



A Comprehensive Study of Artificial Intelligence and Cybersecurity on Bitcoin, Crypto Currency and Banking System

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Abstract

In recent years cryptocurrencies are emerging as a prime digital currency as an important asset and financial system is also emerging as an important aspect. To reduce the risk of investment and to predict price, trend, portfolio construction, and fraud detection some Artificial Intelligence techniques are required. The Paper discusses recent research in the field of AI techniques for cryptocurrency and Bitcoin which is the most popular cryptocurrency. AI and ML techniques such as SVM, ANN, LSTM, GRU, and much other related research work with cryptocurrency and Bitcoin have been reviewed and most relevant studies are discussed in the paper. Also highlighted some possible research opportunities and areas for better efficiency of the results. Recently in the past few years, artificial intelligence (AI) and cybersecurity have advanced expeditiously. Its implementation has been extensively useful in finance as well as has a crucial impact on markets, institutions, and legislation. It is making the world a better place. AI is responsible for the simulation of machines that are replicas of human beings and are intelligent enough. AI in finance is changing the way we communicate with money. It helps the financial industry streamline and optimize processes from credit judgments to quantitative analysis marketing and economic risk management. The main goal of this research has been investigating certain impacts of artificial intelligence in this contemporary world. It's centered on the appeal of artificial intelligence, confrontation, chances, and its influence on professions and careers. The research paper uses

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AI to enable banks to generate financial resources and to provide valuable customer services. The application of the growing Indian banking sector is part of everyday life made up of several banks like RBI, SBI, HDFC, etc. and these banks have digitally implemented using chat-bots that have brought benefits to the customers.

Keywords Artificial Intelligence · Cybersecurity · Banking

1 Introduction

Data Science is a versatile site that uses technologies, techniques, algorithms and systems to extract information and data from acoustic, systematic and unstructured data, and uses applied information and techniques from the data. from different systems. Under the umbrella of Big Data Survival information, which is camouflaged and irreplaceable, inspires some researchers and users with the right skills to further develop today's data capacity, science is supported by advanced artificial intelligence (AI) technology [1, 2]. Big data is a cluster of complexity, diversity, enthusiasm, and potentially high-value information that is arduous to process and analyze in a reasonable amount of time [3]. Machine learning has also bestowed to ameliorate voice, speech and image recognition, as well as in autonomous vehicles. Machine side Learning is deep learning that is clearly patterned along the path of neuron sequences and synapses in the brain change as they open up and try to balance new inputs; sometimes such deep learning could allow a machine to train they perform better than their human peers [4]. AI is responsible for the simulation of machines which are replicas of human beings and are intelligent enough to work or think as brilliant minds without the interruption of humans [5]. In fact the world has become smarter and innovative by acquisition of AI [6]. The statistical understanding of what is also known as intelligent behaviour is concerned with it [7]. Term Intelligence basically means that the potential to inherit and apply various comprehensive skills and awareness to decode a given task or issue. It involves both Human and Artificial Intelligence. The growth of the intellectual machine has basically been studied over the last ten years. Here layout, problems, reasoning and learning operations are performed on the critical human intellect [8]. Its evolution has become the hub to elevate performance of all the existing technologies and the rise in Industries [9].

Today AI is a dominant sector for research in various fields like Transport, Security Surveillance, Engineering, education, medical, business, accounting, finance, marketing, economics, stock market, Agriculture, Sports and so on [5]. Because of all these aspects AI has a vast domain of application in our daily lives such as path mapping by Google Maps, estimating the rate of trips by Uber and Lift, tagging suggestions from friends on Facebook, spam folders in our emails, shopping online and cancer screening recommendations. The overall progress which is ascribed to AI, is responsible to ease human–robot interplays, swap the philosophy of work models, plus Transfigure the style of living standards of humanity [6]. The crucial role of the AI field is to give rise to the complete autonomous intelligent agents that interconnect with their surroundings, which look out for quintessential behaviours, ameliorate over time through trial and error, like humans. It has been a well-established challenge, ranging from

robots able to recognize and respond to their surroundings, to entirely software-based agents, that can interconnect with unrefined dialect multimedia. Artificial intelligence has impacted the economy and society as a whole by expeditious advances. Serving the new objective as a “method of discovery” can have an even greater impact as it is responsible for redesigning the essence of the innovation process and the organization of research and development. Various models have certain algorithms like: Immune/safe, Fuzzy, Decision Tree, Genetic/hereditary, Particle Swarm, Neural Network/Chain, Deep Learning, etc. come under AI’s work list [10]. According to Mr Griliches, by permitting innovation over countless applications, the “invention of a method of invention” has the capability of influencing a much more expansive economy than establishment of any single new product [11]. AI also encourages day-to-day economic growth by encouraging the growth of new buyer’s markets and rectifying current buyer’s markets through research and innovation [6]. As it is known that data security is meant to safeguard the data from unsanctioned access in its whole life process. Over the time, data has set off to be a very crucial asset for firms in almost every sphere. They are crucial to organizations related to the information technology industry, including companies, governments of countries, medical centers, education, engineering sectors and for many others. It is estimated that of all the source material recorded in anthropoid biography, 90% have been generated in the conclusive couple of eras. Data encryption, hashing, tokenization, and key management practices are the main aspects of data security. These aspects secure data across all applications and platforms. From the huge quantity and range of information available, corporations are eager to draw out more profitable details. So, to examine and preferably understand this data, the latest analysis criteria came into sight to be available for private as well as for public well being, and this was Big Data. Humans generated 5 exabytes of knowledge within the year 2003 is equivalent to the quantity of data at the moment created in a span of two days. So, With the rise of social platforms, intermedia and the Internet of Things (IoT), an uninterrupted stream of knowledge is generated, and this trend of increasing the amount and details of information accumulated via corporations will not reform in the near future. We exist in the era of Big Data. We tend to square measure current in the age of Big Data. The main four completely various conditions of Big Data security are information privacy, infrastructure security, information management, integrity and reactive security and infrastructure security. Every latest disruptive applied science which is disordered brings along new problems. And the issues in the case of Big Data, are associated with the quantity/range of information, data trait, data security, information encryption and data seclusion. As well as creating new data, which needs to be newly approached, big data also expands the scale of privacy and security challenges as they focus on conventional safety arrangements. Therefore, the security of big data has become one of the major obstacles to slowing down the rise of technology. In addition, big data, without adequate security assurances, does not provide the required certification. It is responsible for huge liability [12]. As we all know these days cybersecurity is one of the significant needs of the world because these threats are very hazardous to the country’s security due to high internet penetration. More awareness should be spread by the government along with the citizens to always update their systems and webbing security settings and to

use proper antivirus so that the system and networking security settings stay virus and malware-free.

The main motive for the work is because of the increasing trading and digitalization of cryptocurrencies and banking sector. In the modern era because of digitalization people have started accepting cryptocurrencies as digital currency and also the need for data security in the field of finance motivates researchers to work in this field. AI is the effective solution for that purpose because of its human-like working behaviour and it is an emerging aspect in the field of finance. The paper discusses issues and solutions related to data security followed by various AI techniques for prediction of cryptocurrency behaviour. In the other part of the paper it discusses customer service and risk management in the banking sector using AI/ML algorithms. Also, some of the challenges and future scope in the field of cryptocurrency behaviour prediction and security in the banking sector have been discussed. At last, The final conclusion of the work carried out has been discussed.

2 Advanced Technology in Bitcoin, Cryptocurrency and Banking System

A new challenge has been developed for present-day organizations or businesses, to protect their body from cyber attacks. In this era of the rapid increase in the use of the Internet, there has also been an increase in attacks in various areas. Engineering science that is accessible to safeguard corporations from cyber threats to keep their flow of operations straightforward.

Above Fig. 1 showcases the various steps about the flow of IOT sensors in organization levels, analysis level, visualization level and at last the action level.

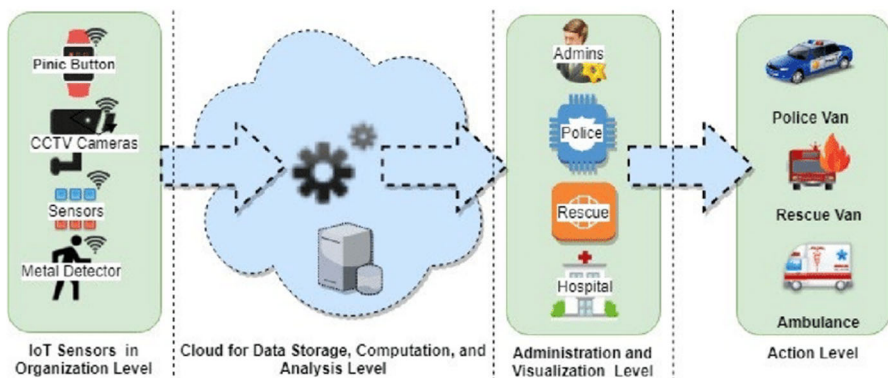


Fig. 1 Smart security framework

2.1 Security Technologies

Various technologies are available to safeguard organizations from online attacks. These technologies prevent such malicious attacks mentioned below

- (1) **Data Loss Prevention:** It can be interpreted as a technology affiliated to the identification of the information conveyed by the firm that is fragile and sufficient to be a blockade to the profession. Frequently, information is conveyed along the way of emails, and under this security technology, emails are examined to make certain that it does not keep privileged data out of the corporation.
- (2) **Intrusion Detection System:** An Intrusion Detection System which is also known as IDS, can be interpreted as the technology which keeps a track of all the traffic that enters the organization to make sure that those are not malicious. It can also be contemplated as a tool accountable for scrutinizing the traffic and uplifting the alert in case the traffic appears to have originated from the untrusted source or is found malicious.

