International Journal of Emerging Trends in Computer Science and Information Technology
ISSN: 3050-9246 | https://doi.org/10.56472/ICCSAIML25-103
Eureka Vision Publication | ICCSAIML'25-Conference Proceeding

Original Article

Data Privacy in the Era of Big Data: Navigating the Risks

Anusha Atluri
Lead Solution/Technical Architect at Acosta, USA.

***Abstract** - The rapid spread of Big Data is responsible for the transformation of industries, which, in turn, has provided companies with the possibility of gaining informative analysis, enriching customer experiences, and taking data as a source for decision-making. This remarkable jump in the data volume as well as choices about ethics, security, and privacy has become a matter of great concern. Data breach, identity theft, and unauthorized access tend to occur more often when companies handle, manage, and examine enormous amounts of personal data. People desire to have more power over how they share their data and at the same time, are more digitally conscious. The legal system has recently drawn its attention to the problem of data overseas, developing regulations such as the General Data Protection Regulation (GDPR), the California Consumer Privacy Act (CCPA), and the Health Insurance Portability & Accountability Act (HIPAA), all of which strictly control data management practices thus, creating a healthier atmosphere for better protection of personal data. The firms should introduce all-inclusive laws concerning securing the user data. Conferring a top place to privacy is necessary, and in so doing, technology companies might allow customers to comprehend the information that is given, its purpose, and its use. As the companies have to follow data minimization practices and they are only given the required data, there are, undoubtedly, ethical considerations. To alleviate any privacy concerns companies can invest in robust infrastructure, educate their staff, and have regular check-ups to ensure effective use and secure data. The confidence of the customer is usually a very crucial issue, and ethical handling of data enhances that trust, thus, making life extending customer relationships. Businesses somehow have to give out the data they own for free as to move with technology by deploying the data in their operations hence managing the risk that comes alongside these new technology-driven insights.*

***Keywords** - Data Privacy, Big Data, Privacy Risks, Data Protection, Cybersecurity, Data Governance, Data Breaches, Anonymization, Machine Learning, Privacy Laws, Data Ethics.*

1. Introduction

The abrupt growth of big data has deeply affected the industries and it has changed how businesses, governments, and individuals do their work on digital platforms. In the world today, which is data-driven, companies get a lot of data so that they can make better decisions, customers get better treatment, and bring innovation ahead. Among many other things like suggesting personal items in e-commerce platforms or predicting cancer, the use of big data has proven to be one of the best strategies for industries to keep themselves in a competitive environment. The data flow is going faster than it did before, leaders of companies look for new methods to get the answer they need, and as a consequence, they can find the trends and optimize the way they are working. But the increasing use of the data has also heightened the concerns of people about the misuse of their data by the organizations that store it. Alongside all the activities on the Internet, there are transactions, social media interactions, and also a digital footprint, where a very complex and elusive data trail is created that, in fact, can be a source of, for instance, identity theft, financial fraud, and privacy infringements, if not properly managed. The surge in the number of the data breaches that reached, in a very short period, the so-called high-profile category, contributed to people's fear and thus made them ask how companies protect the user data.

During the present big data era, one of the significant issues is a trade-off between privacy protection and innovation. Companies are striving to use personal data obtained for competitive advantage but consumers are skeptical about that and long for control of their data. One of the laws that have been adopted by many countries to ensure the standard of data protection is the General Data Protection Regulation (GDPR), Health Insurance Portability and Accountability Act (HIPAA), and California Consumer Privacy Act (CCPA). These regulations aim at providing clear guidelines for security, data collection, and use that is why companies are forced to use a privacy-centric approach. The GDPR has put in place strict rules that businesses should follow for obtaining user permission, collecting data, as well as breach notifications. HIPAA is also a means of helping to establish good healthcare practices, as by enforcement of strict data security, it becomes possible to safeguard patients' confidentiality. Though these standards provide better data privacy, the businesses tend to face the difficulty of full compliance because of conflicts with their data-driven processes. This means that a company needs to put in place strict security policies, which should incorporate anonymization, encryption, and data minimization strategies, to reduce data breach occurrences. Although anonymization removes the identification of users, by which they are preserved, encryption also hides the data from the criminals. Nevertheless, businesses do have to consider implementing strict access limits so that the data is only accessible to the authorized users. A couple of the most impactful steps in the direction of this privacy policy are regular training for the workers and funding security assessments that are significantly introducing privacy standards.

