True Intelligence in Finance

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Abstract

The growing popularity of artificial intelligence (AI), in modern day industry, has begun to spread to the financial sector. Due to this spread, the discussion has begun for what AI model can most accurately accomplish tasks such as financial predictions, risk assessment, and credit evaluation in the financial industry. Neural networks do an exceptional job of accomplishing these tasks due to the fact that neural networks are capable of evaluating non-linear relations between predictor and outcome. This is especially important in the financial industry because most of the predictors for an outcome are usually unknown. Due to the fact that many of the predictors are unknown, it is important that the AI model be able to adjust the weights of known predictors to accommodate for the previously unknown predictor, a capability that neural networks have. Nevertheless, increasing reliance on AI has begun to raise questions on its viability, due to the possibility of discriminatory practices and other societal issues.

\*Remove any arguments in this Paragraph

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**Introduction**

The financial industry is one of the cornerstone industries of our nation and the growing efficiency of this industry could directly result in an increased standard of living. New artificial intelligence models have played a role in this industry since the early 80s and have played a vital role in advancing the industry as a whole. With the increasing interest in AI models these days there’s a lot of debate over what direction the financial industry will be going in, with many people questioning whether it will be possible to replace the humans in finance with smarter and more efficient AI. The answer to these questions depends on the type of AI model the industry decides to implement. Artificial neural networks, created as a result of the growing interest in artificial intelligence and machine learning, will be the more impactful in the financial industry than other AI models like linear regression models. Neural networks are superior when it comes to financial calculations in areas like credit evaluation, risk assessment, and financial prediction, resulting in an overall increase in productivity. However, there are many arguments, against an increased reliance on AI, which should be considered when implementing this technology, seeing as this technology is extremely complex and controversial. In fact, AI models take a lot of time to prep in order to ensure they’re functioning correctly.

**Background**

Functioning AI models for the financial industry are so difficult to make that there is only a dozen or so AI models operational throughout the financial industry, which are utilized by several different financial companies. These models have been modified and replaced over the years, in order improve them and allow them to handle larger amounts of data. One of the biggest improvements to these financial AI models, was the implementation of neural networks instead of traditional linear regression models. The main strength of the neural network is that it is non-parametric meaning that the AI model doesn’t have a set number of inputted parameters but rather the model analyzes the data to come up with its own parameters, whereas linear regression models have to have a specific set of parameters inputted (Burrell, Folarin, 1997, 194). Chase Manhattan Bank was one of the first banks to make this switch and was able to extract reliable data from financial statements something that was not possible with the previous AI models (p.195). One of the issues with neural networks; however, is that there are no specific guidelines for when to use this AI model (Coakley, 2000, 120). Neural networks have been proven to be extremely useful in various areas of finance such as credit evaluation, portfolio management, and financial prediction; however, various other fields have had very mixed results. (p.121). In order to understand why this model is so effective in these fields some background must be provided.

Before implementing neural networks, most financial industries used Efficient Market Hypothesis, statistical analysis, Portfolio Management Theory (CAPM and APT), and Financial Ratios, in an attempt to predict the impact of unknown forces in finance; however, they were particularly weak and often were unreliable (Burrell,1997,194). Financial researchers quickly discovered that supplementing these models with neural networks yielded much more accurate results and have been using this AI model ever since. However, the wide application of this technology has a began to bring up many ethical questions and challenges.

**Precedents and Related Works**

There are many different technologies which have raised many similar questions. When factories began implementing machines to replace factory workers, the rebels began to rebel, arguing that a machine could not do the work of a human simply because it could not put in the care and detail that humans could (Baase, 2013, 333). Machines evolved; however, eventually resulting in their ability to mimic the work done by a human despite the machines inability to pay close attention to factors that might affect the final outcome of the product (p. 333). Yet the impact of these machines is undeniable, due to the fact that they have vastly impacted the world we live in, by allowing for mass production of certain products and allowing for the automation of many jobs. This has allowed society to focus on various different fields and allowed us to advance significantly in the last few decades. The implementation of AI in the financial industry has raised many of the same questions as when implementing machines in factories such as: whether a machine can do the work of a human, whether it can take into account the various factors that can affect the work that it is trying to do, and whether it is ethical to replace the jobs of thousands of workers. Tom Lin, from the University of Florida, proposes another issue altogether which is the issue of regulation (2013, p.684). This was also an issue that arose when it came to replacing factory workers. People believed that without regulation, companies would indiscriminately lay off workers, which would drive the American economy into the ground. However, all these changes did was allow for new innovation, leading to new jobs in different fields, all around keeping the unemployment rate at a steady percentage. Despite this controversy it seems that technology continues to evolve and profoundly impact societal change.

**Support**

It’s truly incredible how the minute difference between neural networks and linear regression models can create such different results. An artificial neural network has various different components. It is composed of various interconnected units which each receive an inputted connection which are then weighted and adjusted for bias (Coakley, 2000, 120). When the value of these connections are summed up for each neuron in the sum is known as the linear combination of inputs. Then value given to these inputs is then analyzed to see if it is either linear or sigmoid. If the values are linear then the AI model resembles the multiple regression model and if sigmoid it resembles the linear regression model (p.121). The only difference between the regression model and the neural network model is that the neural network model is able to adjust the weights assigned to inputs so as to further minimize error (p.121). The ability to adjust weights allows for neural networks to model non-linear processes, making them ideal in the financial industry where conditions are constantly changing (Burrell, 1997, 194).