In the above Fig. 2 shows IDS, that is an application that figures out a network. for venomous activity or policy violations.

- (3) **Intrusion Prevention System** Intrusion Prevention System commonly known as IPS can be interpreted as the system or device that takes crucial measures in opposition to traffic tagged as wanton by IDS. Normally, packets are discarded by IPS

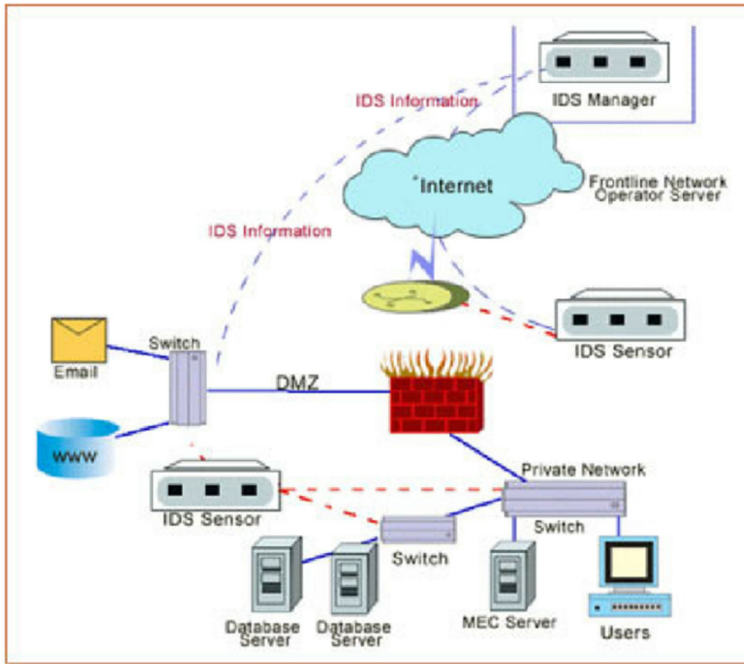


Fig. 2 Intrusion detection system

- that are entering the device once it is esteemed deceitful. The chief surveillance point is to ensure that wanton traffic should not enter the corporation's meshwork.
- (4) *Security Incident and Event Management* It is also known as SIEM. This is primarily concerned with implementing or quoting alerts if anything unfamiliar is found on the corporation's webbing. Multiple devices can be integrated into SIEM to ensure that anything malicious should generate an alert. This is important so that the security team can act against it and keep the internal domain intact and secure. Along with ensuring the security of the network, it is also responsible for keeping track of the logs that are generated. It is also seen as a central system with other equipment/devices connected to it.
 - (5) *Firewall* It functions as the foremost layer for surveillance of any system or device. Several types of firewalls are there for example: To safeguard the net, network firewalls are used. It is built to ensure that the interior lattice is safeguarded from eccentric traffic.
 - (6) *Antivirus* Antivirus is another mechanization used in cybersecurity. Its task is to protect the system from the virus. It is positioned in the network as endpoint protection. To protect oneself from virus attacks, all the devices connected to the network can have an antivirus installed in them.

Blockchain technology is predominantly known for its crucial characteristics of fragmentation, tenacity, confidentiality, and testability. It can significantly save fares and ameliorate capacity with the help of these characteristics. Blockchain is also considered a public ledger. It contains a list of blocks in which all bound transactions are collected. This chain continues to grow as new blocks are added to it regularly [13]. Since this technology of blockchain has been highly accustomed and analyzed, a wide variety of information is found in the content hosted on occupancy forums such as companies' websites, web articles, etc. [14].

Above Fig. 3 explains how blockchain works step by step from the users request for transaction till the transaction gets verified and executed.

Here are some challenges and recent advances:

In the face of enormous prospects of blockchain, it experiences various obstacles that in turn bound its broad usage. Here are some of the utmost challenges and contemporary advancement.

- (A) *Selfish Mining*
It is gullible to attacks from the complicity of selfish miners. In particular, it is shown that the lattice is impuissant, even though only a miniature fraction of the hashing power is used for deceiving. When it comes to selfish mining strategy, the selfish miners keep their mining blocks without any broadcast or publicity, and the private branch is usually notified to the public only if certain conditions are met.
- (B) *Scalability*
The blockchain is becoming hefty bit by bit as the magnitude of the transaction is expanding. Each junction must accumulate each and every proceedings to be legalized on the blockchain as they must inspect whether the root of the present proceeding has been depleted or not.
- (C) *Privacy Leakage*

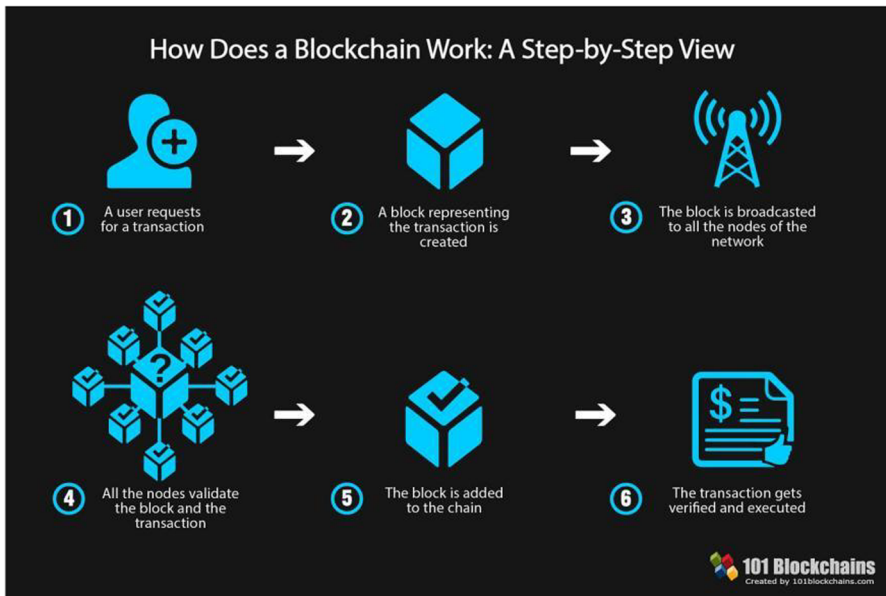


Fig. 3 How a blockchain works

It can maintain a precise proportion of clandestineness through public and private keys. End users negotiate with their private key and public key without any factual identity threat [13]. In this surplus of blockchain-based uses and studies, there is growing confidence in the durability of the applied science of blockchain. Scalability and consensus are areas of data-rich analysis to make blockchain more flexible for large-scale businesses [14].

The Internet can be described as a transmission network that connects individuals to data. On the other hand, the Internet of Things (IoT) is an interconnected process of unique addressing that enables physical objects with different degrees of sensing, processing, and execution capability to interoperate and transmit via the Internet as a junction share the ability [15]. In the developed field of economic and industrial development, IoT has also shown its peak value and potential. Moreover, in the stock exchange and trading performance, it is being tested as a revolutionary step. Nonetheless, the security of data and information is a vital issue and eminently enticing. It is an extensive challenging issue to deal with.

Above Fig. 4 showcases building IOT network sensors at low cost.

Hence, the Internet of Things (IoT) is an emerging prototype that provides services to connect electronic devices and sensors via the Internet to make our lives easier. Moreover, IoT uses the Internet and smart devices to provide innovative solutions to many challenges and issues related to many commercial, government, and public/private industries across the globe [16]. One of the specific advanced implementation areas of IoT is the smart city which also includes smart homes. IoT-enabled kitchen appliances, central AC/heater burner, TVs, sound/videotape streaming gadgets, and surveillance

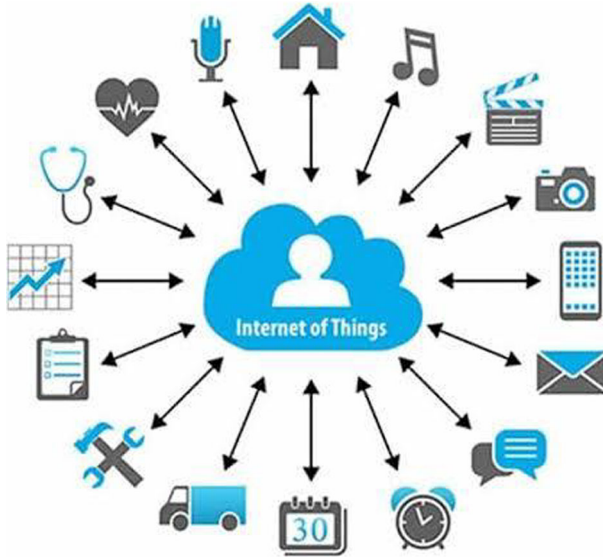


Fig. 4 Internet of Things

systems to supply the finest of support, shielding, and scarce energy utilization are included under the smart home. All of these conveyances are done through IoT-based medical control using the interweb [16]. It is progressively being contemplated as the succeeding instant for the enlargement of the interweb. Hence, affixing straightforward devices to the net in order to attain innumerable discrete goals will be made possible through these means [15].

3 Cryptocurrencies Price Prediction Using Artificial Intelligence and Advanced Technology

Cryptocurrencies are becoming more popular nowadays, Following rapid growth and popularity. Digital coins like Cryptocurrencies are highly profitable investment tools and they are capable of generating huge profits when investing in cryptocurrency exchanges all over the world. As a fast-growing segment of the crypto market, the ability to conduct exchange interactions is very popular, and AI-based smart systems automatically exchange cryptographic resources by paying an attractive salary to their owner. Bitcoin is the most popular and well-known cryptocurrency in the world and its basic structure was the same as in 2008, but the global market is changing and new demand for cryptocurrencies is getting high compared to their initial performance. A major benefit of cryptocurrency is that consumers are able to exchange value digitally without third-party management. A cryptocurrency solution works on principle with a network of computers by analyzing transactions, users will be able to exchange as if they were corporate currencies. There is a finite number of bitcoins that will be available and a total of 21 Million Bitcoins that can be mined. The world's largest

bitcoin processor, BitPay, has recently increased its trading rate by 110% over the past 12 months. An increase in business is an indication of an increase in customer acceptance. Bitcoin is currently experiencing increased consumer acceptance and demand. The adoption of cryptocurrency will be an important topic to look at in the future, as it could be a truly transformative technology that will change the way money is exchanged around the world [17].