Companies, besides technical solutions, should be also striving to foster a work environment with a high level of transparency and accountability where they are trusted and hence build confidence with their consumers. This tech-savvy digital world is the place where people are getting more aware of how companies use their personal data, that is why the companies must communicate their privacy policies in a simple and clear way. Conversely, companies need to take careful measurements to provide consumers with fast and accurate data that they can control, for instance, have the right to access, change, or remove their data that comply with privacy laws. It is through ethical data practices that correct use is achieved, guaranteeing both fair and responsible data processing. In this light, the procedure of data reduction, the method of obtaining only the required data, is used to protect users from unnecessary privacy invasion. Ethical companies that live by these principles are easily able to establish strong bonds with their customers through their fair and transparent behavior, which in turn also brings loyalty.

2. Privacy threats and big data technologies

Big data technology has brought revolutionary changes. It enabled companies to compile and examine vast amounts of data. It also helped in drawing conclusions from it. These technologies pose significant privacy issues. Even though they offer great opportunities, this is noteworthy. Organizations depend on an awareness of the connection. Legislators and consumers all tie their expectations to this. It concerns privacy threats and big data technology. Privacy issues are often a concern in various sectors.

2.1 Understanding Big Data Systems

Big data technologies are instruments. They are models designed for admin of large data processing. They're also designed for data storage and analysis. These technologies are for handling data rapidly produced in several forms. They are often too vast for traditional database systems to manage.

2.1.1 Alternative Data Storage Systems

Big data storage systems are built to house large quantities of both ordered and unstructured data efficiently. Notable venues are showcased below:

- Scaled and fault-tolerant, Hadoop Distributed File System (HDFS) partitions data into blocks and distributes them among nodes.
- Amazon S3 is a cloud storage option that provides flexible capacity. This capacity is united with security measures that are thorough.
- Google Cloud Storage ensures easy use of Google's analytics tools. It also allows for interaction with machine learning technologies.

However, as strong as these systems might be, data in such environments can be exposed. Unauthorized access remains a risk. This is especially true if mechanisms like data masking, access limits and encryption are not adequately applied. An increased risk of unauthorized access is presented in this situation.

2.1.2 Data Processing Frameworks

Analysis of large data amounts depends on data processing frameworks. These are fundamental technologies.

- Rapid in-memory data processing engine is Apache Spark. This engine is widely used for real-time analytics.
- Apache Flink is renowned. This tool is for stream processing. It aids in minimally latency real-time data analysis.
- MapReduce is a programming model that divides work over several nodes. It simplifies distributed data processing.

If developers neglect role-based access restrictions these systems might expose critical information. They may also be inclined to expose it if intermediaries are not safeguarded.

2.2 Privacy Concerns in Context of Big Data

Use of big data technologies by companies causes worries. These worries about privacy become somewhat alarming. Often they arise from poor handling of data. Weak security measures can also be a problem. Insufficient access limits can contribute to privacy risks too.

2.2.1 Information Breaches

Big data systems catalogue and keep personally identifiable information (PII). They hold financial data and sensitive data.

These systems make appealing targets for hackers if there is inadequate encryption. Even absence of access limits can cause risk. Software glitches could result in breaches. Cloud storage that is not correctly set up may cause breaches. Social engineering methods could also lead to breaches. Improper setup Amazon S3 buckets have resulted in notable data breaches. These breached records affect millions of users. Similarly, insecure HDFS nodes may inadvertently reveal private information to unauthorized users.

2.2.2 Data Aggregation: Risks

Big data systems excel by utilizing data from many sources for insights. Aggregating processes might unintentionally expose private information. While the data is anonymised, combination of many datasets often results in re-identification of individuals. This is done through data correlation methods.

