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Chapter 11: Integrating blockchain and artificial intelligence to foster trust, decentralization, and predictive capability in financial transactions

11.1. Introduction

Ongoing crises in the present-day digital economy, such as lack of trust and or excessive centralization and vulnerability in financial transactions, have stimulated innovation in the development of decentralized and trust-enabling technologies. These new technologies include, among other areas of research and development, blockchain systems, opinion dynamics, and predictive analytics. Blockchain technology, originally developed for the support of secure and decentralized cryptocurrency transactions, has evolved rapidly since its inception to provide bottom-up decentralized trust for a variety of digital transactions without the need for trusted centralized intermediaries. The potential advantages of blockchain-integration for the financial transaction processes and trust generation are sufficiently significant to be deemed disruptive. Blockchain smart contracts, in combination with other technologies that enable external data to trigger contract execution or affect contract performance are seen as a key development in this area (Thomas & Zhao, 2025; Unger, 2025; Varma, 2025).

Despite these advantages, there are significant blockchain-integration challenges that need to be overcome before the promises of blockchain technology can be fully realized. These include scalability, governance, security, interoperability, and usability challenges. Further needs include the defining of appropriate regulatory and compliance frameworks for the implementation of blockchain soft and hard capabilities. Blockchain has proven itself to be an excellent means for establishing trust in a system without a priori trust, yet the Data Age is ushering in new challenges such as the real-time optimization and prediction of processes. In particular, currently-available decentralized AI techniques are not capable of providing real-time optimization and prediction solutions (Wang, 2025; Xiong & Yu, 2025).

11.2. Understanding Blockchain Technology

Companies often boast about reservoirs of user data and advanced algorithms to personalize engagement with customers. This allows companies to extract profit from their customers, and when considering the systematic exploitation discovered in recent years, the monetary value derived from our data appears to be quite low. Blockchain technology aims to reconfigure the entity-data-user relations, allowing users to monetize their own data instead of trusting companies to act with integrity. By implementing decentralized data lakes on which users retain ownership over their data, companies can extract value from customer relationships while also allowing customers to benefit from data exchanges. Blockchain technology operates by cutting intermediaries out of existing processes. It implements decentralized data lakes, securing data on a distributed ledger visible to all parties in a transaction. When parties undertake an exchange that is visible to all parties, the possibility of colluding to manipulate or exploit the transaction for private gain is reduced. Users access their data through cryptographic keys and engage in transactions without an intermediary through smart contracts. Records cannot be modified once they are appended to the blockchain, preventing the intermediary from arbitrarily modifying the data in their control to disadvantage one party.

Fig 11.1: Integrating Blockchain and AI to Foster Trust, Decentralization

The goal of blockchain technology is to automate transactions by relying on consensus among involved parties. Instead of being validated by an intermediary, transactions are recorded on a ledger that is universally recognized by the party validating systems. This allows trust by disintermediation but only for contracts that are considered low-value. In finance, where high-value transactions traditionally require high-cost private intermediaries, automation is made possible, and the volume of low-value transactions that can be undertaken without intermediaries increases greatly by virtue of cost.

11.2.1. Definition and Key Features

Blockchain is a distributed ledger technology at the basis of more than 3,000 cryptocurrencies and many non-fungible tokens. At its core, a blockchain allows an unchangeable list of exchanged data among its users, stored in a distributed decentralized way, without the interference of any intermediaries, in a way that is cheap, efficient, and secure. Disruption of the former ways of storing and exchanging digital assets is mostly founded on the validation of transactions through a decentralized agreement by a variety of anonymous validating parties, called nodes. Validation is done using encryption to secure the transaction, timestamping it to avoid double spending, and grouping the transactions into blocks that contain a hash of the previous block, ensuring the final unchangeable chain, that drives the name of the technology, the blockchain. The combination of complexity, penetrability, multiple checking, sharing, timestamping, and unchangeability has created an asymmetric security system that can disrupt many businesses today.

Because of the previous features that prioritize decentralization over privacy, creating a single user without interacting – and usually exchanging something valued with another user – is of little interest, the first use cases showed that the transfer of money was the main temptation. Before universal cryptographic protocols were thought to perhaps enable this transfer in cyberspace, but the solution of double spending required the formation of a centralized trust corporation, as with any money-wielding company. Blockchain enabled the handling of the transfer of value without the necessity of a third-party trusted authority.

11.2.2. Types of Blockchain

Blockchain provides an expensive solution to the problems arising from data management. Blockchains are often broken down into two major categories: permissioned and permissionless. Permissionless blockchains are insecure and expensive because they must protect against all attacks from all third parties. Permissioned blockchains are more like a distributed database in a trusted enclave, although they are typically larger than traditional enclaves because they provide a mechanism for sharing sensitive data among companies that may not exactly trust one another.