Nowadays, Machine learning and artificial intelligence are actively used to analyze traditional financial markets. Technological developments can be programmed to replicate and simulate human actions and human thinking. This will enable them to perform human work. Artificial intelligence has been used to refer to devices that mimic human-like behaviour. Machine learning is part of artificial intelligence where machines can automatically learn from input and output data and find a way to convert it to new data. Machine learning brings AI tools to the point where they no longer require human intervention. A subset of machine learning, deep learning is a symbol of human brain function. Learning in AI, the learning system collects the data and automatically learns about the data without human assistance and this data may be random or already patterned. Cryptocurrency developers are following this approach in developing the framework: Blockchain Network. They test the extent to which they can repair cryptocurrencies like the total number available, the maximum that can be mined to create a cryptocurrency framework, and the system. Artificial intelligence continues to support human software developers at all stages of the development lifecycle. By using AI methods Information-enabled robots mimic human information by performing human tasks and activities without human intervention. The AI tool collects data from various streams and comes up with a framework for hosting the cryptocurrency. Cryptocurrencies with AI power are no different from standard man-made crypto. The only difference is that AI-capable cryptographic systems are developed by human measurement work, while humans create human cryptocurrencies through manual methods. In creating the framework for cryptocurrencies, the AI method validates the features and limitations of cryptocurrencies, as do human scripts by collecting and analyzing crypto-related data from multiple sources and making self-decisions on scripting, code, and programming for processes. Most cryptocurrencies operate on the blockchain system. Cryptocurrency and Artificial Intelligence are both advanced technology developments and they have their own varying degrees of difficulty. However, they can both work together for the benefit of each other in the world of technology. The combination of artificial intelligence in the development of cryptocurrency and blockchain will advance data processing and take it to greater heights. Integrating machine learning through artificial intelligence into cryptocurrency development systems can help improve blockchain infrastructure and increase scalability.

Ganapathy and Neogy [18] carried out a brief study on cryptocurrency and its related terms and importantly discussed AI-based cryptocurrency price emulators. Cryptocurrency has volatile nature in the market so it is not easy for someone to predict its accurate price that an AI-based price emulator has been proposed which takes into consideration the data related to history, cryptocurrency-related tweets, current market trends to predict the future price of the cryptocurrency. Further, it will use machine learning concepts for handling large data without human intervention.

This emulator helps many investors, traders, and cryptocurrency holders to improve their decision-making speed and minimize investment risk.

Bitcoin price prediction for the next day has been carried out by [19] using AI methods. For this work, the paper proposed a combined method of Ensemble Empirical Mode Decomposition (EEMD) and deep learning method Long short-term memory (LSTM). For this work, a dataset from the research team of Sun Yan-sen University has been used which contains data of bitcoin-related to price and volume from August 2015 to March 2019. Here EEMD is used to distinguish high frequency and low-frequency components and LSTM is used to predict next-day bitcoin price. In this work 70% of data has been used for training purposes, 15% data for verifiers, and the remaining 15% as testing data. The predicted output for next day Bitcoin price is not that much enough so this work will be carried out in the future by powerful models and by retraining the model.

Koker and Koutmos [20] proposed a model based on reinforcement machine learning for cryptocurrency trading. For this study [20] used data from 26th August 2015 to 12th August 2019 with 1447 sample points, and also the data of the five largest cryptocurrencies have been taken into consideration. Here they compared the direct reinforcement model with the buy and hold approach. The results indicate that in terms of cumulative returns and risk-adjusted returns the DR model outperforms the buy and hold approach except for Ethereum. Also, this Direct reinforcement technology performs well with Bitcoin. Also in terms of reducing risk, the DR model again performs well as compared to Buy and hold approach except for Monero and Ethereum.

A study proposed a neural network-based model for Bitcoin option pricing and also compared its results with classical models like Monte Carlo simulation, tree model, and finite difference model. For this work data is taken from deribit.com and data was collected from 16th May 2018 to 15th July 2018 and has been used on a daily basis at 11:00 UTC. Here from the results, it can be said that the neural network outperforms any other classical model because it has the ability to deal with the nonlinearity and complexity of the option pricing market and cryptocurrency market. Also, it can be noted that conventional pricing methodologies that Bitcoin options are overpriced whereas applying the designed neural network model can represent real dynamics of a Bitcoin options price.

Madan et al. [21] carried out predicting signs of future Bitcoin price change and for this purpose [21] uses machine learning algorithms such as Support Vector Machine (SVM) and Random Forest. For this research work, a dataset consisting of 25 different Bitcoin-related features has been used from five years of daily basis data. The first phase of the work to predict the daily sign of future Bitcoin price change has achieved an accuracy of 98.7%. In the second phase data with 10 min and 10 s time intervals has been used and from the results, it can be said that 10-min interval data has better sensitivity and 50–55% accuracy than 10-s data. Also, 10-min prediction for signs is more useful to make buy/sell decisions as compared to 10-s data.

Zbikowski [22] used machine learning algorithms for Bitcoin trading. For this experimental work, they used data from the Bitstamp website, and data from 9th January 2015 to 2nd February 2015 has been taken for study. Dataset consists of 2221 samples. This work [22] compared three different algorithms: exponential moving

average, Box SVM and Volume-Weighted SVM. Among all algorithms, VM-SVM achieved the highest rate of return of 33.58% which is 23% over Box SVM.

Sebastião and Godinho [23] carried out prediction of three cryptocurrencies which are Bitcoin, Ethereum, and Bitcoin, and for this work [23] proposed machine learning approaches based on Linear models, Random Forest (RF) and Support Vector Machine (SVM). For this study purpose data collected from 15th August 2015 to 3rd March 2019 have been taken and data from 13th April 2018 have been considered for testing data. Results say that Ensemble 5 has achieved the best results with Ethereum and Bitcoin with Sharpe ratio of 80.17% and 91.35% and with returns of 9.62% and 5.73% respectively.

Souza et al. [24] proposed some techniques to check how Artificial Intelligence-based machine learning techniques perform in Bitcoin price prediction. For this study [24] used data on a daily basis of Bitcoin, gold, and silver in the dollar from Bloomberg and dataset goes from 7th May 2012 to 4th May 2017 and it has a total of 1302 data points containing details about high, low, open and close prices. Also, gold and silver data goes from 16th April 2012 to 4th May 2017 with 1272 data points. Machine learning techniques that are used in this paper are Artificial Neural Network (ANN) and Support Vector Machines (SVM). Results show that both techniques have better results for Bitcoin. However, SVM is good for someone with risk aversion and whereas ANN has good for abnormal returns for short-run periods but with higher risk.

Bitcoin price prediction has been carried out by [25] using a new approach to use data of other cryptocurrencies. Different machine learning approaches are implemented to find the best-fit approach and also the concept of cointegration is used. Basically, cointegration works by using different cryptocurrency information to predict Bitcoin price. Here in this paper, three cryptocurrencies (Ethereum, Zcash, and Litecoin) pieces of information were used. Data of the four cryptocurrencies Bitcoin, Ethereum, Zcash, and Litecoin were collected from 1st April 2018 to 31st March 2019 from coinmarketcap.com. Using Bitcoin as a stable base for cointegration and other three cryptocurrencies were studied in four stages. Results show that Zcash had the most similarity with Bitcoin and as a result, Zcash price and information can be used as a predictor for Bitcoin price prediction.

McNally et al. [26] and Awoke et al. [27] use deep learning models to augur the worth of Bitcoin. (McNally et al., 2018) uses reformed Recurrent Neural Network (RNN) and Long Short Term Memory model (LSTM) for Bitcoin price prediction and also compares with ARIMA model. The Bitcoin data set has been used from 19th August 2013 to 19th July 2016 and the data set has been standardized with mean 0 and standard deviation 1. The paperwork says that LSTM performs slightly better than RNN and reaches the highest accuracy of 52% and RMSE of 8%. Whereas (Awoke et al., 2021) use the Long Short Term Memory model (LSTM) and Gated Recurrent Unit (GRU) as deep learning models and compare their performance. Data set applied for this work comprises daily price worth from 1st January 2014 to 20th February 2018 with attributes like opening price, low price, high price, closing price, and the market cap of outstanding shares. The result of the comparison between two deep learning models says that the GRU model has better performance and is more appropriate for time series data of the highest price whimsicality as compared to LSTM.

Yiying and Yeze [28] and Rayhi [29] carried out cryptocurrency price analysis using some Artificial Intelligence techniques. [28] uses Long Short Term Memory model (LSTM) and Artificial Neural Network (ANN) for analysis of different cryptocurrency prices. The dataset used for this study has been taken from the blockchain.com website and it has a total of 1030 samples from 7th August 2015 to 2nd June 2018. In this study, the price of three cryptocurrencies Bitcoin, Ripple, and Ethereum have been analyzed. Dataset was divided into 80% for training data and 20% for testing data. Results show that ANN models require more long-term data whereas LSTM can be performed well with short-term data. Although the results of both the models have similar accuracy with enough data. [29] uses many methods for cryptocurrency analysis like Moving average, linear regression, Auto ARIMA, KNN, and LSTM. Dataset for the research work has been taken from Kraken platform and exchange values of BTC/USD, BTC/EUR, ETH/BTC, ETH/USD, ETH/EUR, LTC/BTC, LTC/USD, LTC/EUR, XRP/USD have been taken out. Among all methods, results show that LSTM gives the best performance with RMSE value than any other method.

