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Research Article

Ai And Big Data In Digital Payments: A Comprehensive Model For Secure Biometric Authentication

Gagan Kumar Patra[1*], Shravan Kumar Rajaram[2], Venkata Nagesh Boddapati[3]

[1*]Senior Solution Architect, gagankumarpatra12@outlook.com
[2]Sr. Network Engineer, ShravanKumarRajaram@outlook.com
[3]Sr. Technical Support Engineer, venkatanageshboddapati@yahoo.com

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ABSTRACT

Biometric data, including keystroke dynamics and voice data, is being employed by banks to authenticate the identity of users making digital payments. This data is being analyzed using artificial intelligence tools to detect any fraud attempts. The biometric data of users making online transactions is compared to their previous data collected when they used mobile banking, internet banking, and other banking services. If this biometric data is found to fluctuate beyond a certain threshold, the transaction is flagged as a possible fraud. This mechanism is proving beneficial as a large number of fraud attempts are being detected in the early stages before losses amounting to crores of rupees occur. Big data, a very large set of information that is complex and difficult to manage, is being used to aid a machine learning-based fraud detection system in making predictions. Looking at the pattern of transactions already made alongside the claims of fraud against these transactions allows for past transactions to be classified as any of the two classes of predicting fraud: 'fraud' and 'not fraud'. Based on these credible past transactions, future transactions can also be predicted, and frauds attempted can be classified as 'true positive', 'false positive', 'true negative', or 'false negative'. Also, multiple decisions concerning the model of classifying fraud can be considered simultaneously if big data is employed in the machine learning model. This technology is extremely useful for banks to detect fraud early in the transaction process.

Keywords: Biometric Authentication,Artificial Intelligence (AI),Digital Payments,Fraud Detection,Big Data Analytics,Biometrics in Payments,AI in Financial Security,Payment Fraud Prevention,Machine Learning for Fraud,Secure Transactions,Data Privacy,Identity Verification,Transaction Monitoring,Fraud Risk Management,Real-Time Fraud Detection,Biometric Data Integration,Financial Technology (FinTech),AI Algorithms for Fraud,Predictive Analytics in Payments,Cybersecurity in Financial Services.

1. Introduction

Fraud detection has become a crucial activity for financial institutions within the broader context of digital transformation. Leveraging big data allows for a wide range of data sources and innovative approaches to detecting and mitigating fraud in digital payment systems. The evolution of artificial intelligence has unlocked the simply inaccessible potential of big data through machine learning. Fraud detection generally involves creating a reference dataset based on historical transactions used to develop detection algorithms. Transactions can be analyzed according to the fraud detection system rather than through deterministic rules (e.g. if the transaction has an abnormal pattern, it is identified as fraudulent). Standard languages for describing complex database queries are proposed to define data and preconditions for their digital payment systems (e.g. the ANSI/SQL standard of the American National Standards Institute). The detection algorithms are based on machine learning or pattern recognition. Fraudsters constantly adapt their methods in response to the detection systems in an "arms-race" phenomenon.

Biometric data is increasingly integrated into Artificial Intelligence (AI) systems that, through machine learning, recognize fingerprints, facial features, voice patterns, and palm shapes as unique identifiers on digital devices. Biometrics in artificial intelligence question whether planners have considered fully linking biometric data to AI systems for automatic identity recognition. The justification for closely integrating biometric data and AI systems is that both capture individuals' distinctive personal attributes. The biometric data consists of unique biological, psychological, and behavioral characteristics that make individuals easily recognizable. Digital payment systems have integrated biometric processes, such as fingerprints, retina scans, and voice patterns, as part of a broader trend to harness rich sources of contextual data for decision-making. Among this rich set of contextual attributes, biometric data is becoming readily available to a range of actors (from private businesses to governments) through various technology platforms enabling machine learning (ML). This movement is reinforced by events such as the COVID-19 pandemic and heightened security fears that drive companies and public bodies to seek biometric solutions adopted internationally. In parallel, there is increasing pressure on technology companies and assurance providers to enhance the trustworthiness of algorithmic decisions to avert reputational crises. Both universes of pressure are converging on a space - the automatic recognition of a person's identity - that raises its own set of perils, and scrutiny is warranted.