The financial world is constantly moving and being impacted by unknown forces so, being able to adjust your model for previously unknown forces makes this model key for the financial industry. In fact, one of the first applications of neural networks in finance was by Lapedes and Farber who used this model to predict chaotic times in the financial industry. While it was not initially successful, recent research has revamped this model and is yielding increasingly positive predictions (p.194). These small differences between linear regression models and neural networks allow for better performance in various aspects of financial calculations. Firstly, it is extremely helpful for analyzing the success rate of smaller firms by interpreting the current success ratios of the company and by estimating the possible capital in the following couple of years (p.194). Furthermore, by combining past models with the neural network models, financial researchers have been able to simulate company expansions and failures with fairly accurate results (p.195). One of the most impressive feats achieved with the new neural network technologies has been the implementation of accurate models that can predict banking failures (Ristolainen, 2017, 31). These models are known as early warning systems (EWS) and these systems use various models to help predict banking failures based on past failures as well as current international financial data (p.32). This was only made possible in the last decade by the ability to adjust the waits of unknown factors, something that economists have struggled with immensely since the Great Depression. Ristolainen states that the difference between EWS systems with linear regression models and EWS systems with neural networks is that the linear regression models performed phenomenally with the in-sample results, meaning inputted past banking failures; however, they performed very poorly with out-of-sample results (p.34). The reasoning that Ristolainen gives is that the relation between the banking crisis probability and the indicators are not necessarily linear, and in fact most of them are non-linear, meaning that the linear regression model cannot handle the relation between indicators and probability correctly.

Bahrammirzaee examines the various tasks that are given to these neural networks, outside of just finance, and examines how they these tasks relate to the financial field. Some of the main tasks assigned to these AI models are decision making, forecasting, and complex problem solving. As you can see, having the best possible candidate do each of these tasks is essential for the financial industry, which is why most financial companies employ AI to do it. It’s been proven time various times that these are tasks that these AI models excel in and with good reason, they can make relations between non-linear factors, allowing for new technology and along with that new societal implications.

The financial institutions of America play a key role in the economic success of the nation as a whole. This means that a better functioning financial institution results in a more stable and successful economy, and ultimately happier and more comfortable citizens. There are actually arguments against whether a more successful economy leads to more happiness in a nation but that’s a separate argument all together, so for the sake of this argument we will assume that there is a direct correlation between economic success and general comfort and satisfaction in a nation (Dutt, 2008, 527).

As previously stated, there are many tasks that neural networks have helped to facilitate, as well as helping to accomplish tasks which previously seemed impossible. The Lampedes AI model used for helping to predict chaotic times in the financial industry is a giant jump for AI (Burrell, 1997, 194). By being able to predict economic downfall is something that economists have struggled with for years. These types of models could aid in preventing potential economic depressions like the great depression and even the housing crisis of 2008. By being able to recognize dangerous financial practices prior to economic disaster could have huge implications on the way that companies do business. This ability also plays an important role in predicting the publics need for liquidity. The single biggest cause of the great depression was the banking system’s ability to provide its clients with the proper amount of liquidity, forcing large chains of banks to go under. By being able to better predict the need for liquidity it would better allow financial institutions to prepare for these potentially disastrous events and combine their efforts to better deal with them.

Some of the other areas where neural networks have really shined were in the areas of credit evaluation, portfolio management, and financial prediction. These are all areas that companies have struggled with seeing as there are so many factors which can affect the predictions. By allowing financial institutions like banks to make more accurate predictions it allows for more stable loans and more flexibility on these loans. The stability of these loans would allow for a healthier banking system and a more stable economy. However, this also presents a very possible issue which is the issue of discrimination. By attempting to predict the financial success of loan applicants and evaluating their credit, companies would be making decisions simply based on the attributes of the applicants. This could very easily lead to discrimination based on race, gender, and social standing. This then creates the issue of whether companies should be allowed to do this and whether perhaps a computer should not be allowed to make decisions that might entail race, gender, and social standing. Jeff Hawkins, founder of Palm Technologies and founder of Redwood Center for Theoretical Neuroscience, believes that there is no way for AI to replace us in finance (2007, 3). He believes that when making decisions AI often tends to simplify the data in order to make it easier to process because the system either doesn’t have the processing power or it would simply take too long to come to a proper conclusion (p.3). He then believes this simplification makes the results invalid and would mean that humans are the only candidate possible for dealing with issues in finance.

The one flaw in this argument is that it assumes that the human brain is more successful than these AI models. As explained with the early warning system models, machines are much more capable of predicting behavior than humans are when given objective data. Perhaps when it comes to race, gender, and social standing, people are more bias than machines, and in turn we should let machines do the decision making for us. Machines can’t take into account the stereotypes and past discrimination but rather they simply take in real time data making them immune to bias, something we cannot say about humans.

**Conclusion**

After considering the differences between neural networks and the other types of AI models it seems that neural networks are the much more appropriate AI models for the financial industry due to their ability to adapt to previously unknown predictors. This minute difference between models can make for a tremendous impact on the American economy as a whole, and in effect an incredible impact on the way its citizens live. This new AI model could mean for more a more reliable banking system, a more accurate credit evaluation system, and improved systems to predict financial instability. However, the implementation of this technology could easily cause various social issues, such as the issue of unemployment, but based on past examples of new technology implementations it seems highly unlikely. Furthermore, we could see an issue of oversimplification and possible discrimination by AI and companies, against specific groups of people, an issue that many people argue would be incredibly difficult to regulate. Overall society seems to have come to a cross road where it must decide whether it is accepting of technology and it allows AI to make decisions on its behalf. Many people are skeptical of this idea; however, based on the results of various AI models, in relation to the results of humans, it seems possible that AI may be able to make better decisions then humans, despite its limited processing power. Will we advance in our goals to create intelligent machines or will we join the luddites in their reluctance in their fear of the new.

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