4 Challenges and Future Scope

In the context of cryptocurrency, the main limitation is its very high price fluctuations and it is therefore hard to predict the exact price in particular for short-term prediction but it can be further reduced by advanced techniques with more data and with some more parameters. Another challenge for Artificial Intelligence techniques with cryptocurrency is that it is relatively new to the market since it is first introduced in 2009 as compared to the traditional stock market so lack of information related to cryptocurrencies with high price fluctuation makes it hard to predict better results for cryptocurrencies. A potential critical threat to digital cryptocurrency is that it can be hacked, erased, or misused by hackers. These types of limitations may be overcome by using very advanced technologies and making these digital currencies very safe by using technologies that are hard to hack. Further, its model performance can be increased by reducing noise in the dataset and also by considering different aspects with fine functionality so as to increase the performance of the model [30]. Cryptocurrency can be helpful for an unbanked individual to overcome bank-related problems because in developing countries many people are not connected to a bank so the transfer of cryptocurrency can be made using a simple mobile application and using QR Code scan because most of the people have access to mobile and also this type of transaction requires advanced technology and network for security and efficiency [17]. Another scope in the domain of Artificial intelligence in cryptocurrency is that also one can extend it to sentimental analysis for perfect prediction of cryptocurrency fluctuations because cryptocurrency prices are more dependent on sentiments and data can be gathered from Twitter or any other tool for sentiments and also improve the model by using high neural networks for better performance [31] (Table 1).

Table 1 A comprehensive study on cryptocurrencies price prediction using AI

Sample period	Algorithm	Method	Application	Accuracy	Aim	Reference
Different 5 cryptocurrencies data has been taken between 2013 and 2018 and divided into training and testing dataset	Machine learning, SVMs, ANNs, deep learning	Data Acquisition	Artificial intelligence, machine learning	SVM outperformed other classifiers with the accuracy of 95.5%	cryptocurrency forecasting using machine learning algorithms	[32]
-	Big data and CC	Block chain technology	For security enhancement	90%	Information on Cryptocurrency, Blockchain and Big Data	[1]
Step-1:- 5 consecutive set of 2200 values are used from 1st March, 2020 to 8th March, 2020 Step-2:- 2 set of 5500 values are used from 1st March, 2020 to 8th March, 2020 Final step:- whole dataset of 11000 values are used from 1st March, 2020 to 8th March, 2020	Artificial intelligence	Back propagation neural networks	AI to bitcoin course modelling	90% for train neural networks, 10% to estimate forecasting accuracy	Bitcoin Course Modelling And Application Of AI	[33]

Table 1 (continued)

Sample period	Algorithm	Method	Application	Accuracy	Aim	Reference
–	AI	Autonomous Ethically Guided Cryptocurrencies (AEGCs)	To grow human moral values and advancing money	–	Sensitive Cryptocurrency: Using artificial intelligence to develop currencies that promote human ethical values	[34]
March-2019 to Dec-2020	ANN and RF	Auto trading strategy	Machine learning for trading applications	–	Approach to Securities and cryptocurrency Trading using Analytics Data Analysis and Artificial intelligence	[35]
June-2015 to Aug-2016	CNN with deep reinforcement learning	repulsive	–	–	Deep Reinforcement Learning and Portfolio Management of Cryptocurrency	[36]
Sep-2011 to Oct-2017	PATSOS- a hybrid neuro-fuzzy model	Categorization and repulse	To forecast the direction in the change of the daily price of Bitcoin	Achieved the rate of return of 37.34% for Bitcoin trading which is 71.21% higher than conventional methods	Predicting the value of Bitcoin with strategies	[37]
–	AI through machine learning and deep learning	Block chain network	AI driven crypto currencies	–	AI driven by crypto currency	[38]

Table 1 (continued)

Sample period	Algorithm	Method	Application	Accuracy	Aim	Reference
April-2013 to Mar-2018	NARX neural network	repulse	Main application is to forecast daily Bitcoin returns	Mean Squared Error (MSE) of 0.00142	Forecasting Bitcoin Price using Genetic Algorithm and NARX Neural Network	[39]
-	Machine learning	Novel retraining	-	78%	Discovering price formation in cryptocurrency markets with machine learning	[40]

5 Customer Service and Risk Management in Banking System Using AI and Cyber Security

"AI is the rearmost formation for humankind," is nicely penned by Swedish thinker Nick Bostrom in one of his books named 'Super Intelligence'. In the twenty-first century, almost every field has been affected by the stages of clinical diagnostics, robotics benchmark, deflection, pedagogy, wellness and commerce, AI management, and modern disruptive electronic exchange. Computer-based intelligence has made its standard felt among various fields because of its potential to help customers expand. It authorizes customers to settle on swift and progressively educated choices with inflated productivity. Artificial intelligence in the banking sector makes banks more effective, reliable, supportive, and to covenant. It is the proficient brim of modern banks in this digital age. The impact of artificial intelligence in the banking sector, reduces operating costs, customer service and improves automotive procedures.

AI not only empowers banks by automating their knowledge workforce, but it also makes the entire automation process smart enough to address competition and cyber risks.

It continues to evolve and be innovative over time. AI is an integral part of the bank's processes and operations. It enables banks to better leverage human and mechanical capabilities to improve operational and cost efficiencies and provide personalized services. All these benefits are no longer a vision of the future for banks. By embracing AI, banking industry leaders have already taken due diligence to reap these benefits.

Moreover, AI has the power to predict future scenarios by analyzing past behaviours. Some of its notable features are:

- (1) **Successful Decision Making:** Bankers use these coherent systems that anticipate and riposte like a human connoisseur, providing excellent solutions based upon information accessible in real-time, for tactical decision making. These structures maintain a storehouse of expert data in their databases called knowledge databases.
- (2) **AI gains a better understanding of customers and behaviors based on past interactions.** It enables banks to generate financial resources and results by combining personalized services with transparent exchanges to provide valuable customer engagement and strong relationships with their customers.
- (3) **Direct communication:** Chatbots recognize situations and feelings in messages and respond as logically as possible. These rational devices not only sanction banks to save time and improve effectiveness, but they also help banks save millions of dollars, resulting in accumulative worth economizing.
- (4) **AI has the ability to recognize suspicious data patterns among vast information capabilities to implement fraud management.** AI has conducted previous studies with its own advanced pilots to predict the future behaviour of data points. It helps banks to increase sales and cross-sell effectively.
- (5) **Coherent procedure self-regulating:** This facility permits the self-regulation of various data-rigorous, expensive, and error-prone banking services such as assert administration. This secures the ROI, reduces costs, and ensures accurate and fast processing of services at every step. Coherent procedure self-regulating basically

automates a set of functions that rectify their forgoing loops through continuous machine learning.

- (6) In addition, AI in banking also helps customers to pick out loan amounts at an alluring interest rate. Banks are now able to use machine-driven mechanisms and intervene under existing authoritative concurrence under this technology.
- (7) Sector, reduces operational costs, assists the customer, and improves machine-driven in the procedure.
- (8) The operation of AI in the factors of acquiring customer accounts, coinage, and bank usage is not a recently acquired concept, but it is an increasingly an interesting concept recently, security cyber mine directed to banks. The dangers are obvious all over the world.

Moreover, these days, money launderers can, through several measures, prove that the source of their illegal funds is legal. AI identifies these hidden functions and saves banks millions, thanks to the power of cognition and machine learning. These cyber-threats are not only on sales accounts or bank funds but also on money managed by banks and money held by companies in the company's bank accounts. This discloses the risks to the activity and creditworthiness of financial institutions. Nevertheless, most banks are able to establish and arrest criminals. Now, This type of technology like AI is far from being developed, as the level of comfort and evolution of machine learning mandatory for such capabilities will be more complex than is at present. This is because an AI-based security breach does not pose a real threat to cyber threats that use such technology to generate viruses, that can withstand long-term attacks autonomously if the actions of hackers are involved in the project it will be possible. Or at the minimum that will be the case in the future, and banks know it, which is why they don't invest in AI security projects. Without threat, there is no need to defend against it.

As known Financial institutions hold some extremely important data and criminals know it. And as we all know, banks keep important data about their customers, so the risk stakes are very high. Therefore, it becomes imperative for financial institutions and banks to have a powerful cyber security system. Also, like in any business, cyber security plays a huge role for any profit or non-profit organization. Hence cybersecurity has become extremely important in the financial sector. This is becoming more and more important day by day as the basis of banking leans towards nurturing trust and credibility. In this context where every man is going money-less using electronic cash such as Debit Card, EFT, Direct Deposit, Credit Card, etc. it becomes crucial to clinching that all security measures are guaranteed to safeguard your information and seclusion. A data breach or personal data in the wrong hands can do a lot of damage. This becomes a serious issue and can make it difficult to trust financial institutions. Even if fraud is noticed immediately or cards are canceled, your data is still fragile and can reveal a lot of data that can be used against you. Therefore, a weak cyber security system can lead to a data breach which can easily lead to their customer base taking their money elsewhere. Banks need to be on their safeguard beyond most merchandising. That is the main aim of keeping the kind of valuable confidential information that is done by the banks. Your information that is with the bank can be ruptured if you are not safeguarded from the menaces of cybercrime.