Fig 1 : Biometrics Technology in Digital Banking

1.1. Background and Significance

Over the last decade, biometrics has emerged as the most promising access control technology in many security applications, including personal mobile devices, border control, national defense, and other identification applications. Biometric recognition uses an individual's unique characteristics to identify or verify their identity, such as face, voice, fingerprinting, handprints, or iris and retinal scanners. Unlike traditional methods based on 'something the person has' or 'something the person knows,' these measurements address the problem of being lost or stolen. Biometrics as a significant security improvement is based on 'who' a person is or 'how' they behave. Regardless of the variety of biometric traits, as biometrics become popular, they could be used in place of passwords, Personal Identification Numbers (PINs), or tokens.

Digital payments are cashless transactions executed through digital channels, either online or offline. Digital payment transactions have relatively increased in recent years compared to conventional payment methods due to their convenience for customers and cost-effectiveness for merchants. Facial recognition, fingerprint, and other biometric traits provide security and convenience to digital payment transactions and thus play an essential role in information technology. The integration of biometric data with AI in the digital payment process improves customer experience and prevents possible digital payment fraud. Big data, including digital payments, customer profiles, and biometric authentication, can combat fraud in the digital payment process using various efficient models.

1.2. Research Objectives

The specific goals and aims of the study are outlined, namely: to explore whether biometric data and AI can be integrated in a digital payment application and whether such integration can foster the identification of the potential of leveraging big data for fraud detection. There are 3 research questions stated. Research contributions include implications and insights that will assist firms in the digital payment and e-identity sectors to rethink the design of their digital payment applications. This use further explores the added value of data streams beyond the historical transaction data already present in many applications, thereby enhancing the standard approaches based on Statistics and Machine Learning. Additional insights are provided into how to effectively gather, pre-process, and utilize this new data source. These contributions help to address the

emerging challenges of increasing fraud levels in digital payment applications and increasing complexity in detected fraud schemes. The outcomes of the research substantiate the growing relevance of biometry and AI to digital payments and e-identity. Growing regulatory requirements regarding the detection and prevention of fraud in digital payments push firms to develop novel approaches for fraud detection and prevention. So far, the approaches taken in the academic literature and seen in practice rely on existing historical transaction data only (e.g.,).

2. Biometric Data in Digital Payments

Technology integration of big data analytics and artificial intelligence governs real-time transactions and data analysis, providing valuable insights through extensive search and statistical modeling. Fraudulent activities can be detected, controlled, and predicted through proper monitoring of digital transactions with the help of big data analytics technologies. The extensive digital transaction data processed in a fast, affordable, and economical way will enable banks and financial institutions to keep users safe in the modern economy. Connective biometric authentication can be combined with AI and big data analytic technologies to ensure effective risk management by keeping and predicting analytics data. Biometrics accounts for approximately 20% of the global smart payment transactions currently and is anticipated to be roughly 604.49 billion dollars by 2024, with a compound annual growth rate of 18.84%.

Digital payments facilitate transactions through electronic means, such as the Internet or mobile apps. To ensure secure and authorized payment transactions, the payment channel requires adequate authentication processes during request initiation. Biometric authentication integrated with digital payment systems can offer high security. User biometric information, such as facial scanning, voice recognition, and fingerprint matching, is stored in a remote server or cloud after verification. Further transactions can be authenticated through continuous matching of biometric traits without password entry. Biometric authentication takes advantage of unique biological traits or behavioral patterns specific to an individual, making it more difficult for unauthorized users to mimic them. Biometric characteristics can provide the secrecy and privacy necessary for user identification. A biometric system has five essential units: biometric data collection, biometric template generation, database storage, biometric matcher, and decision-maker. These units are crucial for efficient biometric processing and the successful implementation of a biometric recognition system.