At present, only a very small number of permissioned blockchains exist, and practical usage has yet to be proven. Commercial-level offerings include various platforms. Proof of existence blockchains and cryptography-based systems are services that associate an external document to a hash committed to the ledger blockchain.

Most cryptocurrencies are built from a public permissionless blockchain. One of the first practical proposals was a well-known cryptocurrency. Although it has many advantages, it is limited to a simple set of operations, like moving value around. Another cryptocurrency allows currency exchange, which is needed in many payment services, on the ledger of all transactions. These cryptocurrencies help banks act as a trusted third party to clear transactions across multiple currencies, but many banks do not trust outside clearinghouses. In a payment service, efficiency alone is unlikely to push companies to assign the needed trust to any external clearinghouse. Instead, these cryptocurrencies and other blockchains are using decentralized solutions built upon the trust of many companies to act as clearinghouses.

11.2.3. Blockchain Use Cases in Finance

Numerous blockchain use cases in finance existed even before the crypto-boom started in late 2017. But still, the rise of cryptocurrencies was generally considered their killer use case, since it was only pre-specified algorithms that formed the core of decentralized, non-governmental currencies. In addition, Bitcoin acted as the first use case of a blockchain based distributed ledger, a new kind of database that can be required for multiple other use cases, like accelerating settlement speeds or reducing clearing and settlement risk without needing a trusted 3rd party arbiter.

An early non-cryptocurrency use case is from a startup that provides financial institutions with real-time, gross settlement systems, currency exchange and remittance services throughout the network. The currency acts as a liquidity bridge that's needed if two financial institutions don't have an existing credit line and has already signed on over 75 banks to use the network. That means that the network builds on a new database technology, reduces counterparty risk (by settling "on the fly"), and utilizes a cryptocurrency. The core technology is different from others, because it uses a Consensus Protocol (no mining), and only allows trusted nodes to confirm transactions (e.g. those from banks or credit card companies).

11.3. Artificial Intelligence in Financial Services

When the average consumer thinks about artificial intelligence, they may think of chatbots associated with customer service in the private or public sector. While chatbots are indeed AI applications, the scope of artificial intelligence goes far beyond customer service interactions. Artificial intelligence encompasses a variety of activities, such as deep learning, automatic reasoning, cognitive computing, common-sense reasoning, knowledge representation and many others. Weak AI refers to AI systems that are designed and trained for a particular task, such as playing chess or diagnosing a disease from images, and which perform at or near human level on that task. Beyond weak AI, which is still a system based on algorithms and instruction based computing, is strong AI. Strong AI systems are those that can perform tasks outside of predefined customer directives, making decisions about actions based on limited prior experiences while being able to adapt to new situations in real time.