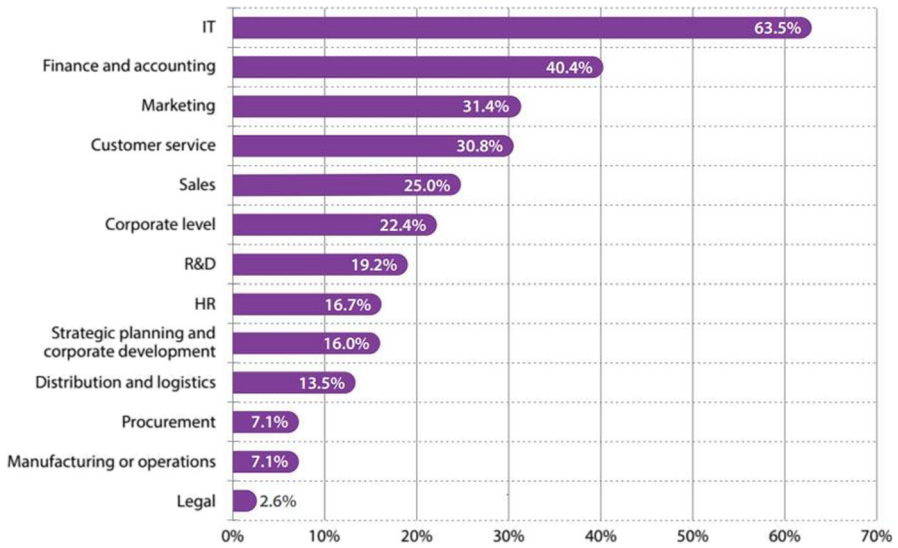


Fig. 5 Where Banks are Using AI

Above Fig. 5 shows Banking and Financial Services: Percentage of Companies Using All Today In Each Function.

Role of Artificial Intelligence in combating cyber threats in banking done by [6] Criminals are using various cyberspaces to increase cybercrime with the advancement of information technology. To alleviate these cyber and cyber risks, the banking and financial corporations seek to implement artificial intelligence. Various opportunities are provided by AI technologies, which help the banking sector to grow in wealth and development. Artificial intelligence has evolved into a concept of imitating the human brain with the ability of AI to study a large number of problems with a holistic human approach. The rise of internet computing and complex distribution raises important questions about privacy and information security. The banking sector has been using artificial intelligence for a number of years. In the banking corporation, artificial intelligence technologies are augmented and are used for a new range of applications. As per an analysis, the cyber value was ₹50.50 billion in the global economy in 2011, with Asian organizations contributing more than \$ 1 billion. Daniel-de-service attacks. Around 70% of CEOs of capital markets and banks consider cyber security a threat to their evolution. Security events have affected financial services organizations 300 times more than businesses in various industries. On the other hand, the monetary facilities business is picked out with 33% of paramount attacks. It is very crucial to advance a one or two security plan of action to safeguard against cyber-attacks in banking in this state of affairs. The intercontinental banking and financial industry assert that a cyber threat can cost approximately \$ 360 billion in a year. Financial institutions have been affected by worldwide cyber-attacks in recent years. Many nails try to use artificial intelligence to deal with attractors. Banks, on the other hand, try to collect statistical analyzes, decision trees, withdrawals, and trading data; these factors can

maintain customer credit risk and provide customers with reasonable ways to repay their loans. Many banks try to use artificial intelligence to deal with attractors. Banks, on the other hand, try to collect arithmetical analyses, decision trees, withdrawals, and trading information, and these factors can maintain consumer credit risk and provide various other reasonable ways to repay their loans. Better reach and correct points have been made possible by artificial intelligence techniques. This strategy has been applied to reduce the risk and number of false positives and negatives. Banks select the most suitable debit scheme with a summary of artificial intelligence. AI technology is being used to improve customer interaction and experience, improve the efficiency of banking processes and develop security and risk management. AI provides banks and financial institutions with information about cyber attacks and the costs of solutions. Artificial intelligence techniques identify a variety of issues related to fraud and data breaches.

Financial Services in Artificial Intelligence carried out by [41] you need to have client or agent interactions in cognitive robots or a retail banking setting. DL, ML, Big Data, NLG and NLP. It has the ability to report on individual information where education and self-improvement are the keys to successful implementation. AI is becoming increasingly complex and complex, making it vital for companies. Update on technology to maintain your competitive advantage. We are in an era where consumers and consumers are constantly switching to digital platforms and so, in order to keep the race going, traditional companies need to be more focused on messengers and messengers by being focused on their needs. Implementing AI not only enhances the customer experience but also leads to better and more accurate financial decisions with legacy suggestions.

Implications of Improving Artificial Intelligence and how Artificial Intelligence now Transforms the Face of the Financial Institution [42] Artificial Intelligence (AI) is the main model for the simulation of human intelligence in machine learning. Banks often use procedures to achieve certain benefits, which help improve sales, service customers and thus increase profits. AI includes instructions in deep-learning technology, which helps reduce mental and emotional errors. Banks often use this method to get proper profits, which leads to better sales and customer service. Helps reduce the risk of mental illness and depression. The main function of AI is to copy important data and draw conclusions from various sources. Here you see how artificial intelligence is transforming the Indian banking industry. It exposes areas where there is fake intelligence and banking and exposes the use of India's second-largest banks and corporations. But banks have not yet reached the stage of the AI revolution, and human interaction is still very important. In addition, the banking system has a proven track record of the current state of affairs, such as bankruptcy or bankruptcy laws. The survey methodology was chosen to collect data and survey the opinions of 112 clients from selected banks. The study tool for collecting qualitative data here was a closed-ended formal questionnaire. Quantitative data analysis was performed using SPSS 21.0 software. Generally, callers prefer luxury wallets over money, meaning the public can use artificial intelligence. Online fraud is a big problem now. People can access your account easily. 61.4% of respondents believe that an emergency can achieve bank security. 16% of people don't trust cars very much, and some people need a conversation, preferring to go to the bank the traditional way.

Finance in Artificial Intelligence has been carried out by [43]. AI provides grants to the financial services industry by the hurricane. Every day, every piece of money uses AI to reap benefits such as financial cuts, time savings, and added value. Artificial intelligence has become an open trend in today's market. It is already used in many homes. Financial institutions use artificial intelligence in many creative ways. For the period from 2035 to 20 days, the number of years shall be in accordance with the procedure laid down in Article 20. With the growing popularity of e-commerce, online fraud has increased, and now the damage from fake transactions is 13 times greater than the true value of counterfeiting. ALA has helped the banking sector with smart banking services like personal banking, voice banking, signatures, data-driven AI application, customer support, and more. In addition, AI is expected to have the largest impact on the banking and financial sector by 2020. But it will, of course, affect competitiveness.

Challenges and opportunities in the banking sector using Artificial Intelligence have been done by [44] Here the author has mainly focused on the Indian Banking Sector where we see the benefits of using artificial intelligence and Different ways to develop artificial intelligence of art tech and improve its performance in the Indian banking sector. Original applications also include AI chatbots for AI messenger service, personalization of services for individuals, and AI robots for self-service in banks. According to a fin-tech India report released by PWC in 2017, global spending on artificial intelligence applications reached 5.1 billion as compared to April 4 billion in 2015. There is also great interest in the Indian banking sector. An October report in The Economic Times found that startups in India increased funding by 108% in 2018. Currently, around 400 startups are active in the fields of machine learning and AI. Private players alone have invested around \$150 million in the AI sector in India, and the number has been growing since 2016. There is also great interest in the Indian banking sector. An October report in The Economic Times found that startups in India increased funding by 108% in 2018. BankChain was announced on 8 February 2017 as the largest bank SBI in India. It is a fellowship of more than 30 members, led by SBI, the largest credit provider in the country, and includes banks like NBFC and the National Payments Corporation of India (NPCI), a corporation created by Indian banks to corroborative retail payments. Bank-chain is a banking assemblage that researches, creates and implements blockchain-based solutions. It is backed by Pune-based Prime Minister Primechain Technologies to engender these determinations. It presently carries 37 members and 8 direct projects. According to the PwC Fintech Trends (India) 2017 report, global investment in AI applications reached \$ 5.1 billion (€ 4.3 billion) in 2016. Not just PNB but also some banks in India such as HDFC, SBI, HSBC, ICICI, and Axis have inclined towards AI. Built Eva an AI-based chatbot evolved by Bengaluru Senseforth that countered more than 2.7 million consumer appeals, interconnected higher than 530 thousand unique end-users, and led almost 1.2 million interviews. The tool is able to be acknowledged in less than 0.4 s and on the first day of launch, thousands of customers from 17 countries were given the answer to more than 100,000 questions. Software robots in over 200 business procedures beyond copious firm leadership have been utilized by ICICI bank. Banking Sectors are benefited in many ways by the use of AI. Artificial intelligence is transforming customer-oriented

business processes and services in the banking sector in India. The humanoid chatbot interface can be used to expand regulation and lower consumer interaction costs. Implementing AI potentially make business processes more efficient, deliver services, and can target a larger, such as including financial.

Swankie and Broby [45] has explored the impact of artificial intelligence on Bank risk assessment. AI is the key to this and can change financial performance. It has various methods that allow the computer to monitor human behaviour and analyze big data within minutes. These systems include machine learning, in-depth learning, vocabulary, natural language processing, and observation. There are currently three basic types of artificial intelligence: real-time/narrow artificial intelligence (non-biological knowledge), general artificial intelligence (the ability to do cognitive work other than humans), and supernatural (much more intelligent). Despite the rapid pace of technological change, artificial intelligence and ingenuity remain under the control of modern technology. Finally, risk management is critical to the success of banks and the constancy of the financial system. There is no doubt that, in addition to the key cost reduction effects of using AI in banking, it has the competence to change the work environment [46] and add remarkable business value. This is an area for future study and could be further highlighted by a recent £ 150 million grant to Oxford University to fund a new Institute for AI Ethics. However, given the speed of technological innovation, its aptitude impact, particularly in the field of AI and on the bank's risk management function, deserves further investigation.

