# ARTIFICIAL INTELLIGENCE (AI) TECHNIQUES FOR DIGITAL FINANCE AND AXES

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## ABSTRACT

The aim of this research article was to discover the artificial intelligence (AI) contribution towards digital finance, axes and techniques.  With the emergence of new technologies and the wide adoption of artificial intelligence techniques to make daily tasks much smarter and even predict and anticipate changes, most sectors have gone digital. Finance has also benefited from this movement, thanks to the new form of digital finance or e-finance investors and stakeholders can anticipate the opportune moment to carry out their transactions. E-finance is an active and sensitive area of research because the information processed is money, from which the margin of error must be almost zero to avoid economic crises, sometimes the bankruptcy of individuals or companies. According to our research, this theme is recent, and several efforts have been made in the last decade to develop it. This article will present the scientific progress of e-finance and discuss the main axes in which research is currently concentrated. Finally, we will discuss the prospects for this area of research.

**Keywords:** Artificial Intelligence, E-Finance, Predict, Transactions, Economic Crises

## INTRODUCTION

Artificial intelligence or AI is a form of algorithms that allows the simulation of human intelligence to make tasks more intelligent or autonomous. Artificial intelligence encompasses the Machine Learning "ML" paradigm which allows the machine to automatically learn from an experience e according to a task t and measures its performance p. Commonly, ML is used for prediction to find hidden data by combining data mining and knowledge discovery in the database. Deep learning or "DL" is a recent branch of ML to stimulate the capacities of the human brain concerning its processing of images, sound, text, etc. DL is based on the Multi-Layer Perceptron "MLP". Artificial intelligence involves several areas of research and technologies such as Big Data, Natural Language Processing, machine learning "ML", data mining, and Deep Learning. AI has always existed in our daily life. There are technological advances on several levels. Application areas continue to diversify, from medical to transportation, security, business, and finance.  AI plays a very important role in the finance sector; its use allows for providing faster and more efficient solutions. Thus, AI can increase finance by reducing losses, processing data faster and smarter and, of course, improving customer relations, hence the term "E-Finance" which defines itself in the use of electronic communications and computing to provide financial services and markets. With the powerful data processing capability of ML companies can obtain real-time stock market insights to make investment decisions. Several companies use AI to process data to rank stocks based on certain investment criteria. Indeed, thanks to this model, companies will be able to recommend the best stocks of the day and thus build an optimal portfolio. The paper is structured as follows: first, the AI and finance are described, and later, the global axes of AI and finance are presented. Then, the techniques used in each axe are

detailed. In the end, we conclude by a table that summarize the most techniques used in each axe and give a summary of the comparison.

## AI AND FINANCE

Advances in management information technology have led to the development of new technologies that are highly valued in the financial sector. The goal is to automate some tasks and thus be faster. This is how AI can make the work of financial players easier, reliable and faster. As such, its application areas are broad, with the most well-known areas being accounting, customer service, and human resources. Due to the growing amount of data that needs to be processed every day, it is favored by other banks and financial companies, such as management companies. They have computerized all their services, so this technology is good for them. The financial industry is in the midst of a real revolution. Finance is very interested in new technologies and the various services and functions that can be integrated through these technological advances. On the other hand, it should be noted that new technologies are sometimes considered a threat to the financial world. In finance, the main advantage of these technology combinations is their ubiquity. In the long term, we can look forward to an entirely digital world, allowing the transmission and analysis of data to determine the right price for each user's situation. AI increases the number of services available, accelerates processes to make them instantaneous, and finally allows for the personalization of these services.

## GLOBAL AXES OF AI AND FINANCE

Several research works have been published concerning AI and its application in the field of finance. Milana & Ashta (2021) carried out a survey in which they presented all the contributions made with AI and ML in the field of finance. The authors presented all the axes and perspectives of active research in this field, mainly six axes; the first is about financial management, indeed this axis makes it possible to bring much more flexibility as regards the simplicity of the management processes and possibly reduce the processing time and the cost. The second axis is linked to the help of decision-making, classically this task is ensured by the