For example on surface anonymous purchasing patterns or location data might be linked with public records. This might occur to identify someone, compromising privacy rights in a big way.

2.2.3 Unauthorized Information Access

In big data systems many teams often work. They use data for varied purposes. If there is a lack of strong access limitations critical data can face risk. This issue can give rise to significant security weaknesses.
Inadequate access models are a substantial risk. Insufficient verification of identity can lead to problems. Lacking audit mechanisms may also prove to be a weakness. Companies that greatly depend on vendors or cloud services are at higher risk. Access restrictions must be defined in an adequate manner. Control over these restrictions must be maintained as well.

2.3 Reducing Personal Data Privacy Risk

Mitigating privacy concerns in sizable data environments demands a holistic strategy. It must include legislative, organizational and technical elements. First, legislation changes are beneficial. They need to provide clearer guidelines for data processing and personal data handling. Organizational change is also required. Data handling policies must be revised. It's equally important to ensure all employees are compliant with new guidelines. Finally technical modifications are key. They will modernize security protocols and encryption technology. This ensures a high level of data protection.

2.3.1 Anonymizing and encrypting data

Eliminating unlawful access is contingent on encrypting data. This needs to be done both during transmission and storage. Encryption methods such as TLS and AES-256 are strong. They offer robust data security even in cases of intercepting. Techniques for anonymizing data are also necessary. Differential privacy tokenization and data masking, for example, are techniques. They might help to further reduce risks. Turning identifiable data into non-identified data could offer insights to companies. All without compromising personal privacy.

2.3.2 User Administration and Control of Access

Ensuring only authorized users access private data is critical. Strict role-based access limits (RBAC) are highly instrumental in reducing data susceptibility. Enforcing multi-factor authentication (MFA) is a must for companies. Together with this strict policies for user access must be in place. Tracking access patterns is a key process. Identifying unusual behavior swiftly is also important. Both of these depend on routine audits. They also depend on activity logs.

2.3.3 Respect of Regulatory Guidelines

User data safety is dependent on adherence to data protection standards. Standards like GDPR HIPAA and CCPA rules. They demand it from businesses. They must follow data minimizing guidelines and have clear data governance systems. Plus they must give customers more control over their information. Data Protection Impact Assessments or DPIs and Privacy Impact Assessments or PIAs. These are tools that help companies proactively. They can find and reduce privacy issues with data handling practices.

2.3.4 Awareness and Employee Instruction

Human error represents a substantial factor in data breaches. Regular staff training on secure data operations and social engineering dangers is critical. It is essential for minimizing unintentional data leaks. The training is also important for data privacy best practices.

3. Strategies for Personal Safety

The importance of safeguarding data privacy has swelled. This is because of the fast adoption of big data technologies by businesses. Big data comes with crucial insights. They help make important decisions. But the enormous amount of data collected and its complexity have intensified risks. The risks include data exploitation. They also include identity theft. And they include breaches. Companies must establish strong protection strategies. These strategies must include technical, organizational and regulatory elements. The goal is to ensure privacy for users.

3.1 Data Encryption Methods

To protect private data we rely on encryption. It turns information into an unintelligible code. Code only readable with designated key. Strong encryption methods ensure intercepted data remains safe. Data At Rest Encryption. Data at rest pertains to data maintained on backup systems databases and physical or cloud servers. Encrypting this data is vital. It ensures not everyone can access it without necessary decryption keys.

Among the most secure encryption methods is Advanced Encryption Standard. It uses a 256-bit key. This method is crucial for protecting financial data. It also protects medical records and private business information. Encrypting individual files is important. It ensures that only authorized users can access specific records with file-level encryption. Database management systems such SQL Server MySQL, MongoDB have built-in encryption features. These features are meant to enhance stored data security.