Xie and Jiang [47] has focused on the effects of AI on financial sources. Artificial intelligence technology has transformed the entire economic cooperation and created a range of imaginative monetary services such as smart guidance, smart development, auditing and alerting, and smart messaging when needed. Economic systems encompass the development and implementation of artificial intelligence and machine learning, as well as their impact on macroeconomics and microeconomics. At the time, he realised that artificial intelligence creates a series of problems and risks during use. The use of artificial intelligence and machine learning in the economic field can be divided into four parts. First, it is a messenger-based (face-to-face) implementation, which includes credit scoring, insurance, and customer-focused service robots; second, regulatory (back-end) appeal consist of capital optimization, risk management, and market effective assessment; Third, monetary market affairs and satchel administration; Finally, AI and machine learning in financial institutions are utilized for "Regtech" or for "Supertech" in the monetary controller. Due to, the sake of designing full AI, it is necessary to develop guiding principles that target everyone along with the entire process of developing, designing, using, managing, and controlling AI, and carefully applying AI applications to risk finance. In the field of financial risk management, the use of artificial intelligence to collect information must adhere to certain standards to ensure the legality of information collection and the interests of those who do not harm the source of the information. Artificial intelligence categorized the types and strengths of information gathering and information gathering behaviour.

South African banking system and its workforce performance using AI have been carried out by [48]. This paper determines the features that improve employee creativity and performance among the acknowledgment and assimilation of AI (artificial intelligence) to conduct different activities. As per the norms of South Indian Banking.

The ultimate goal is to rectify the carry-out of employees in a banking institution in South Africa and ensure the success of an artificial intelligence organization. Research shows that technological advances can be a barrier, but for the most part they offer a good opportunity. Banking institutions can also adopt advanced technologies that revitalize productivity. Growth, innovation, and job formation. This study emphasizes adopting local banks in South Africa; and thus, the other banks in other parts of the continent are not affected by the outcome, including other banks in the world with this sort of problem. The research method is purely built upon a quantitative perspective. And this perspective presumes observing action or marks that are further diminished to quantitative values. This study follows an experimental approach based upon key information. Despite the current survey technique, many systematic questionnaires were conducted to collect relevant data from 160 retail bank employees. A total of 180 employees of the South African retail bank were arbitrarily nominated. The questionnaire was sent to the participants at the administrative level and below, the potential number of participants is 500 people. The questionnaires returned were accurately completed by 165 and 160 participants. The result of the concerned group was the impression that a positive correlation was indeed observed between AI and workforce performance. Technology Acceptance of Artificial Intelligence in Banking and its Impact on Banking Efficiency has been done by [49]. Artificial intelligence is the best way to change the various important issues against consumers and keep the competitive side there. Artificial intelligence is an order of magnitude progression in computer structures that allows us to perform tasks that typically require human knowledge, including speech recognition, visual recognition, language translation, and problem-solving. The Artificial Intelligence (AI) approach is being aggressively adopted with the help of the banking sector in India. It is an insight organized to understand the many internal and external elements that influence the popularity of AI in banks using consumer awareness, trust, intelligence, and customers. Accordingly, changes in the way AI is adopted can be proposed so that the competitive advantages and advantages of banks arrive at the folk.

Parmar et al. [50] has focused on using Artificial Intelligence for booming tactics accomplishment in India's banking sector, where the initial center of attention of the paper, in general, is to focus on recent developments in the context of India's banking sector, actively diverting attention from leadership banking to AI benefits for the enjoyment of buyer who wants to do. The banking sector is ready to expand the enforcement of its strategy by taking advantage of the latest digital technologies so that customers can understand the fast and secure processing affairs. The practical experimental application of the growing Indian banking sector is part of everyday life made up of several banks like RBI, SBI, HDFC, ICICI, Axis, and Yes Bank. These banks are digitally implemented using chatbots that have brought benefits to the customers and customers are finding this platform satisfactory for personally conducted financial transactions on a real support time. It can therefore be concluded that its effectiveness is coupled with the active execution of AI in the banking sector of India strategy governance can be remarkably civilized. On the other hand [51] has concentrated on the requisite and application to use AI in India's banking sector. Banks research and apply technology in a number of ways. The Indian banking sector is traversing different ways to improve customer service with artificial intelligence. He has stressed the

use of Artificial Intelligence by Indian banks by quoting SBI, BOB, HDFC banks to shorten after-sale services in the future. The goal is to provide customized communication services to customers through the application of AI algorithms. The technology keeps the track of client behaviour patterns built upon fichero profiles and trading antiquity and recommends upshots that are designed to avail the demands. The bank has progressive a number of digital services such as Humanoid Intelligent Robotic Assistant which directs the mortals of the bifurcate to figure out opposite counters, an EVA (Electronic Intelligent Assistant) website designed to retort quotidian questions of bank users, FB Messenger butt. Abets customers in matters such as invoice payment, mobile reimbursement, and cab reservation, etc. Assists customers in matters such as bill payment, mobile reimbursement, and cab booking, etc. The lives of the customers have also become easier. But the survey found that nearly 80% of consumers are unaware of digital application services. Businesses were among those who used these services and most were dissatisfied with the services. In addition, participants were not very interested in purchasing insurance and personal loans through the application. It is preferable to make a personal visit to the bank. The banking industry is investing heavily in the application of artificial intelligence. However, there are challenges in this field in terms of awareness and approval of new and upcoming technologies, security concerns, and data threats. Banks are required to advertise these products and have strict policies for their optimal use.

Above Fig. 6 explains the functionality of a well designed chatbot for customer service.

Mahalle et al. [52] has emphasized data privacy and system security in cloud computing-based banking services. Architecture and infrastructure for cloud computing have been approved by organizations and governments around the world. Data and Applications access is provided by cloud computing infrastructure from anywhere around the world, and businesses are still estimating privacy and security chassis. Banking and monetary facilities consider various norms for data security and privacy along with cloud computing infrastructure framework usage, such as IDM, that assists in user authentication and facilities based upon attributes. To manage access, the Single

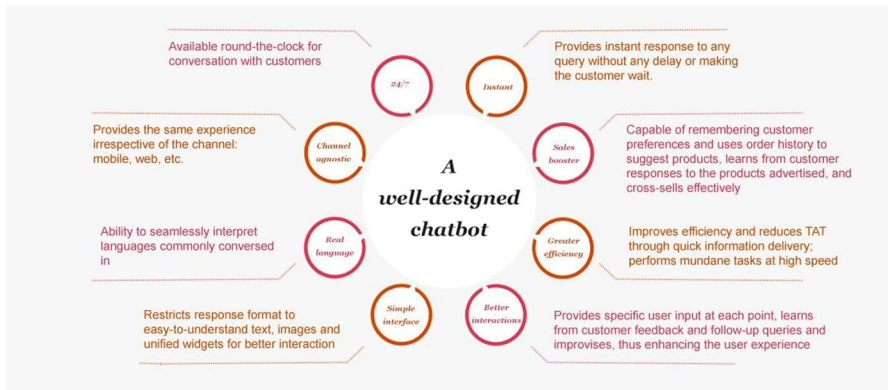


Fig. 6 Rise of AI-Powered Chatbots in the Banking Industry

Sign-On (SSO) approach has been implemented, which allows users to access a variety of banking and financial services applications. SLAs and agreements are considered essential for the operation of cloud services, which contributes to the smooth running of the Bank. Cloud computing has considerably shrunk the cost of managing an IT foundation by constructing a sturdy and firm architecture, but for institutions such as banks and monetary services that include financial information from consumers and corporations, the cloud model poses long-term risks and poses a threat of potential losses. Precarious or unfavourable situations directly affect profitability and reputation and lead to severe fines by regulators. According to [53], cloud computing technology is the source for enhancing data management skills and providing a variety of services. This technology provides precision and diverse Customer service. This gives banks a variety of benefits such as cost reduction and improved data processing. It provides additional services with no cloud computing, minimal capital cost, and no cost associated with IT load. Customers can access this flagship technology without access to any major banking system, technical influence, or other restrictions. To date, it offers a wide range of technological applications and services are a very expensive business for financial institutions. But now cloud computing offers a wide range of low-cost capital and IT services associated expenses. In the cloud, data can be stored and fed from the same cloud service provider. One of the main reasons for using the cloud is “security”. This could change the overall picture of financial services. Today, anyone can use this modern single-core banking system. In light of the challenges they face, cloud computing is today’s technology, it is a dynamic area of data security. One of the immediate concerns is the backlog of customers and companies. Security is compromised first, and data privacy is the biggest concern that isn’t maintained. Uploading can compromise security by making it difficult to detect errors. Again, the liability ambiguity is that the regulatory regime is not necessary for data protection. There may be a paucity of information about the new cloud technology distributed in the market. Third, software and/or data tampering may affect finances, and job loss is, after all, an internal threat, a potential threat to suspension with suggested solutions. Provides a shared service in cloud computing without significant operating costs in the form of an online banking system, personnel, equipment, hardware, and software. Cloud technology is the latest update to the advanced conversion system that uses the cloud as a cloud. Storage for data storage facilitates recovery if needed. For the most reliable operations, it is best to use the private cloud and use the public cloud for a long time. Depending on the application layer, banks may use a hybrid cloud. Despite this technology, numerous services including good data storage, convenient storage, and good sharing of data are available, but many problems are faced by different entrepreneurs. Providers like data protection and privacy stored in the cloud. Lack of investment can reduce the level of profit. Excited customers are always waiting for fast-growing services, fierce competition for customers, and seasonal features.

