Knowledge Management,

Shanmuganathan, S. (2016). Artificial neural network modelling: An introduction. In Artificial neural network modelling (pp. 1-14). Springer.

Kilanko, V. (2022). Turning Point: Policymaking in the Era of Artificial Intelligence, by Darrell M. West and John R. Allen, Washington, DC: Brookings Institution Press, 2020, 297 pp., hardcover 24.99, paperback 19.99.

Kilanko, V. The Transformative Potential of Artificial Intelligence in Medical Billing: A Global Perspective.

Kiran, P., & Srivastava, A. (2018). WhatsApp and its impact on social life of youngsters: a perspective. *Management Insight*, *14*(1), 57-64.

Mungoli, N. (2023). Adaptive Ensemble Learning: Boosting Model Performance through Intelligent Feature Fusion in Deep Neural Networks. arXiv preprint arXiv: 2304.02653.

Sahija, D. (2021). Critical review of machine learning integration with augmented reality for discrete manufacturing. Independent Researcher and Enterprise Solution Manager in Leading Digital Transformation Agency, Plano, USA.

Sahija, D. (2021). User Adoption of Augmented Reality and Mixed Reality Technology in Manufacturing Industry. Int J Innov Res Multidisciplinary Field Issue, 27, 128-139.

Kiran, P., Vasantha, S., & Srivastava, A. (2017). SEM Modeling Approach for Studying the Social Impact of Whatsapp Usage. *Indian Journal of Public Health Research & Development*, *8*(2).

Mirwani, P., Karmani, S. T., Acharekar, S. V., Srivastava, A., & Agarwal, M. (2023). Analyzing Effective Digital Marketing Strategies for Online Merchants. *European Economic Letters (EEL)*, *13*(3), 701-708.

Mungoli, N. (2023). Scalable, Distributed AI Frameworks: Leveraging Cloud Computing for Enhanced Deep Learning

Performance and Efficiency. arXiv preprint arXiv: 2304.13738.

Jasmin Praful Bharadiya: A Comparative Study of Business Intelligence and Artificial Intelligence with Big Data Analytics

Mahmood, T., Fulmer, W., Mungoli, N., Huang, J., & Lu, A. (2019, October). Improving information sharing and collaborative analysis for remote geospatial visualization using mixed reality. In 2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR) (pp. 236-247). IEEE.

Mughal, A. A. (2018). Artificial Intelligence in Information Security: Exploring the Advantages, Challenges, and Future Directions. Journal of Artificial Intelligence and Machine Learning in Management, 2 (1), 22-34.

Srivastava, A., & Sengupta, I. (2017). Predicting stock market: An approach with artificial intelligence. *Management*, *13*(2), 73-77.

Yonbawi, S., Alahmari, S., Daniel, R., Lydia, E. L., Ishak, M. K., Alkahtani , H. K., ... & Mostafa , S. M. (2023). Modified Metaheuristics with Transfer Learning Based Insect Pest Classification for Agricultural Crops . Computer Systems Science &

Engineering, 46(3).

Lee, E., Rabbi, F., Almashaqbeh, H., Aljarbouh, A., Ascencio, J., & Bystrova , N. V. (2023 , March). The issue of software reliability in program code cloning . In AIP Conference Proceedings (Vol. 2700, No. 1). AIP Publishing.

Kiran, P., Srivastava, A., Tiwari, S. C., & Ramaiah, T. S. (2020). Evaluating forces associated with sentient drivers over the purchase intention of organic food products. *Asian Journal of Agriculture and Rural Development*, *10*(1), 284.

Sharmili , N., Yonbawi , S., Alahmari , S., Lydia, E. L., Ishak, M . K., Alkahtani , H. K., ... & Mostafa , S. M . (2023). Earthworm Optimization with Improved SqueezeNet Enabled Facial Expression Recognition Model . Computer Systems Science & Engineering, 46(2).

Rutskiy , V., Aljarbouh , A., Thommandru , A., Elkin , S., Amrani, Y. E., Semina, E., ... & Tsarev, R. (2022). Prospects for the Use of Artificial Intelligence to Combat Fraud in Bank Payments . In Proceedings of the Computational Methods in Systems and Software (pp . 959 -971). Cham: Springer International Publishing.