3.1.1 Transport Encryption for Data

Data in transit is the information on the move. It goes between systems, networks and users. Data encryption comes into play during transmission. It serves to thwart enemies from intercepting and using this data. TLS or Transport Layer Security is broadly used. It defends online transactions and web traffic. In doing so, it maintains the secrecy of data exchanged between user and server. A very effective measure comes in when employees access company resources remotely. This measure involves using a VPN - Virtual Private Network. VPNs create safe tunnels for the flow of data. End-to-end encryption E2EE, is another security measure. It ensures that data encrypted on a sender's device is only decrypted on a recipient's device. This method is frequently used in messaging applications. It's also used in financial transactions and safe communication platforms. In these scenarios this approach proves to be highly effective. Artwork: Encryption End-to-End. Known by abbreviation E2EE utilizes messaging apps like WhatsApp and Signal. The system ensures that no third party, not even service providers, may view messages.

3.2 Masking and Anonymizing Data

By separating sensitive data from known individuals, anonymization and masking techniques reduce privacy concerns.

3.2.1 Anonymisation of Data

Even when combined with other data, anonymizing personal information means changing it to prevent it from linking to identifiable people. Diminishing data granularity to hide sensitive information—that instance, changing exact ages into age ranges helps to generalize. Randomizing data points or adding noise will help to hide real values while still maintaining data usefulness. While anonymizing is helpful, it is important to recognize the risk of re-identification—that is, the possibility whereby the combination of anonymous data with publicly available information may expose individuals's identities. During testing, development, or analysis, data masking—that is, replacing real data with fake or changed values—helps to protect sensitive information. Applied in non-production contexts, when sensitive data is obscured before replication for testing needs, static data masking Dynamic data masking ensures that authorized users view just approved information by obscuring data in real-time during access.

3.2.2 Tokenising

Tokenizing sensitive information—such as credit card data— substitutes unique tokens devoid of any exploitable value for it. The original data is securely kept in a different location, therefore stopping attackers from utilizing tokens they have intercepted. Payment processing systems make much use of tokenization in order to protect financial transactions.

3.3 Identity management & access control

While identity management verifies and tracks user identities, access control ensures that only authorised staff members may access private information.

3.3.1 RBAC role-based access control

One common approach that distributes access to people based on their job titles is RBAC. Companies can prevent unwelcome access to crucial information by clearly defining roles (e.g., administrator, analyst, or developer) & designating appropriate data access levels. Low Privilege Principle (PoLP): This process ensures that users get minimal access needed for their roles. Access under temporal constraints: Temporary access rights for assigned projects help to reduce risk of the prolonged data exposure.

3.3.2 MFA, Multi-factor Authentication

MFA improves security by requiring users to validate their identity using many techniques, among which something known (password). Something you own (smartphone, token). Biometric identification fingerprint, facial recognition. Using MFA helps businesses greatly reduce their credential compromise risk.