Fig 2 : Biometric Data in Digital Payments

2.1. Types of Biometric Data Used

Voice recognition technology recognizes human voice based on unique timbre and pitch characteristics. It can be applied in phone banking and ATMs. However, its limitations include the similarity of accent and increased use of voice recorders or impersonators. Iris recognition is based on iris texture, unique color, region, and shape. It consists of an infrared camera and is used in attendance systems. It has high speed and accuracy, but expensive initial costs, image quality requirements, and ethical concerns of information collection exist. Behavioral biometrics, which considers body movements as biometric characteristics, is cheap, acceptable, and high-speed and requires low initial setup costs.

Fingerprint recognition technology determines individual effectiveness based on fingerprint patterns. The effectiveness of this biometrics system depends on the quality of the acquired image. Most prior techniques concentrate on quality assessment, deletion, and enhancement. To achieve the robustness and reliability of the fingerprint recognition system, this needs to include quality enhancement as a pre-processing step too. Facial recognition is a biometric identification method that detects and recognizes faces in images or videos, offering advantages for high-security locations. It utilizes facial features to identify individuals and is considered a mature technology since it was commercialized in the late 1990s. Automatic identity recognition technology processes human information, such as fingerprint, speech, face, and signature, to recognize identity. Requirements include recognizing a person, unique characteristics, extracting the information automatically, and finding the person from a group.

2.2. Advantages and Challenges

The biometric data need to be collected anonymously, so the identity cannot be identified easily. Liveness detection techniques can be utilized to ensure that biometric data is being provided by a live person not by any fabricated mediums. There is a need to conduct various tests on the biometric data pre-collection phase like image quality, perception, anticopy, and reproducibility tests. Identity fingerprint templates have to be encrypted during mobile capture and should be kept secret. Templates like 1D, 2D, and 3D can be utilized in biometric systems along with large templates. There is a need to develop different templates for every payment account, as using the same template for every account is not safe. Before investing there has to be a detailed analysis concerning competitors and implementation.

Biometric data can be utilized to strengthen security in a digital payment system. Enhanced acceptance, convenience, and security were the basic advantages of biometric payment systems along with their fast processing. Biometric data concerning iris, face, palm print, voice, and fingerprint can be used in a payment system. In the latest systems, biometric data is reformatted, which means that the original biometric data is transformed into a score that can be used for authentication and matching. AI techniques can be utilized to screen huge and distant biometric data to identify fraudulent behavior concerning digital monetary transactions.

3. Artificial Intelligence in Fraud Detection

Fraud is an intentional act of deception or misrepresentation to secure unfair or unlawful gain. Fraud appears as theft in organizations (trust breach). Fraud is one of the key issues for the banking sector globally. Traditionally, fraud detection systems rely on the knowledge, control, vigilance, and guidance of fraud investigators and experts. Decision trees can determine whether a transaction is fraudulent, resulting in unexplained but statistically significant links between the chosen outcome and the attributes used for its prediction in banking transactions.

Biometrics is the measurement of an individual's physical, physiological, or behavioral characteristics. It can be divided into two categories, such as traditional (pins, tokens, credentials) and biometric security systems. Traditional methods do not address the problems of lost or stolen forms of authentication. Biometrics can also be divided into two categories: physiological traits and behavioral traits. Biometric security is a significant improvement in security because it is based on individuals' inherent or natural traits.

Artificial intelligence (AI) can analyze big data networks and biometric information to detect fraud in digital payments. AI algorithms can identify biometric patterns in transactions to examine a person's account history. Identifying unusual activities could enhance security and trust in payment systems. AI-based biometric solutions can control privacy while detecting and preventing false transactions.