human factor which makes the process very complicated, especially with the mass of information that can be decisive, the application of AI can prevent companies from losing while selling purchasing of shares. The third axis is related to algorithms that help to avoid bankruptcies, in this axis, the NN algorithm has been adopted by a large community of researchers, and it has been reported that the latter performs better than statistical methods. The following axis presents all the techniques used to determine the credit rate as well as its solvency among borrowers. In this axis, all the studies cited are based on the following algorithms: Artificial Neural Network "ANN", Sequential Minimal Optimization "SMO", Naïve Bayes "NB", Logistic Regression "LR" and Recursive Partitioning, comparative studies have shown that SMO and LR give high accuracy rates. The fifth axis discusses the importance of AI for fraud detection, taxes, and accounting, which until now have been very complex to handle by classical models, as the methods used take new forms, which encourages the use of Reinforcement ML and Unsupervised Learning. The last axis is related to the security of exchanges using AI techniques and Block chain, where they confirmed that the use of ML models such as Support Vector Machine "SVM" and ANN can help in this sense since they can help minimize the risk in exchanges. In the same context, Goodell et al., (2021) published a survey in which they underlined the importance of coupling AI and Finance to address other challenges including three axes; fraud detection, price estimation, and FinTech (Financial Technologies). Indeed, the last axis includes two disciplines, one related to the Innovative Financial Business and emerging information technologies: blockchain, cryptocurrencies, digital advisory, payment services, trading systems, and crowdfunding. AI allows to provide users with financial advice and portfolio management services without human interaction. Other surveys dealt with the federating themes of AI Finance highlighting other aspects, Pallathadka et al., (2021) talked about the application of AI in Business, Commerce, and Finance proposing challenges and solutions. Not far from what has been cited previously this survey added other concerns of the research community mainly: Recommendation

systems and human resources. Regarding recommender systems, companies in the financial sector will be able to increase their sales and improve their revenue with the help of machine learning algorithms that can perform deep analysis based on historical data. Concerning human resources, the use of AI techniques, such as NLP, can save time and improve the recruitment process, and even after recruitment employee engagement is also an important factor that AI can improve. Machine learning can provide innovative training techniques in this regard.

## TECHNIQUES USED BY AXES
### Decision making
Decision-making is an important part of the investment. It can help limit competition, enter a new market or launch a business. On the other hand, this decision can decrease the company's financing capacity, leaving minimal chances for opportunities. In this sense, Paiva et al., (2019) proposed a model based on the SVM method to classify the assets that tend to achieve a certain payoff return and they also integrated the diversification method mean-variance to have an optimal result. On the other hand, Chena and Zhou (2020) chose to solve the problems related to decision making by combining Machine Learning techniques such as gradient descent and MPC "Model Predictive Control" in order to have more efficient results.

### Bankruptcy
Bankruptcy prediction is the problem of detecting the financial distress of a company, which will lead to eventual bankruptcy. This is an important issue in the financial sector, as successful prediction will allow stakeholders to take early action to limit their financial losses. Several studies have been conducted in this direction, Chen et al., (2020) contributed with two prediction models Bagged-pSVM and Boosted-pSVM which are based on the SVM machine learning model that has satisfactory classification performance. Barboza et al., (2017) chose to test several ML models such as Multivariate Discriminant Analysis "MDA", SVM, ANN, Random Forest "RF", and LR, their results proved that SVM and RF models performed better than ANN, LR, and MDA. Mai et al., (2019) in their part used Convolutional Neural Network "CNN", LR, RF, and SVM to solve the problems related to bankruptcy prediction.

### The credit rate and its solvency
Today, a suite of decision support tools for customer risk assessments is implemented and used to automatically assess customer creditworthiness and non-payment risk using artificial intelligence algorithms such as K-Nearest Neighbors "KNN", Decision Tree "DT", RF, NB, and LR which were used and tested by Wang et al., (2020) who found from their tests that RF works better in their specific experiment. In addition to that Dumitrescu et al., (2020) proposed the Penalized Logistic Tree Regression model "PLTR" which uses the information from the Decision Tree "DT" to improve the performance of the LR.

### Fraud detection
Fraud occurs when a person, whether a corporation or an individual, intentionally misleads another person with a false financial transaction, identity, product or service, or false promises with no intention of keeping them. Several companies lose significant amounts of money each year to fraud. The old traditional methods of fraud detection play an important role in reducing these losses. However, the most sophisticated scammers have devised a variety of methods to evade detection, including cooperation and various other means to construct fake identities. Pourhabibi et al., (2020) suggested working with graph-based anomaly detection (GBAD) techniques that are widely used for fraud detection in several domains. Chang et al., (2022) tested several algorithms including LR, KNN, DT, RF, and Autoencoder, and then proposed to integrate the NearMiss under sampling method since it improves the performance of the models.