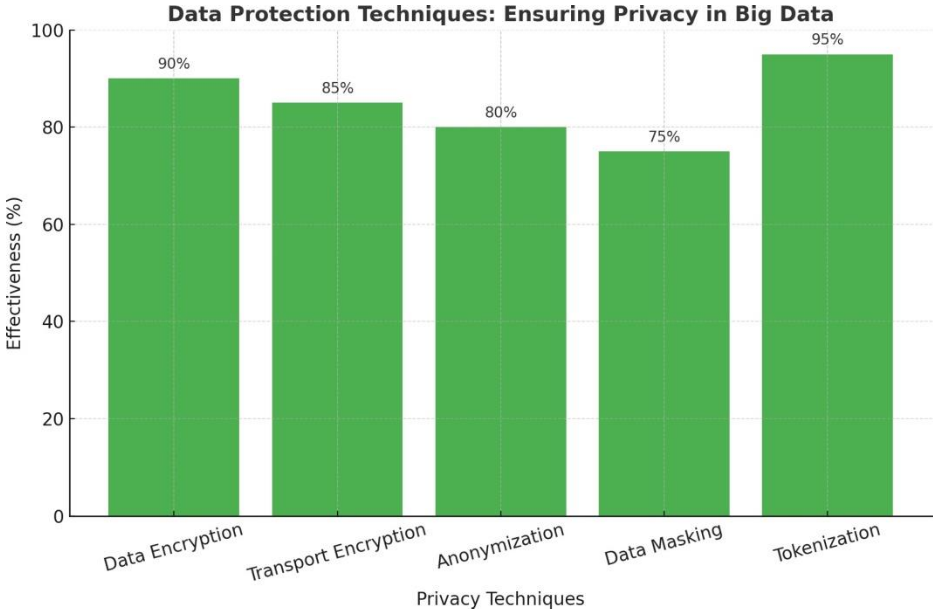

Figure 1. Data Protection Techniques: Ensuring Privacy in Big Data

4. Legal & Control Systems

Protecting data privacy is vital. This has become a top concern. Businesses increasingly lean on big data technologies. They gather and evaluate large amounts of information. Additionally they use it. Governments and regulatory bodies worldwide have responded. They've done this by constructing diverse legal systems. The goal is to shield individual privacy rights. These standards lay down rules for collecting, processing, storing and giving out data. Thus they ensure ethical data practices are observed in businesses. Companies wishing to adhere to rules and prevent major penalties require understanding. They need to grasp these models. This section focuses on critical data privacy laws. It also touches on geographical inconsistencies. And it looks at best methods to guarantee compliance.

4.1 Legislative Global Data Protection

Privacy laws for data have evolved on a global scale to tackle expanding complexities about protecting personal data. The majority of these guidelines' objectives are to allow greater individual control over their data. And to make sure companies comply with ethical data management standards. However, their reach and implementation methods are not always the same.

4.1.1 GDPR General Data Protection Regulation

General Data Protection Regulation is a far-reaching data privacy law. It is applied worldwide. The European Union adopted this rule in 2018. This control is relative to any firm managing personal information of EU citizens. The data location of the company is irrelevant. GDPR's basic principles consist in. Transparency is key. Companies need to tell consumers about data collection. Goals of such actions should be clear. Knowing their rights is important too. Also, users have to give clear consent before any data collection. This is essential. People have the right to access their records. If they wish, they can ask for deletion. Users can also request data in a structured way. That request can be for other providers. Entities have a timeframe. 72 hours must be given after data breach. This timeframe is for informing authorities and affected individuals. The law is strict when it comes to non-compliance. Fines may reach a considerable amount. It can be €20 million or 4% of worldwide turnover in a year. The GDPR is not lenient. It imposes fines for non-compliance.

4.1.2. California Consumer Privacy Act

Introduced in January 2020 CCPA is a significant privacy law. CCPA enhances the rights of Californians. It aids consumers to control their personal data.

Companies must disclose their data collecting operations. Here are CCPA's main characteristics:

- Consumers might inquire about the specifics of gathered, sold, or shared personal data.
- Users' right to erasure permits them to request companies to erase their personal information.
- Consumers possess the right to opt-out. They can prevent their data from being sold to other parties.
- Non-Discrimination: Companies are not allowed to deny services. They also cannot charge more for those asserting their privacy rights.
- Penalties for each intentional infringement under CCPA range from $7,500.

4.2 Regional Data Privacy Laws

Countries have shaped their privacy laws. This is in addition to GDPR and CCPA. The laws center on political, cultural and financial elements. Singapore has a Personal Data Protection Act. It controls personal data. Singaporean companies handle this data. There are fundamental ideas around data collecting. They need approval. They ensure data accuracy. They handle security policies. PDPA also demands a Do Not Call registry. This lets people refuse commercial solicitations. Brazil has a General Data Protection Law. It is inspired by GDPR. LGPD aims to protect privacy rights. These rights are for Brazilian people. The law applies to businesses in Brazil. They handle data. LGPD emphasizes clear guidelines. Guidelines are around data management. User consent is crucial. So is the entitlement to see and change their data. Companies must have data protection officers if they handle significant data sets.