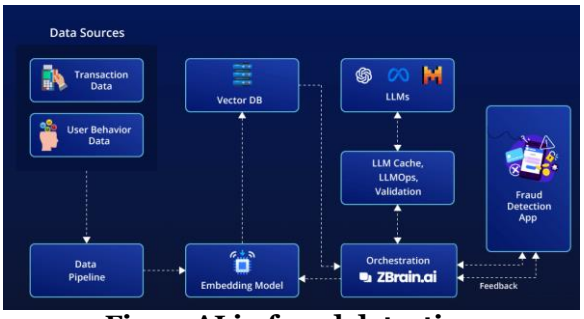

Fig 3 : AI in fraud detection

3.1. Machine Learning Algorithms

There are two categories of output results from machine learning algorithms - classification and regression. In classification-type algorithms, the output result is discrete. Based on a training dataset, the algorithm can classify the new input data into predefined categories or labels. Regression-type algorithms deal with continuous outputs. Predictions on new inputs can be made based on previous inputs and actual outputs. There is sub-categorization within these two main types. Under supervised learning, labeled data is required; here, the algorithm learns from the training data provided and then predicts the labels for new inputs. During the training phase, the predicted outputs are compared with the actual outputs. Based on this comparison, the learning model is adjusted until no learning is possible or the model is accurate enough. With unsupervised learning, the data is unlabeled; here, the algorithm attempts to detect patterns in the data provided. Two types of outcome results are obtained, - clustering (grouping of similar objects) and association rule mining (detecting random relationships between attributes).

The evolution of Internet services and online marketing has paved the way for a radical increase in digital payments. As the number of digital transactions increases, fraudulent transactions are also increasing at an exponential rate. Banks and financial institutions are required to detect these frauds and take immediate action before it is too late. Implementation of machine learning algorithms in digital payments to leverage big data for fraud detection appears to be a viable approach. Machine learning algorithms are capable of analyzing huge

amounts of data, detecting patterns in real-time, and thus making predictions on the likelihood of fraud and questionable transactions occurring.

3.2. Deep Learning Techniques

BioID takes advantage of both behavioral biometric data such as how users interact with devices while making transactions and physiological biometric data such as palm vein pattern recognition. Most of these work upscale fingerprint-based biometric data acquisition methods to integrate biometric data in the fraud detection process, which consists of two steps: a biometric verification model that identifies whether a transaction is generated by the claimed user and a fraud detection model that identifies whether the transaction is suspicious. With advances in biometric data acquisition technologies and significant improvements in deep learning techniques, methods for leveraging biometric data and deep learning have been proposed to build artificial intelligence models for fraud detection in digital payments. Digital payment fraud detection is an important application of big data analytics, as large volumes of user and payment transaction data are collected and stored by financial institutions, and fraudster habits can usually be identified through the analysis of user behavior patterns. Fraud detection is generally transformed into a classification problem where deep learning techniques help identity fraudsters through a sequence of normal transactions. Several techniques are reported in the literature to take advantage of biometric data for building fraud detection models.

4. Integration of Biometric Data and AI Payment fraud continues to be a concern with

Payment fraud continues to be a concern with expanding cardholder acceptance in recent years of direct financial loss for payment service providers and cardholders' trust in the payment system. The escalation of detected payment fraud events is associated with a transition where cardholders are presently offered the ability to authenticate alone upcoming transactions with biometric identifiers. The system can expedite the fraud detection cycle through the identification of transactions exclusively accessible within big data, i.e card payment requests connected to business partners with registered secondary cardholder identifiers, and through the necessity of inputting a personal identification number with no additional biometric data (as with regular card use). Determining payments and expediting the identification of fraud behavior appearing non-obviously to cardholder acceptance would benefit transaction chain authentication within payment service provider networks and cardholder anonymity.

Individuals utilize fingerprints, voice recognition, and facial scans to authenticate every transaction. A remarkable characteristic of biometrics is that the very trait collected for identification cannot be lost. As the system takes readings from the individual, no foreseeable alterations can occur with the biometric characteristics. Implementation of biometric data development strategies by financial companies, and nationwide regulators to protect users against fraud, can potentially support people's belonging in foreign countries with unforeseen local expenses. Still, it would test upon individuals and their cultural heritage, about ethical and privacy concerns. Widespread acceptance of card-based transactions worldwide is anticipated in the forthcoming years, as cardholder data protection is at the very heart of the payment system. Such mechanisms would also present a myriad of organizational and cross-border economic development opportunities.