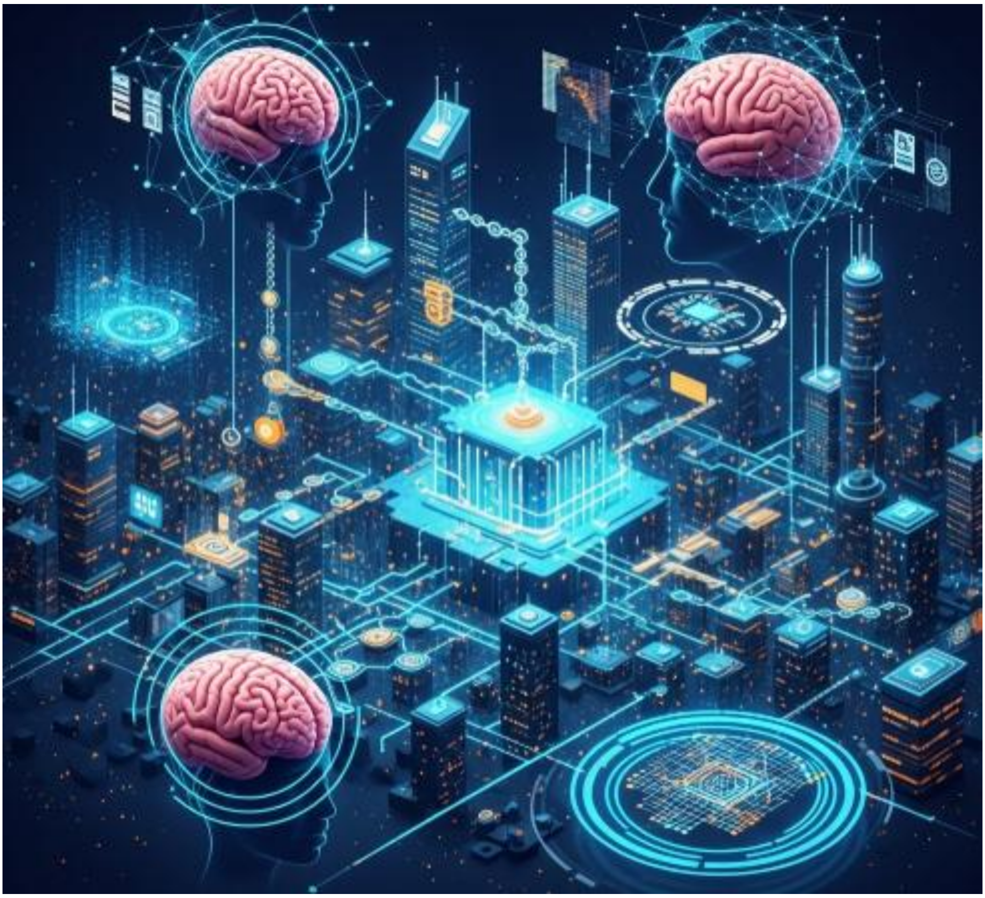

Fig 11.2: Artificial Intelligence in Financial Services

Examples of strong AI systems today include self-driving cars, image recognition applications on smartphones, service robots, expert systems, language translation programs, product recommendation engines, and armed military drones. Financial service transactions are ripe opportunities to leverage weak AI tools at scale, particularly because many of the services provided where algorithms are trained on vast sets of transaction data are already being developed for consumers globally. Specific AI tools can be applied across the life cycles of financial service transactions, including assessing a consumer's need for credit underwriting, which product to underwrite, how much to underwrite, how quickly to underwrite, how to service the underwriting over its lifecycle, how to assess the quality of the underwriting over its lifecycle, and ultimately how to credit score and report the outcome.

11.3.1. Overview of AI Technologies

AI is a broad field that encompasses many technologies. In financial services, we can distinguish three areas of application. The first is "symbolic AI," based on structures such as ontologies, rules, decision trees, and other manually built formal models of the real world. This is the "expert system" model of AI. The second is what is called statistical machine learning, in which, rather than building a model, we use a statistical algorithm that extracts the rules and structures from a data set containing "examples" of the situation we are interested in. The third is what is referred to as neural networks, which summarize the learning in non-symbolic weighting of functions that relate each input to an output.

Symbolic AI relies on the intuition and knowledge of a human expert to dictate what factors are important, what rules govern behavior, and how various elements are linked. Statistically learning algorithms automate the identification of rules, such as using random forests or boosted trees to identify the predicting importance of various factors, and statistical estimation of structural relationships. Neural nets allow both approaches (symbolic and statistical) to be combined since they usually require a training data set to estimate the network parameters, but the networks can also be designed to recognize the particular important "rules".

Most implementations of machine learning and AI in financial services today are of the statistical learning type, such as fraud detection for credit cards. There are several reasons for this. First, many important horizontal use cases in financial services, such as loan origination, credit risk, customer service, fraud, and anti-money laundering involve a critical factor that is hidden from the bank: trust. Trust cannot be directly modeled by a human expert into the rules of a symbolic system, but it can be learned by a machine learning algorithm that builds a model from a set of data.

11.3.2. AI Applications in Finance

While AI has a variety of applications in different industries, the finance domain has seen some of the earliest and most impactful applications of AI, with many existing AI systems. Applications include automated trading, fraud detection, robo-advisors, credit scoring and lending, risk management, algorithmic pricing, stock forecasting, and sentiment analysis.

Specifically, AI-driven hype around algorithmic trading has grown rapidly. Hedge funds have been implementing sophisticated and advanced trading strategies based on AI models to augment their returns. These models analyze old data, find patterns, and predict price changes within small timeframes. Similar to algorithmic trading, high-frequency trading which executes many trades per second to capitalize on small price differences has started widely using AI to augment returns.

On fraud detection, AI applications are monitoring transactions in real-time, flagging suspicious ones that do not conform to previous behavior and routing them for further verification or even blocking them. Banks have started offering short-term credit lines based on diverse alternative data. AI-based credit scoring analyzes alternative data containing social media and online browsing information to evaluate creditworthiness. Machine learning is being increasingly used for risk modeling. Banks have started offering draft discounting from trusted buyers based on the cash flow predictions from machine learning models.

Apart from the above mentioned use cases, financial information is hotly debated on social media platforms. Sentiment analysis algorithms are picking up the general sentiment from these social media platforms and correlating them with movements in stock prices. AI is being employed to scrape news articles and correlate the sentiment in these news articles with market movements. These correlation models are being used to time stock purchases/sales. Better correlation models are being used to time stock purchases/sales better. Better models help institutional investors buy large blocks of stock at optimized prices.