4.2.1 The India Personal Data Protection Bill (PDPB)

Under review India's PDPB seeks to protect personal data. At the same time it aims to support the country's digital economy. Similar to GDPR law demands data localization. This means sensitive data must stay within India. The creation of a "Data Fiduciary" role orders companies to treat data with ethics and openness.

4.3 Sector-Specific Data Protection Policies

Certain companies are tasked with handling incredibly sensitive data. These scenarios warrant the creation of specific laws. This is to protect data security and privacy. HIPAA or the Health Insurance Portability, Accountability Act is vital in the United States. HIPAA oversees the protection of American medical records. It pertains to insurance companies. It also relates to medical professionals. In addition to these it is tied to outside companies which manage patient data. HIPAA consists of a few basic elements. These are the establishment of guidelines for safeguarding personal health records. The guidelines also apply to medical records known as the Privacy Rule. Another element is the Security Rule. This rule mandates businesses to implement safeguards for e-PHI. E-PHI stands for electronic protected health information. There is also a rule on breach notification under HIPAA. The rule necessitates informing the affected individuals. The individuals should be informed if there is a data breach. Ignoring HIPAA could result in major repercussions. These repercussions include penalties. They might also include criminal activity.

5. Growing Privacy Technologies

It is a challenging task to ensure data privacy. This is especially true with the constant increase in data creation. To combat privacy concerns in the era of big data a variety of creative solutions have been developed. These solutions are designed to amp up data security while reducing the risk of unauthorized use. They give consumers more power over their personal data. The application of these technologies assists companies in finding a more optimal balance between privacy protection and data usage.

5.1 Technologies Promoting Privacy: PETs

The goal is to curtail or avoid entirely the exposure of personal data during its collection, storage and processing. This is what privacy-enhancing technologies (PETs) are designed for. The emphasis is on protecting data throughout different life phases. However, utility should never be compromised.

5.1.1 Variations in Privacy

Apple, for an instance of its use, employs differential privacy. How does it employ it? It uses it for uncovering patterns of use. These use patterns are free from the act of monitoring specific users. In addition to protecting customer privacy this approach is beneficial. It helps Apple to refine its services. What services does it refine? Apple can improve services like Siri and QuickType. Benefits of differential privacy, Mathematical background is good. Anonymity of data is guaranteed. This is important. Data analysis is facilitated. The lowest possible privacy implications are there. It is perfect for companies.
Companies trying to get understanding from private information.

5.1.2 Homomorphic Encryption

Cryptographic methods exist. Homomorphic encryption is its name. This method lets calculations be done straight on encrypted data. How? By allowing for a desired output revealed via decryption of findings. There is one catch. The catch is that original data is not revealed.

An example. Homomorphic encryption is used by researchers. They examine encrypted medical records with it. They can do it without looking at underlying patient data. It maintains anonymity in the healthcare sector. Main benefits for homomorphic encryption:

- Offers computational end-to-end data security.
- Lowers danger of data disclosure in processing, caught or not.
- It is perfect for sectors. These sectors manage private information. Insurance, healthcare and finance for example.

5.2 Safe Multi-Party Computing (SMPC)

Cryptographic technique exists. It is called secure multi-party computing. This technique lets several participants collaborate on computing a result. Yet it provides this without disclosing their separate inputs. Companies often find they must cooperate on data. They do it without exchanging sensitive information. In these cases, this privacy-preserving method helps greatly.

5.2.1 federated learning

Method exists. It is SMPC-based. It is called federated learning. This method trains machine learning models. It does this across several devices or servers. It does this without moving actual data. How can it do this? It just transmits model updates. Gradients are an example of these updates. This assures sensitive data never leaves the local device. Google has embraced federated learning. It does this to better its Gboard keyboard predictions. It does this without sacrificing user privacy. How? By maintaining the training data on users' devices. This helps to prevent exposing personal information. Federated learning has several advantages:

- Reduces possibility of concentrated data leaks.
- Facilitates group learning free of data sharing.
- Ensures improved adherence to rules on data protection.