The expansion of biometric data developed through POS machines, ATMs, smart devices, and other accessible venues, alongside AI technology and the potential of extensive data to detect fraud behavior through pattern assessments and rapid processing, offers forward-thinking technology-based remedies for the security of financial institutions and users alike. Digital payment systems in development have proven to be contemporary, hassle-free, and secure. Regarding fraud detection with biometrics, AI technologies can help authenticate payments via identifiers that remain unique to account holders.

4.1. Benefits of Integration

Integrating biometric data in digital payments enables streamlining the authentication of customers and focuses solely on the customer. The personal biological data of customers can be securely monitored while using the biometric method, and this would eliminate the forgetfulness of credentials, loss of cards, or theft. This is also a major trust issue on which enterprises heavily rely, and integrating biometric authentication into their platforms will build trust amongst users. This convenience can lead to higher customer satisfaction. Systems that only match the DNA of an individual could be set up. It is impossible to forget; if this is successfully implemented on a large scale and marketed correctly, many people will want to sign up for such an advanced convenience. Overall, if a business integrates biometric data, it strengthens the security of the customers and the enterprise and minimizes risks.

Automated fraud detection is one of the most fascinating benefits of using big data. Companies will have effective systems that capture and analyze data to reveal patterns that indicate fraudulent account activity. AI is being tested for the possibility of future enhancements in fraud detection. Currently, AI is being used for detecting fraud in the stock market. Behavioral analysis will indicate red flags in a transaction, and if algorithms find it suspicious, it is flagged for review. More systems that can simply alert the user and put a hold on the account until they can confirm it is them can be established. Biometric AI can analyze data collected from all sensors in real-time without waiting to review data trends collected over time. Biometric hardware can bring

advanced fraud detection. AI can easily accurately analyze data with the outcomes being a lot less likely to have false positives. Data will ensure that accounts are always monitored and that the analysis occurs continuously. Integrating biometric data and AI in digital payments brings numerous benefits, particularly in terms of security and fraud detection. Biometric data can include any physical characteristic of an individual, such as fingerprints, facial recognition, retinal scans, and more. These distinct biological features will replace traditional passwords, PINs, or any other account verification practices. Adding a layer of biometric data will ensure that only one specific user can access the account, lowering the chances of fraudulent transactions.

Fig 4 : Benefits of Financial Fraud Detection Using Machine Learning

4.2. Case Studies

The financial transaction data for the banks contains sensitive customer information spanning decades of operations. Further, the customer transaction data can be leveraged to detect fraudulent financial transactions. As these transactions exhibit a high magnitude of volume, the transaction data can be labeled as heavenly unbalanced. Although the dataset is susceptible to finance fraud, only a minute proportion of the transactions are dubious. Thus TL (transfer learning)-based methodology will be devised to accommodate the issue of imbalanced datasets with low learning validation, thereby embedding auxiliary datasets into the bank's internal learning model. Ultimately, the benefits of integrating biometric data with big data for fraud detection are considerable.

Several machine learning models have been implemented in banks across the globe to detect fraudulent transactions; however, most institutions only use one model. In the following section, various implementations at banks will be explored, with a focus on India in light of recent high-profile bank frauds. As of 2019, a list of top banks globally by misleading financing was stated. The European Central Bank stated a loss of 121 billion euros in France, while the UK banks incurred a debt of 12 billion pounds from the frauds disclosed. In 2019, India was troubled with the Punjab National Bank underwriting a fraudulent letter of credit with a debt of 20 billion dollars by the jeweler Nirav Modi. Other recent discrepancies include a 137 billion dollar loan default by the now-defunct IL&FS and a financial struggle for Housing Development and Infrastructure Limited.

5. Big Data in Fraud Detection

It is only recently that research efforts have been directed toward developing new detection methodologies on biometric data. Three areas of data mining related to biometric fraud detection are anomaly detection used to expose behavioral changes in a biometric system, prediction and risk assessment modeling biometric characteristics of the users or transactions to expose sensitive users that are likely to attack the system. Two vision-based approaches developed in the biometric domain are the use of biometrics in digital signatures to improve the security of user and signature images and the development of smart glass used to capture faces in front of it non-intrusively. Nevertheless, there has been limited research on the integration of biometrics with innovative algorithms to tackle online banking fraud payment. With the recent emergence of smarter and sophisticated mobile devices, the digital payment landscape is changing, driving rapid growth of mobile payments. Integrating biometric data with AI is vital and it is crucial to ensure that biometric data from mobile devices are handled properly to protect the privacy and security of users. Several server-based biometric data and AI are applied at the server-side and firms collect biometrics to enhance security without burdening the users or devices.