11.3.3. Benefits of AI in Financial Transactions

The development of AI-based applications has given rise to a number of significant advantages for all participating entities in financial markets and transactions, such as banks, investors, and traders. The foremost among these advantages is allowing cost reductions by significantly decreasing operative costs and capital costs associated with increasing revenues through improved organizational efficiency and increased reliability of the systems used via machine learning processes that set the foundation of AI systems. This, in especial, was illustrated by banks that adopted AI strategies that resulted in substantially decreasing the share of operating expenses relative to revenues. This has been especially important following the global financial crisis due to increased demands for healthier balance sheets by investors, as well as excessively high speculative behavior recorded with the securitization of structured financial products.

By creating and developing intelligent financial systems that process information much faster than humans, using neural networks and machine learning, organizations have reported significant performance improvements, especially in verifying multiple sources of information on clients for reducing fraud exposure. These organizations have benefitted from AI systems’ processing speed and modeling of predictive patterns, as the trading and settlement processes have been dramatically compressed. Financial processes have been made more secure and trustworthy through AI’s verification capabilities against massive datasets associated with any decision made. Last but not least, especially noticeable have been the developments concerning sentiment predictive trading models fully driven by AI deployed in trading algorithms for predicting short-term market volatility associated with news releases due to market participants’ sometimes irrational investment behavior.

11.4. The Intersection of Blockchain and AI

Blockchain and AI have become two of the most important technologies of our era. AI and machine learning techniques have transformed nearly every aspect of the way we live and work. Blockchain technologies are now enabling greater trust in transactions of many types, and are at the core of the decentralized finance movement. What happens when we put these technologies together? There is an obvious synergy here. Blockchain information regarding trust, transaction verification, and security can give AI systems a greater level of confidence in the data being processed and result generation. And AI techniques, with their deep learning capabilities for pattern recognition and predictive modeling in large datasets, can enhance the capabilities of blockchain-based systems, enabling better decisional security. Thus, a combination of blockchain and AI could offer superior decentralized security, speed, accuracy, and predictive capabilities, resulting in safer and more efficient financial transactions.

Despite this clear promise, most implementations of these two ideas remain separate. Blockchain can offer security and coordination for distributed decision-making systems that use AI on decentralized datasets. Designing AI systems that employ decentralized datasets enabled by blockchain technology can enhance the capabilities of both systems by leveraging blockchain's security and decision transparency.

11.4.1. Synergies between Blockchain and AI

Although blockchain and AI have been proposed in tandem to enable decentralized, trustworthy predictive capabilities in the context of financial transactions, they are typically discussed in isolation of each other. Blockchain overheads are usually considered undesirable for AI applications, while AI is usually directed at data that could use the security properties of blockchain, mainly in terms of transaction delays or transaction finality. However, these complementary features of the two technologies can be joint, with blockchain providing desirable security properties to AI and AI being able to provide useful security properties to blockchain. Also, when considering the three properties of trust, decentralization and predictability, other dimensions of the two technologies appear. We summarize these joint features of AI and blockchain in the remainder of this section.

Decentralization and self-sovereignty features of blockchain-based systems allow data privacy for the transition from a centralized cloud storage system to a decentralized permissionless system, where data is owned by individuals and directed at their needs. However, the evolution of AI is moving in the other direction, to advanced companies with greater aggregated training data that can provide better solutions, leading to asymmetries in capabilities. Therefore, the ability of blockchain to allow for better storage of data becomes an important shift with implications for the future of blockchain and AI. By providing data storage that allows for better model predictions, this can enable a hybrid approach with a combination of decentralized AI and centralized AI models.

11.4.2. Challenges in Integration

While the advantages of integrating blockchain and AI are significant, there are also some downsides to consider. One major source of difficulty is the considerable hurdle that data availability presents for both parties. Data is the lifeblood for AI algorithms. Without data, no model can be developed. AI models require data in order to train. On the other hand, the decentralized nature of blockchains means that making use of the large amounts of data available on the blockchain is no easy feat. Additionally, the AI algorithms require large datasets in order to develop a successfully predictive model. There also remains concerns about the quality control of the data. The blockchain will not evaluate or filter the quality of the data inputs. With regard to the AI models, if they are poorly trained, it can result in disastrous consequences.

There are also issues regarding scalability and throughput concerns. Current AI algorithms may not be optimally suited for integration with the current blockchain transaction structures. The high costs and transactional speeds in the current generation of blockchains may make it difficult to properly integrate AI at scale. Furthermore, if AI makes decisions regarding sensitive data, there is an additional worry of maintaining the privacy of the users on the blockchain. The programming language for developing smart contracts does not have built-in privacy mechanisms. Finally, there are also challenges related to accountability. As both AI and blockchain are autonomous by nature, it may be difficult to ascertain accountability. If a bad actor causes performance issues through malicious intent, who should be held accountable? This presents several unique challenges that must be considered when integrating AI and blockchain technology.