6 Challenges and Future Scope

Artificial intelligence and in the future, it will all be based on mechanical power. But everything has its advantages and there are also menaces, so there may be moral

Table 2 A comprehensive study of customer service and risk management using AI/ML algorithms

Country	State	Algorithm	No.Of Bank	Method	Application	Accuracy	Aim	Reference
India	1	-	16	Both scheduling and sampling	artificial intelligence	23.52%	Application of AI and its technology in the Indian Banks	[56]
Saudi Arabia, Pakistan and India	-	Supervised.unsupervised AI learning	92	TAM & Statistical analysis	Cyber Security, Information Security Technologies	52.2%	Cyber Security Analysis of Internet Banking in Emerging Countries: User and bank views	[57]
South Africa	160	Workforce management	-	data, recognition, natural language processing, machine learning, robotics, planning, perceiving, problem-solving, and decision making	AI, Robotics	R, R ² (78.31%)	AI Integration of Employee Performance for the South African Banking Institute	[48]
China	-	Machine learning algorithm	-	hercules architecture	software engineering, Machine learning	-	Implementation of Hercules Architecture on Online Banking System	[58]

Table 2 (continued)

Country	State	Algorithm	No.Of Bank	Method	Application	Accuracy	Aim	Reference
Malaysia	1	-	402	Descriptive Analysis via sampling technique, and quantitative method	Data Security	56%	Reliability of Customers on Virtual Banking System and its Security in Malaysia	[59]
Malaysia	-	-	-	Traditional security software and hardware products, Network Security	CyberSecurity, Big data technology	--	Cyber and Information Security Threats on Environmental Analysis in the financial industry	[60]
India	1	ML, DL, NLG, NLP, Speed Recognition, Visual Recognition, Optical Character Recognition	-	Digital Technology	Artificial Intelligence, Information Technology	87%	Artificial Intelligence and its application in the Indian Banking System	[50]
USA	1	-	-	Information Security Governance Framework	Information Security	86%	Information Security and its governance on Banking System	[61]

Table 2 (continued)

Country	State	Algorithm	No.Of Bank	Method	Application	Accuracy	Aim	Reference
India	1	ML, ANN, DL, NLP, CV, CC	5	FinTech	Artificial Intelligence	90%	Artificial Intelligence and its impact on The Commercial Banking System of India Cost benefit analysis	[62]
India	1	--	30	FinTech	Artificial Intelligence, Machine Learning, Big data Analytics, IoT, Cloud Computing, Robotic process automation	--	A Case Study of Emerging Banking Systems and its technology	[63]

problems all mechanically related [54]. Banks have in advance come a long way in using integrated AI technologies. With the ability of AI to handle traditional tasks and time, the number of banks that espouse AI is growing with the potential for error. After realizing the potential, banks and financial services companies are rapidly espousing artificial intelligence to reanalyze how and why they run their business. Underneath the umbrella of AI, the use of tools and deep learning cybersecurity is moving up. About one in five groups used AI-2018 BC. However, they are willing to accept about two out of thirds (63%) of the three institutions, with skyscrapers they plan to hire AI by 2020. Cyber threats following COVID-19 raise serious concerns to the Banks of India and the Reserve Bank of India (RBI). The acute challenge is that different banks are currently in various stages of digital transformation and the maturity levels for cybersecurity that define past investment, budget allocation, and size contact customers and provide service. To combat COVID-19 challenges related to bank managers one has to embrace new digitization and cyber security rules for meeting business requirements, regardless of the levels of cyber security in their banks. The frauds taking place is one of the most major challenges faced by areas of the bank in the analysis of financial problems and fraud areas where artificial intelligence systems have worked well [42]. Suspicious behaviour, spam emails can be monitored and security vulnerabilities can be predicted [55] (Table 2).

7 Conclusion

AI which is known for its versatility has provided amazing decision-making skills based upon the available information. These devices have the capabilities to respond in judicious ways on the basis of context and emotion of situations. AI has provided excellent encryption and can track suspicious activities efficiently. It has helped customers to pick out loan amounts at an alluring interest rate. Moreover, it has a better understanding of customers and their behaviour based on past interactions. All these qualities make AI the hero of ours and the upcoming generations. Usually banking security has been a crucial concern but AI is developing every day to reduce these issues making it a reliable source everywhere. By balancing the expertise and right usage one can achieve complete encryption. Artificial Intelligence can make everything efficient and faster if used wisely. It is not only self-regulating but also has the ability to understand one's emotions. They also help banks save millions of dollars, resulting in the accumulative worth of economizing. Cryptocurrency and Bitcoin market are catching attention and as a result, it is now an important asset so it is necessary to reduce the investment risk, accurate prediction and to protect it from fraud because it is a digital currency it does not have physical existence. Some of the research is going on for better prediction of the cryptocurrency and better results now Artificial intelligence and Machine learning techniques are coming into usage. Some of the Artificial intelligence and machine learning techniques had been discussed. In general, it was observed that Support Vector Machine, Long Short Term Memory Model, and Artificial Neural Network give better results than any other techniques. Neural Network-based models require longer-term data whereas LSTM based models can sufficiently perform with short-term data. Also, Cryptocurrency and Bitcoin

are dependent more on market trends so they can be incorporated into sentimental analysis along with an AI model based price prediction model. A new approach of cointegration is also discussed which describes how we can make use of other similar cryptocurrency data to predict the future of Bitcoin.

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References

- Hassani H, Huang X, Silva E (2018) Big-crypto: Big data, blockchain and cryptocurrency. *Big Data Cogn Comput* 2:1–15. <https://doi.org/10.3390/bdcc2040034>
- Chaafer P, Shah M, Kshirsagar A (2021) The applications of artificial neural networks, support vector machines, and long-short term memory for stock market prediction. *Decis Anal J*. <https://doi.org/10.1016/j.dajour.2021.100015>
- Shi Y, Tian Y, Kou G et al (2011) Optimization based data mining: theory and applications. *J Chem Inf Model* 53:1689–1699. <https://doi.org/10.1007/978-0-85729-504-0>
- Tien JM (2017) Internet of things, real-time decision making, and artificial intelligence. *Ann Data Sci* 4:149–178. <https://doi.org/10.1007/s40745-017-0112-5>
- Cioffi R, Travaglioni M, Piscitelli G et al (2020) Artificial intelligence and machine learning applications in smart production: progress, trends, and directions. *Sustain* 12:492. <https://doi.org/10.3390/SU12020492>
- Soni N, Sharma EK, Singh N, Kapoor A (2019) Impact of artificial intelligence on businesses: from research, innovation, market deployment to future shifts in business models. *J Bus Res* 1–38
- Brands E, Rajagopal R, Eleswarapu U, Li P (2017) *Groundwater In: International Encyclopedia of Geography: People, the Earth, Environment and Technology* Wiley, Oxford, UK, pp 1–17
- Shabbir J, Anwer T (2018) Artificial intelligence and its role in near future <https://doi.org/10.48550/arxiv.1804.01396>
- Vishal Dineshkumar Soni (2019) Role of artificial intelligence in combating cyber threats in banking. In: *Int. Eng. J. Res. Dev. IEJRD*. https://www.academia.edu/43646442/ROLE_OF_ARTIFICIAL_INTELLIGENCE_IN_COMBATING_CYBER_THREATS_IN_BANKING. Accessed 20 Jun 2022
- Mariam Khaled Alsedrah (2017) Artificial intelligence https://www.researchgate.net/publication/323498156_Artificial_Intelligence?channel=doi&linkId=5a9888ba45851535bce0cc57&showFulltext=true. Accessed 20 Jun 2022
- Cockburn IM, Henderson R, Stern S (2018) NBER working paper series - the impact of artificial intelligence on innovation Natl Bur Econ Res Work Pap Ser Working Pa:

12. McGhin T, Choo KKR, Liu CZ, He D (2019) Blockchain in healthcare applications: research challenges and opportunities. *J Netw Comput Appl* 135:62–75. <https://doi.org/10.1016/j.jnca.2019.02.027>
13. Zheng Z, Xie S, Dai H, et al (2017) An overview of blockchain technology: architecture, consensus, and future trends *Proc - 2017 IEEE 6th Int Congr Big Data, BigData Congr 2017* 557–564. <https://doi.org/10.1109/BigDataCongress.2017.85>
14. Aras ST, Kulkarni V (2017) Blockchain and its applications-a detailed survey. *Int J Comput Appl* 180:975–8887
15. Abduljabbar R, Dia H, Liyanage S, Bagloee SA (2019) Applications of artificial intelligence in transport : an overview <https://doi.org/10.3390/su11010189>
16. Meena Y, Kumar Verma R, Singh Sankhla M, Kumar R (2019) Secure cyber network to sharing information through cryptography & stenography. *Eng Technol Open Acc* 2:1–5
17. Devries PD (2016) An analysis of a cryptocurrency, bitcoin, and the future. *Int J Bus Manag Commer* 1(2), 1–9.
18. Ganapathy A, Neogy TK (2017) Artificial intelligence price emulator: a study on cryptocurrency. *Glob Discl Econ Bus*. 6:115–122. <https://doi.org/10.18034/gdeb.v6i2.558>
19. Yang L (2021) Next-day bitcoin price forecast based on artificial intelligence methods <https://doi.org/10.48550/arxiv.2106.12961>
20. Koker TE, Koutmos D (2020) Cryptocurrency trading using machine learning. *J Risk Financ Manag* 13:178. <https://doi.org/10.3390/jrfm13080178>
21. Madan I, Saluja S, Zhao A (2015) Automated bitcoin trading via machine learning algorithms <http://cs229.stanford.edu/proj2014/Isaac%20Madan2015>
22. K Zbikowski (2018) Application of machine learning algorithms for bitcoin automated trading application of machine learning algorithms for bitcoin automated. In: Ryżko, D., Gawrysiak, P., Kryszkiewicz, M., Rybiński, H. (eds) *Machine intelligence and big data in industry. Studies in big data*, vol 19. Springer, Cham. https://doi.org/10.1007/978-3-319-30315-4_14
23. Sebastião H, Godinho P (2021) Forecasting and trading cryptocurrencies with machine learning under changing market conditions. *Financ Innov* 7:1–30. <https://doi.org/10.1186/S40854-020-00217-X/TABLES/7>
24. Silva de Souza MJ, Almudhaf FW, Henrique BM et al (2019) Can artificial intelligence enhance the Bitcoin bonanza. *J Financ Data Sci* 5:83–98. <https://doi.org/10.1016/j.jfds.2019.01.002>
25. Maleki N, Nikoubin A, Rabbani M, Zeinali Y (2020) Bitcoin price prediction based on other cryptocurrencies using machine learning and time series analysis *Sci Iran* <https://doi.org/10.24200/sci.2020.55034.4040>
26. McNally S, Roche J, Caton S (2018) Predicting the price of bitcoin using machine learning *Proc - 26th Euromicro Int Conf parallel, distrib network-based process PDP 2018* 339–343 <https://doi.org/10.1109/PDP2018.2018.00060>
27. Awoke T, Rout M, Mohanty L, Satapathy SC (2021) Bitcoin price prediction and analysis using deep learning models In: *Lecture notes in networks and systems* Springer Deutschland GmbH, pp 631–640
28. Yiyang W, Yeze Z (2019) Cryptocurrency price analysis with artificial intelligence 5th Int Conf Inf Manag ICIM 2019 97–101 <https://doi.org/10.1109/INFOMAN.2019.8714700>
29. Rayhi N Al (2020) Cryptocurrency exchange market prediction and analysis using data mining and artificial intelligence. Thesis Report in British University Dubai. 1–59
30. Patil DA, Jain TA, Khot MAR, Joshi BD (2021) Cryptocurrency price analysis using machine learning and artificial intelligence. *IJCRT* 9:3
31. Marne S, Churi S, Correia D, Gomes J (2021) Predicting price of cryptocurrency-a deep learning approach *Int J Eng Res Technol* <https://doi.org/10.17577/IJERTCONV9IS03083>
32. Hitam NA, Ismail AR (2018) Comparative performance of machine learning algorithms for cryptocurrency forecasting *Indones J Electr Eng Comput Sci* 11: 1121–1128 <https://doi.org/10.11591/ijeeecs.v11.i3.pp1121-1128>
33. Liashenko O, Kravets T, Repetskiyi Y (2020) Application of artificial intelligence to bitcoin course modelling *Bull Taras Shevchenko Natl Univ Kyiv Econ* <https://doi.org/10.17721/1728-2667.2020/209-2/2>
34. Gladden ME (2015) Cryptocurrency with a conscience: using artificial intelligence to develop money that advances human ethical values *Ann Etyka w życiu Gospod* <https://doi.org/10.18778/1899-2226.18.4.06>

35. Al-Ameer A, Al-Sunni F (2021) A methodology for securities and cryptocurrency trading using exploratory data analysis and artificial intelligence 2021 1st Int Conf Artif Intell Data Anal CAIDA 2021 54–61 <https://doi.org/10.1109/CAIDA51941.2021.9425223>
36. Jiang Z, Liang J (2018) Cryptocurrency portfolio management with deep reinforcement learning 2017 Intell Syst Conf IntelliSys 2017 2018-Janua:905–913. <https://doi.org/10.1109/IntelliSys.2017.8324237>
37. Atsalakis GS, Atsalaki IG, Pasiouras F, Zopounidis C (2019) Bitcoin price forecasting with neuro-fuzzy techniques. *Eur J Oper Res* 276:770–780. <https://doi.org/10.1016/j.ejor.2019.01.040>
38. Ganapathy A, Redwanuzzaman M, Rahaman MM, Khan W (2020) Artificial intelligence driven crypto currencies *Glob Discl Econ Bus* 9:107–118 <https://doi.org/10.18034/gdeb.v9i2.557>
39. Han JB, Kim SH, Jang MH, Ri KS (2019) Using genetic algorithm and NARX neural network to forecast daily bitcoin price. *Comput Econ* 562(56):337–353. <https://doi.org/10.1007/S10614-019-09928-5>
40. Fang F, Chung W, Ventre C et al (2021) Ascertaining price formation in cryptocurrency markets with machine learning. *Eur J Financ*. <https://doi.org/10.1080/1351847X.2021.1908390>
41. Mardanghom R, Sandal H (2019) Artificial intelligence in financial services: an analysis of the AI technology and the potential applications, implications, and risks it may propagate in financial
42. Kaur N, Sahdev SL, Sharma M, Siddiqui L (2020) Banking 4.0: “the influence of artificial intelligence on the banking industry & how Ai is changing the face of modern day banks.” *Int J Manag* 11:577–585. <https://doi.org/10.34218/ijm.11.6.2020.049>
43. Shah D, Patel D, Adesara J et al (2021) Exploiting the capabilities of blockchain and machine learning in education. *Augment Hum Res* 6:1–14. <https://doi.org/10.1007/s41133-020-00039-7>
44. Vijai C (2019) Artificial intelligence in Indian banking sector: challenges and opportunities *Int J Adv Res* 7:1581–1587 <https://doi.org/10.21474/ijar01/8987>
45. Swankie G, Broby D (2019) Examining the impact of artificial intelligence on the evaluation of banking risk https://www.researchgate.net/publication/337908452_Examining_the_Impact_of_Artificial_Intelligence_on_the_Evaluation_of_Banking_Risk. Accessed 20 Jun 2022
46. Kshirsagar A (2018) Bio-remediation: use of nature in a technical way to fight pollution in the long run *ResearchGate* <https://doi.org/10.13140/RG.2.2.26906.70088>
47. Xie Y, Jiang H (2017) Stock market forecasting based on text mining technology: a support vector machine method *J Comput* <https://doi.org/10.17706/JCP.12.6.500-510>
48. Mamela TL, Sukdeo N, Mukwakungu SC (2020) The integration of AI on workforce performance for a South African banking institution 2020 *Int Conf Artif Intell Big Data, Comput Data Commun Syst icABCD 2020 - Proc* <https://doi.org/10.1109/ICABCD49160.2020.9183834>
49. Venkatesan S, Sumathi N (2019) Technology acceptance of artificial intelligence in banking and its impact on banking efficiency. *Int J Innov Technol Explor Eng* 8:371–374
50. Parmar I, Agarwal N, Saxena S, et al (2018) Stock market prediction using machine learning *ICSCCC 2018 - 1st Int Conf Secur Cyber Comput Commun* 574–576 <https://doi.org/10.1109/ICSCCC.2018.8703332>
51. Salunkhe RT (2019) Role of artificial intelligence in providing customer services with special reference to SBI and HDFC bank *Int J Recent Technol Eng* 8: 12251–12260 <https://doi.org/10.35940/ijrte.c6065.118419>
52. Mahalle A, Yong J, Tao X, Shen J (2018) Data privacy and system security for banking and financial services industry based on cloud computing infrastructure *Fac Eng Inf Sci - Pap Part B*
53. Balanagalakshmi B, Bullard SK (2020) Cloud computing technology-security issues in banks-an overview. *Eur J Mol Clin Med* 07:5299–5304
54. Verma M (2018) Artificial intelligence and its scope in different areas with special reference to the field of education. *Int J Adv Educ Res* 5 *Int J Adv Educ Res* 3:2455–6157
55. Finance MBA, Economics MA, Accounts MC et al (2020) Commerce use of artificial intelligence and blockchain in banking sector : a study of scheduled commercial banks in INDIA. *Use Artif Intell Blockchain Bank* 10:10–13
56. Munish Sabharwal (2014) The use of artificial intelligence (AI) based technological applications by Indian Banks. In: *Behav. Biometrics*. https://www.researchgate.net/publication/299430567_The_use_of_Artificial_Intelligence_AI_based_technological_applications_by_Indian_Banks. Accessed 20 Jun 2022
57. Alghazo JM, Kazmi Z, Latif G (2018) Cyber security analysis of internet banking in emerging countries: User and bank perspectives 4th IEEE Int Conf Eng Technol Appl Sci ICETAS 2017 2018-January:1–6. <https://doi.org/10.1109/ICETAS.2017.8277910>

58. Ou P, Wang H (2009) Prediction of stock market index movement by ten data mining techniques. *Mod Appl Sci*. <https://doi.org/10.5539/mas.v3n12p28>
59. Adhikari T, Nunzi JM, Lebel O (2017) Solid-state showdown: comparing the photovoltaic performance of amorphous and crystalline small-molecule diketopyrrolopyrrole acceptors. *Org Electron* 48:230–240. <https://doi.org/10.1016/J.ORGEL.2017.06.008>
60. Jingxiong D (2020) Analysis of cyber security threat environment and information security analysis of cyber security threat environment and information security system of financial industry under new situation. Project Report. 1–6
61. Ula M, Ismail Z, Sidek Z (2011) A framework for the governance of information security in banking system. *J Inf Assur Cybersecurity* 2011:1–12. <https://doi.org/10.5171/2011.726196>

62. Sindhu J, Namratha R (2019) Impact of artificial intelligence in chosen Indian commercial bank-a cost benefit analysis. *Asian J Manag* 10:377. <https://doi.org/10.5958/2321-5763.2019.00057.X>
63. Kautikwar T (2020) A study of role of emerging technology in Current banking Industry. A case Study from ICICI Bank. Report. 1–12

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