Fraud is an illegal act perpetrated by persons, persons, or groups to deceive others for self-interest. In the financial world, fraud can be considered a growing threat to any kind of transaction. For efficient financial fraud detection, the fraudulent activities must be detected timely within the transactions and must not allow such imbalanced accounts to be made every time and resources used for controlling fraudulent activities. Online card payment fraud cases are growing at a rapid pace globally with the increase in the cashless economies. This continuous growth of card payment fraud incidents creates a demand for a scalable and reliable card payment fraud detection system. Detection models used can predict the classes of unseen new data within an acceptable time frame. One approach used the transaction location data stored in the ISO8583 extended message identifier for smart cards to cluster pre-processed transaction data. Then unsupervised algorithms with possible follow-up action on clusters were applied for clusters with low cardholder activity showing a high potential in detecting card payment fraud attacks.

Fig 5 : Big Data for Fraud Detection

5.1. Role of Big Data in Fraud Detection

Fraud detection based on big data can be understood as a process of looking for patterns in a big data set. The dataset that can be characterized as big data has at least one of the following properties: it comprises a lot of records such that it is hard to process them; it is growing very quickly such that it is hard to manage it by traditional tools; it is hard to analyze such data with traditional tools. Fraud detection is by nature anomaly detection. Examples of unwanted events in the domain of fraud detection are false credit ratings of individuals (in the bank credit domain) and theft attempts in ATM installations. Fraud detection can also concern unwanted behavior of customers, such as calling customer service too often, shopping too frequently or too rarely in a particular store, etc. The domain of fraud detection is dynamically changing. Fraudsters are continuously adapting to the offered countermeasures, trying to find ways to pursue their activities. As a consequence of this dynamic character, fraud detection is by nature a learning task. If no learning is done, the system becomes useless after some time. All of the above-mentioned properties are related to data. Meaning, that all of the abovementioned properties can be modeled using data.

Transactions involving non-cash payment instruments are growing at a faster pace than cash transactions. Electronic payments refer to payments made in digital form without the exchange of checks or currency; they are processed without human intervention and can be made across the globe. Card payment fraud includes fraudulent e-commerce transactions made using compromised cards or fake cards. Although card payment fraud is a small percentage of the total number of card transactions, the total monetary loss is significant.Fraud detection in the realm of big data involves identifying patterns and anomalies within vast and complex datasets that exhibit characteristics such as massive volume, rapid growth, and challenging analysis. This process is crucial for spotting fraudulent activities like false credit ratings, ATM theft attempts, or unusual customer behaviors such as excessive service calls or erratic shopping patterns. The dynamic nature of fraud, driven by the ever-evolving tactics of fraudsters, necessitates a continuous learning approach to maintain the effectiveness of detection systems. As electronic payments—transcending cash transactions in both frequency and scope—become increasingly prevalent, the need to combat card payment fraud grows. Despite representing a small fraction of total card transactions, card payment fraud incurs substantial financial losses, underscoring the importance of advanced fraud detection mechanisms in safeguarding digital transactions and financial systems.

5.2. Challenges and Solutions

Personal biometric information is sensitive, allowing the identification of an individual through its physical or behavioral features. Biometric data is unique to an individual and cannot be modified, raising challenges in data privacy and security, especially when integrated with AI algorithms to obtain a more complete view of the users. To comply with laws such as CCPA or GDPR, data must be anonymized before storage. The integration of biometric data in digital payments must also address concerns regarding compliance with existing regulations, which only apply to non-biometric data. Recently, there has been development in privacy-preserving biometric identification that can be used for anonymizing biometric data, including secure multi-party computation (MPC) protocols tailored to face recognition or the generation of cryptographic hashes from biometric data. National regulations must also follow regarding the storage and processing of biometric data, with general compliance rules allowing the adaptation of current data storage and processing infrastructures. AI is currently being utilized most in marketing operations and user experience optimization in digital payments; however, it can also be utilized in fraud detection. There are several challenges in the integration of biometric data in AI algorithms. Little attention has been paid to understanding the data distribution regarding this new kind of fraud.