11.4.3. Case Studies of Successful Integration

Despite the nascent state of integrated blockchain and AI solutions explored in this chapter, some examples already showcase the integration's potential and robustness, illustrating that successfully addressing the challenges identified in the last section is feasible and can yield impressive results. One well-known integration example is a decentralized AI data marketplace where data sharing and monetization are made possible and incentivized. Using their services, an AI developer can find data, while a data provider will get paid for sharing their data. The technology stack includes a blockchain and an engine used for data storage and access. There is also a growing number of blockchain platforms that are working independently to implement blockchain applications and integrations for the AI domain. An innovative example is being developed with the goal to build, share, and monetize AI services at scale. To achieve that, it creates a platform for AI developers to publish their software services on the decentralized marketplace. With its middleware infrastructure, the different services can connect and work with each other seamlessly, sharing resources and costs. The end-users of any of the services available in the network pay for and interact with the AI services using the network's native cryptocurrency.

11.5. Enhancing Trust in Financial Transactions

Trust is an essential component of financial transactions. Credibility drives value in monetary transactions as much as actual currency units. In the modern day, trust is increasingly vulnerable, and mechanisms that fasten it lack a proper degree of assertiveness. Financial institutions based on non-decentralized and relatively heavily regulated frameworks should be less exposed to trust vulnerabilities; nevertheless, trust is an underlying factor of both their value and misuse cases while distrust can lead to severe economic events like bank runs. A decentralized digital currency is much more exposed to trust vulnerabilities; on one hand, implementing a high degree of decentralization means adding malicious agents to the equation, reducing the rate of attacks. On the other hand, it is also essential to stress users the importance of securing the privacy keys relative to their accounts, to avoid online hacks and loss of coins. Without distrust-triggering opportunities, the replacement of traditional equity-based monetary systems with transaction-based currency systems might be justified solely based on tech benefits.

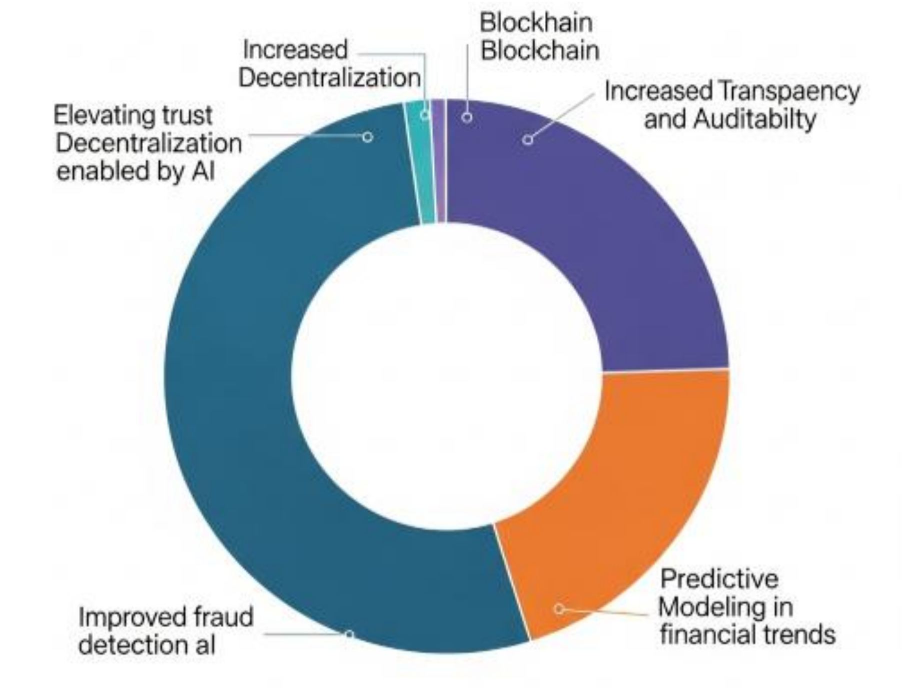

Fig 11.3: AI to Foster Trust, Decentralization, and Predictive Capability in Financial Transactions

Traditionally, the main mechanisms for securing trust are based on central authority audit or insurance; in other words, an audited centralized authority and deposit protection fund, or peer group credibility, in the case of decentralized networks. In the former category, trust is established via third party verification of action that may be temporary unless otherwise warned by alert systems; furthermore, the updating of trust is solely regulated by the amount of auditing by the central authority. In the latter category, it is generally enforced among participants, via spamming disincentives; moreover, cumulative often up to a maximum value, historical 'good behavior' records perturbed up to less than allowed, or supervised via historic statistical mechanisms for real-time alerts.

11.5.1. Role of Transparency

Generally speaking, trust means confidence or reliance in, or expectation of, something. Trust is defined as an expectation by a principal regarding the behavior of an agent, which is a critical component of relationships between stakeholders. Trust makes it possible for stakeholders to negotiate, cooperate, and make mutually beneficial decisions, thus avoiding costly transfers. Trust also allows people to lean more on the benevolence of others and enjoy more positive experiences of socializing. However, these good actions are merely private attributes: unless someone interacts with you, that person cannot know your attributes either positively or negatively. Nobody is able to know all the people in the world. How, then, can we tell the trustworthy person from the untrustworthy? How can we trust the untrustworthy?