### FinTech (Financial Technologies)
FinTech is a combination of two major terms in this article "financial" and "technologies" or financial technologies. The FinTech sector in its broadest sense includes all companies implementing innovative solutions to improve or rethink the financial sector. Regarding this axis, Adekoya et al., (2022) worked with the Time-varying parameter vector autoregressive (TVP-VAR) model proposed by Antonakakis et al., (2020), which is a model that is more flexible and robust in capturing possible changes in the underlying structure of the data. Ting-Chen and

Chang (2021) also used seven ML methods (LR, MLP, DT, RF, NB, BN "Bayesian Network" and SVM), to evaluate the influence of FinTech patents in the case of the Taiwanese financial industry, Noor et al., (2019) also used NB, DT, and RF as well as KNN and Deep Learning Neural Network "DLNN", and from their comparative study, they concluded that DLNN performed better in their case.

### Human resources

AI can optimize purchasing through semantic analysis or identification of business skills, and can also analyze the risk of discrimination. Thus, HR will be able to set up a real recruitment process. Parida et al., (2022) tested eight artificial intelligence algorithms (Stochastic gradient decent classifier (SGD), LR, KNN, Support vector classifier (SVC), NB, MLP, AdaBoost and RF) for predicting job recommendations, and they concluded that in their cases Random Forest returned the highest accuracy value, on the other hand Roy et al., (2020) used RF, Multinomial NB, LR, Linear SVC and received the highest accuracy value in Linear SVC.

### Recommendation systems

A recommender system is a specific form of data filtering designed to present information that is likely to interest users. Typically, a recommender system can compare a user's profile with some reference characteristics and try to predict what opinion the user will give. In finance, this could be the case for recommending stocks for users to invest in. Choi et al., (2022) used RF, Recurrent Neural Network "RNN", DNN, Long Short-Term Memory "LSTM", LR, CNN, DT, NB, SVM, and KNN during their development of a spare parts recommendation system. Li et al., (2020) tested the models ARIMA and SARIMA, Support vector regression, Wavelet analysis, and Wavelet Neural Network "WNN", Elman RNN, and LSTM-RNN and showed in a comparative study that the RF model achieves the highest accuracy value in prediction, however, in the case of using two criteria it is found that LSTM performs better in prediction.

**Table 1:** *Most used AI models per axes*

| | | SVM | RF | LR | KNN | DT | NB | MLP | DLNN | RNN | LSTM | CNN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Decision Making | Felipe Dias Paiva et al. (2019) | X | | | | | | | | | | |
| Bankruptcy | Zhensong Chen et al. (2020) | X | | | | | | | | | | |
| | Flavio Barboza et al. (2017) | X | X | X | | | | | | | | |
| | Mai Feng et al. (2019) | X | X | X | | | | | | | | X |
| The credit rate | Yuelin Wang et al. (2020) | | X | X | X | X | X | | | | | |
| Fraud detection | Victor Chang et al. (2022) | | X | X | X | X | | | | | | |
| FinTech | Ting-Hsuan Chen and Rong-Cih Chang (2021) | X | X | X | | X | X | X | | | | |
| | Umara Noor et al. (2019) | | X | | X | X | X | | X | | | |
| Human resources | Binny Parida et al. (2022) | X | X | X | X | | X | X | | | | |
| | Pradeep Kumar Roy et al. (2020) | X | X | X | | | X | | | | | |
| Recommendation System | Young-Hwan Choi et al. (2022) | X | X | X | X | X | X | | X | X | X | X |
| | Wenqiang Li et al. (2020) | X | X | | | | | | | X | X | |

**CONCLUSION**

E-finance has fully benefited from the artificial intelligence movement, tasks that were performed manually or based on statistical models have now become more intelligent, autonomous, and predictive. We find that most of the contributions touch the different axes to recall the decision making, bankruptcy, credit rate, creditworthiness, fraud detection, FinTech, human resources, and recommendation systems. However, following all of the research conducted, we note that FinTech is the most widespread in the research community. The majority of the research done on this topic has proven that RF, KNN, and SVM models perform very well in terms of prediction. Therefore, these findings can serve as a first guide for future contributions.

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