A 2022 survey highlighted that around 88% of financial organizations suffered more than 10,000 fraud attempts per month, a 25% increase in comparison to a loan approval gamble. As the number of fraud attempts rises, it becomes increasingly necessary to integrate biometric data and Artificial Intelligence (AI) in digital payments for fraud detection. By providing a new view of potential fraud in digital payment systems, biometric data enhances fraud detection capabilities. A large amount of this biometric data must be effectively leveraged to improve fraud detection by AI algorithms. The focus of this discussion is on addressing the challenges and providing solutions for leveraging big data for fraud detection in digital payment systems, specifically relating to biometric data integration.

6. Conclusion

As different frauds would have different data sources and usage patterns, it is advisable to carefully analyze the datasets before selecting the ML and AI models. Artificial intelligence models have a specialized advantage as they can note a combination of patterns across multiple data parameters. Based on the ongoing advancement in the biometric industry, extracting, utilizing, and analyzing biometric data of individuals at the point of transaction has significant potential to become the next standard in digital payment systems to mitigate fraud. Fraud detection is a system used to mitigate the risk and prevent the financial institution from losing the hard-earned money of the customer. A fraud detection system is a gatekeeper of the overall payment ecosystem, which checks, verifies, assesses, and analyzes any fraudulent activity. In traditional systems, various parameters and attributes are used to check for any probability of fraud. Given today's highly digitized ecosystem, a need has arisen for modern fraud detection systems that assess and analyze borderline cases on an intricate level.

The financial sector as a whole has seen a complete transformation in favor of a more digitally accessible lifestyle. One of the major outcomes of this transformation is the evolution of the payment ecosystem. Today, digital wallets, as well as contactless and cardless payments, are an integral part of any consumer payment experience. Several companies like Apple Pay, Google Pay, Amazon Pay, and Samsung Pay have already embraced the truly digital payment solution through modern days of Near Field Communication as well as Biometrics verification. Nevertheless, due to the complete digitalization of financial services, the financial sector must have an elegant and robust fraud detection system in place.

6.1. Future Trends

This paper also discusses future trends in a world where the integration of biometric data and AI in digital payments is massively expanded, including inevitable challenges that lie ahead. Digital payments are continuously gaining traction and are predicted to be the most common method of payment in the future, further accelerated by COVID-19. Examining future trends is increasingly relevant and concerns the industry, academia, policymakers, civil rights organizations, and society. The results shed light on specific emerging technologies and anticipated advancements in biometric authentication and AI in combating payment fraud.

The threat of cybercrime and payment fraud is increasing dramatically, and the future of digital payments may see cybercriminals harnessing the power of AI for their benefit. These cybercriminals can target an organization's financial integrity, stealing millions or even billions, figuring out critical password vaults, and later targeting individuals, banks, or perhaps even governments. Payments could consist of delicate biometric traits such as fingerprints or iris, which would create new challenges for the security of a system. New use cases in privacy-preserving AI to avoid model poisoning and protect against inversion attacks may be developed. Moreover, the regulatory landscape is continuously evolving, with an emphasis on privacy and transparency.

The future holds promising trends in integrating biometric data and AI in digital payments, with a particular focus on leveraging big data for fraud detection. Biometric payment authentication, using a person's unique physical characteristics for identity verification, is gaining popularity due to its seamless and secure nature. Future trends in biometric payment authentication include the emergence of smart wearables integrated with biometric technology for hassle-free payments. Companies may also invest in developing AI-driven biometric authentication tools for fin-tech apps, enabling merchants to verify customers' identities with just a selfie using face recognition models trained with proprietary datasets.

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