Transparency promotes trust, which in turn decreases the cost of financial transaction monitoring. This is an important factor in economies of scale. It is suggested that investors are likely to reward companies that offer greater disclosure with increased share prices because of reductions in the cost of monitoring agency problems. Monitoring costs are lower within transparent companies because disclosure can make private information more public. This also helps analysts estimate and then monitor expected performance. More information does lead to less risk and greater trust. Almost all financial institutions have a department that maintains contact for lenders and investors with stock analysts to provide them with disclosed information about the company. Additionally, investors trust security analysts to research and analyze the facts they disclose, and to provide them with knowledge about the trustworthiness of the company.

11.5.2. Decentralization and Trust Mechanisms

In conventional financial transactions, trust is established through the use of an intermediary with the authority and incentive to reduce transaction risk through monitoring of counterparts and the transaction itself. Blockchain technology decentralizes authority, allowing both parties to transact directly with one another. However, unlike traditional intermediaries, smart contracts do not have the authority to modify, invalidate, or reverse transactions. Therefore, if either party to a transaction engages in malicious behavior, there is little deterrence from doing so using a smart contract. This requires a mechanism to provide assurance that counterparts are trustworthy. Trust mechanisms used with smart contracts usually take the form of increased incentive structures. Increased incentives become possible when smart contracts use decentralized storage of funds, or escrows, to create economic incentive for trustworthy behavior. This has been described as "truster trust reduction," since increased withdrawal and punishment action incentive for non-trustworthy behavior helps combat a lack of trust or authority of either party, substituting for the authority of a traditional intermediary. Accordingly, funds in a smart contract escrow could be automatically administered by either the blockchain or the parties to the transaction requiring performance of the contract. This creates an environment in which both parties have the ability—as well as the strong desire—not to default on the terms of the contract since doing so would result in substantial punishment.

The oversight function of a trust mechanism varies in degree depending on the nature and terms of the smart contract. In an ideal situation, the term of a smart contract dictates appropriate opportunities for both parties to withdraw funds, imposing a penalty on each party for failure to perform their contract obligation. For example, a reward for performing a contract obligation might include the total amount of funds in the escrow, while a penalty for failure to perform the obligation would take the form of a small, preset amount that would remain in the escrow, withdrawn by the other party, in addition to the escrowed funds.

11.6. Predictive Capabilities through AI

Machine learning is a subset of artificial intelligence that focuses on developing algorithms that learn from and make predictions based on data. Unlike traditional approaches, which rely solely on human programmers to define the rules for making predictions, ML algorithms instead automatically find their own patterns in data, enabling them to make predictions about new situations based on previously uncovered patterns. Researchers and practitioners use ML to deploy predictive models to enhance decision making. Such models can provide stakeholders with insights to journey the resulting actions. Predictive models help forecast various events in financial transactions. A historic step in earnings prediction occurred in 1966, reporting results using traditional statistical models. Since then, earnings prediction has matured, resulting in positive forecast and prediction outcomes, providing early warnings of bankruptcies, and producing better informed and efficient investment decisions.

The emergence of sizable datasets, increased computing power, and novel developments in computational statistics in particular, have propelled the rise of predictive analytics. These advances apply enabling technologies, such as data mining and ML, to data analysis to guide decision-making regarding future actions. Decision making regarding financial transactions can involve complicated questions, such as: What is the chance that forecasted earnings will be poor? How long before a firm files for bankruptcy?

11.6.1. Data Analytics in Financial Transactions

Data Analytics, the discernment of patterns from aggregate data subsets, has functioned as a decision-making spur in several fields, such as commerce, economics, healthcare, energy, aerospace, transport, and more. Over the past few years, the growing accessibility of data in terms of size and types, combined with the development of sufficient computer energy and processing capability, has led data analytics to evolve from descriptive and interactive instruments to capable predictive decision-making enhancers. The attention given by entities to the development of databases, combined with the financial gap generated due to research, search, and product development costs, has turned analytics into an inevitable element in the planning of any action. Although traditional statistical approaches are still valid within a respective scenario, probabilistic machine learning models, capable of better dealing with uncertainty, have become popular for expanding the predictive potential of available datasets. As robots empower society and push towards higher levels of efficiency, it becomes of utmost importance that prediction models exploit the available data to its maximum extent in order to assist in the development of more accurate and timely decisions. Artificial Intelligence, psychologically defined as the simulation of human behavior in machines programmed to think and act like humans, has in its machine learning algorithm sector, essentially based on Artificial Neural Networks, a utility tool for exploring the potentiality of such enormous amounts of data.