5.2.2 Zero-Knowledge Proofs (ZKPs)

Zero-knowledge proofs (ZKPs) are cryptographic methods. One party, the prover, may demonstrate the truth of a statement. This is done without disclosing underlying facts. ZKPs are useful in blockchain technology. They benefit from safe authentication and identity validation.

ZKPs for instance, can let users show they are over a given age. This is done without revealing their birthday. In this way, privacy is improved in digital identification systems.

- Benefits of Zero-Knowledge Proofs:
- They assure strong privacy free from data access.
- Benefits include being perfect for discreet data exchanges, identity confirmation and safe transactions.
- More and more often used in blockchain systems for safe transactions.

Hardware-based solutions are known as secure enclaves. They build isolated areas inside computer systems. These enclaves guarantee private data is handled in a secured environment. The environment is kept unreachable to host running systems or other programs.

Safe enclaves are made possible by technologies such as Intel SGX (Software Guard Extensions). A safeguarded environment allows companies to execute delicate operations. These operations are done privately and under control.

Characteristics of Safe Enclaves:

- Guarantee total data in use security.
- Protects information even in cases of system compromise.
- Perfect for medical documents, financial transactions and work assignments.

5.3 Blockchain and Distributable Technologies

Well-known for its distributed and immutable nature, blockchain technology has turned into a potent tool. This tool is for enhancing data security. And for improving privacy as well. The technology has a great flexibility. It can be used for various purposes too.

5.3.1 Systems for Decentralized Identity

Decentralized identity systems empower individuals. They can manage their digital identities. There is no need to depend on a centralized authority for this. These systems securely record confirmed credentials. They use blockchain technology to do so. Consider Microsoft's ION (Identity Overlay Network). It allows users to manage their identities straightforwardly. With this system, dependency on other vendors decreases.

Major benefits of these distributed identity systems are as follows:

- Centralized data leaks become less likely.
- Consumers gain more control over their personal data.
- The integrity of data is ensured. This is done through blockchain records. These records cannot be altered.

5.3.2 Digital Privacy Smart Contracts

Smart contracts are agreements. These agreements have pre-defined rules. These are entered straight onto the blockchain. They provide privacy. They provide security also. They help handle data automatically. Smart contracts let people manage access to their medical information. This empowers healthcare institutions. Patients can give doctors temporary access. They can do this while making sure illegal users are kept restricted.

Smart Contract advantages:

- Handles safe data exchanges automatically.
- Guarantees open communication. It also assures responsibility in data exchange.

6. Conclusion

Impacts of big data on the modern digital world stress the urgent need for privacy protection. Privacy tech takes a major toll. Even if these technologies give chances for great innovation, privacy is majorly compromised. Technologies give chances for customized services and better decision-making. In large companies that process tons of sensitive information data breaches are big threats. Unlawful access and data misuse are pressing problems too. Companies are at risk of losing financial stability. They also risk customer faith and regulatory penalties.

In the lack of strict security criteria companies are at risk. This is also true for privacy-centric practices. To minimize risk companies need to adopt a holistic approach. This approach should include technology policy and user awareness. The application of strong access limits helps. Anonymizing techniques help too. Data encryption is also beneficial. This can minimize potential unauthorized access. Compliance with privacy standards is vital. Standards like GDPR CCPA and HIPAA, for example. They ensure openness in the company's data collecting practices. It also gives customers control over their personal information.

Equally important, this control is a priority for businesses. An organization's ability to identify and minimize privacy issues should improve. One way to do this is through staff training. Investments should be made in this. Also, it involves developing a culture. A culture that values data responsibility.

The future success in merging big data with privacy depends on companies. Companies need to adopt a "privacy by design" strategy. In this strategy, privacy measures are explicitly included. They are put into their data management systems. Consumer trust should be emphasized. Ethical data practices need to be upheld by businesses. This will help them harness big information. They can do this without compromising their personal privacy. In relation to big data technologies, it's important to promote development. However, it's equally important to respect user rights. It's also important to maintain public trust. The harmony of innovation with ethical data management will decide these aspects.

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