With worldwide GDP growing annually at an average of 4% since 1980, and with a market cap increasing from USD 100 trillion in 2016 to almost USD 250 trillion in 2021, Finance has functioned as the driving force of global society's wealth creation. Financial transaction data analysis has always commanded undue attention for its ability to create value through better predictions and recommendations. Data mining-based companies have brought forth a substantial portion of their cash from sales through recommendation engines.

11.6.2. Machine Learning Models for Predictions

The advantages and disadvantages of the predictive algorithms are discussed. A wide variety of predictive ML models are available, and optimization and tuning parameters are always applied to maximize its prediction performance. These include:

(1) K-Nearest Neighbors predicts the class of a new observation based on how closely it resembles other observations in the training set; (2) Naive Bayes models the occurrences of individual variables and computes the joint probability with the assumption that these variables are all independent; (3) Decision Trees recursively partitions the feature space to enable the accurate class prediction for new observations; (4) Neural Networks

inspired by the biological brain consist of interconnected neurons that communicate through weighted edges; (5) Boosted Trees combine the predictions of multiple base learners, typically shallow trees, to make accurate predictions; (6) Support Vector Machines search for the optimal hyperplane in the data which separates two classes with the maximum margin; (7) Random Forests constructs an ensemble of decision trees; and (8) Multinomial Regression learns the conditional probability of the outcome class, given the predictors in a supervised approach.

The aforementioned models are only a small subset of the exact prediction algorithms. They have different underlying assumptions toward the model, and they also have various advantages and limitations. One standard does not fit all. Nobody can claim one approach is the ability to learn without making assumptions about the data.

11.6.3. Impact of Predictive Analytics on Decision Making

Decision-making using the predictive output of the analytics, which are composed of prescriptive, cognitive, and predictive analytics, is as important as creating new predictive capabilities. Predictive analytics provides superior predictive capabilities to decision-makers, and its effective use considerably increases organizational performance. Predictive analytics have shown positive results in areas such as investment decision-making, project portfolio management, allocation of advertising and marketing push, credit and financial risk management, detection and prediction of credit card frauds, and inventory forecasting. Predictive analytics employs a large array of Machine Learning algorithms, and most often the outcomes of predictive analytics are assistive in nature where predictions of near future events are used to inform or guide executive or operational level decisions. The use of predictive analytics has shifted towards becoming a regular aspect of decision-making in contemporary organizations.

There is empirical support for the decision support perspective. Executives use predictions from predictive models to evaluate several near-term future organizational events, including sales and revenues, earnings performance, stock valuations, and supply contracts. Data-driven forecasting of financial metrics is now generally accepted, somewhat sophisticated forecasting is performed by many stock investment firms and successfully media-enabled. Decision scientists have considered integrating prescriptive, predictive, and cognitive capabilities together as a possible approach for the next generation of decision support research and practice. The use of predictive analytics contributes to several organizational capabilities, including cognitive decision capabilities, collective intelligence decision capabilities, and unique decision capabilities.

11.7. Regulatory Considerations

Creating a blockchain-based ecosystem that allows markets to self-regulate is only one of the goals of this entire endeavor. It has been assumed throughout this chapter that research would get close to a near-perfect predictive model that could be relied on and that behavioral predictions did also converge towards some rationality and thus near "laws of nature". In order for a market to self-state, investors need to rely on predictions so that they self-fulfill, as otherwise, there would be market disturbances due to indecisiveness, usually not backed with sufficient reason, but still being enough to trigger sometimes highly detrimental market disturbances. Investors and institutions will thus have to adhere to these predictions and instructions. From the factors, peer institutions and their data, uncertainty is not entirely reduced or eliminated, but probabilistically assessed. Autonomous behavior of institutions and investors gives rise to responsibility, accountability, and liability, which are the aims of the attempt to decrease systemic risk, but cannot be sufficiently guaranteed. Only a well-practiced and game-theoretical cooperation of all digital ecosystem participants provides a conceptual base for a solid trust into the ecosystem Regulations and restrictions come usually late and do not assist participation, trust, and dependency but hinder it. Therefore, suitable designs of such a system should consider ways and means to avoid or circumvent the view of governmental interventions that might lead to infringement of these assets. Efforts in building a regulatory framework for emerging technologies should set out from letting the innovation work on itself inside a sandbox environment without forcing entrepreneurs to leave for foreign markets. Only when the realities of an evolving ecosystem cease to drive toward disillusionment, unfavorable conditions must be put in place to overcome eminent shortcomings without labeling the whole project concept with a negative stamp.

11.7.1. Current Regulations on Blockchain and AI

percent of all euro-area companies are covered by some form of existing legislation. That is to say, virtually all EU companies performing processing of personal data will have to comply with some legal obligations, be it the GDPR, ePrivacy Directive or other. But what scope of responsibility do laws provide for risk sources? What happens if a corporation goes missing once the damage has been done? In particular, what happens to the damage caused by LLMs? Such AI models process vast amounts of original data from heterogeneous sources, synthesizing original answers based on abstraction skills. The entire chain of digital contacts universities, private researchers, startups, students, and even users still unaware of being data subjects involved in problem-solving processes is affected precariously.

The other point to discuss is to what extent the potential harms stem not from mere lapses by economic agents, but rather from the automated processes per se, that is to say, either by "malfunctioning" or simply by "predictable" decisions made by machines. Traditional accountability models, based on circuits of damage-reparation, falter if faced with the emergence of a new mass of externalities, different from those normally expected from the legal transactional scene. Two questions need to be raised: how far does the protective remit of existing regulatory tools stretch? To what extent must regulatory models develop further, in order to adapt to automatic models? Looking at blockchain systems, pre-existing legal scenarios usually regulate underlying economic transactions. Also these laws give most relevance to proofs being available, which unquestionably stem from solid identity technologies. Once relying on transparent decentralized databases, neither KYC nor AML are as simple as observed in centralized financial platforms.

11.7.2. Future Regulatory Trends

The promise of blockchain and artificial intelligence technologies stems from their potential to not only deliver disruptive innovation, but to also do so in a manner that fosters the stability and trust required to facilitate the transfer of power and influence; to share stakeholder value; and to engender the prediction of future trends and transactions for both market participants and regulators. Such innovation is forged through the development of highly decentralized systems at the edge; is designed to be resilient against technological or regulatory disruption; and serves to create a virtuous cycle of data generation, information clearance, predictive capability, and the delivery of services to market participants. The combination of these properties engenders positive network effects that are characteristic of current major technology platforms. While innovation at the edge in finance is widely desired, the potential that this innovation could bypass and even undermine existing regulations creates a trepidation on the part of the regulatory establishment. However, the concurrent development and deployment of decentralized systems, which effectuate the delivery of transaction predictive services that add real value for market participants, affords regulators with a credible and definitive response to the use of technology for market manipulation or other types of exploitation. This will likely incentivize regulators to embrace innovation in the finance sector that is enabled by the integration of blockchain and AI, while simultaneously empowering other public institutions with predictive capabilities that are based on these technologies in the desirous public interest.

11.8. Conclusion

To conclude this chapter, we present the main idea of this work and how it develops to achieve the proposed objective. Financial transactions, regarded here as actions by economic agents aimed at exploiting economic resources, whether directly or indirectly related to a monetary resource for which they intend to benefit, are typically represented by two records, each of which is maintained by different parties actively involved in the transaction. The contents of the records are related but not identical, since each record reflects an individual perspective and interest. In fact, the transactional content should generate some degree of benefit for the two parties involved in the financial transaction. Relative to external parties, verification of the transaction by an authority is useful but typically entails a certain delay before a confirmation is issued, which may vary from a mere hour to a week, depending primarily on whether or not the transaction is conditioned by a previous transaction. In an attempt to eliminate or at least reduce this delay, cost, and lack of confidence stemming from the difficulty or impossibility of verifying the trustworthiness of record maintenance parties, parties often tend to rely on an authority who can endorse the transaction and grant it the respective status of completed, effective, and trusted transaction.

11.8.1. Future Trends

This paper made a case for a multi-agent future of financial transactions, with cognitive agents owning, guiding, and controlling digital assets and the transactions that govern them. It is a future in which an artificial intelligence would partake in the transactions on the same level as the human actors and create the predictable behavior that allows for trust, thereby removing the friction necessary for the transaction to take place. Blockchain technology would provide the basic infrastructure for these transactions to occur in a decentralized manner, using light and power like any other resource in the economy, while artificial intelligence, using superlative capabilities in prediction, pattern recognition, and learning, would provide the necessary capability to lower risk by predicting the probabilistic distribution of results and informing delegated decision making by an ownership of the transaction.

While our work primarily addressed the cognitive augmentation of the human actor's delegations, we envision that the enabling of higher degrees of automation at a zero-cost may render any human cognitive involvement in some classes of simple transactions increasingly inefficient, due to the cognitive augmentation offered to the other party of the transaction, the intelligent agent. As an extension of this line of work, we envision that cognitive agents may start to replace human actors in crowdsourcing applications for image labeling or similar other pieces of work that are offered at ever-decreasing costs. Eventually, as generative AI continues to achieve further refinement by leveraging ever larger datasets, the work of human actors may increasingly become a complementary resource, performing checks on the generated content, with the replacement being gradual over time as the capabilities of AI continue to evolve and improve, in unpredictable cycles that have occurred before with the advent of previous technological revolutions.

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