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DEPARTMENT OF MATHEMATICAL SCIENCES

Part 1: Research Paper Review

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Research Paper: “Classification-based Financial Markets Prediction using Deep Neural Networks” by M. Dixon, D. Klabjan and J. H. Bang.

Contents

1	The principles of (data-driven) algorithms such as modern machine learning and data mining algorithms.	1
1.1	<i>Machine Learning</i>	1
1.2	<i>Deep neural network (DNN)</i>	1
1.3	<i>Data Mining</i>	2
2	The application of (data-driven) algorithms in the financial industry.	3
2.1	<i>Improving consumer service and promoting the development</i>	3
2.2	<i>Optimize monitoring of threats and market outcomes</i>	3
2.3	<i>Automated market processes</i>	4
2.4	<i>Improve Efficacy</i>	4
2.5	<i>Self-service analytics for all financial services</i>	4
	References	5

1 The principles of (data-driven) algorithms such as modern machine learning and data mining algorithms.

1.1 *Machine Learning*

Machine Learning is a series of methods that enable computers, by systematically finding statistically significant correlations in data, to automate data-driven model building and programming. To recognise increasingly complicated and secret patterns in data, analytical and communication techniques have advanced, utilizing machine-learning algorithms[1]. Also, models will now be built to respond to broader and more complicated data sets, and decision making can be assisted to predict in real-time the effects of such possible scenarios. Machine Learning is the initialization of algorithms. The goal is to construct algorithms that can be generalized from a certain number of instances [9].

1.2 *Deep neural network (DNN)*

Deep neural network (DNN) is an artificial neural (ANN) network, which includes many layers of input and output layers. The DNN determines the right mathematical method to convert input into output, whether linear or non-linears. The network passes across layers to assess each output's likelihood. For examples, a DNN trained to classify dog breeds would cross the specified picture and measure the probability of a certain breed becoming a dog in the picture. The consumer will evaluate the tests and pick the percentages that the network will show and return a name[2]. The use of DNNs to test a basic trading strategy is used in the research paper "Classification-based Financial Markets Prediction using Deep Neural Networks" to show its predictability and its connection to the viability of the strategy.

In the paper, DNNs are used to cope partly with past ANN shortcomings. In particular, the paper addresses model dynamic, non-linear linkages between the independent and the dependent variable and decreased overfit tendencies. The feed-forward topology has gained much more interest and is the approach to financial prediction, particularly in multivariate forecasting

analyses. Return propagation and gradient descent is the chosen training form of such systems since they are easy to apply and appear to converge in contrast with other training methods to a better local optimum. There are a variety of training parameters to use for a DNN, such as scale (number of layers and amount of units per layer). Owing to time costs and computing power, it is not feasible to switch around the parameter space for ideal parameters. Mini-batching is used as a standard method to accelerate computation. The history algorithm is further presented in a way that can be used for rapid output.

Supervised learning algorithms are created using labelled instances, such as an input that indicates the expected performance. Unsupervised learning is used against non-historical evidence.[\[8\]](#).

1.3 *Data Mining*

Data Mining is a tool collection for massive, complicated datasets. Since such techniques of data mining are almost always measured. To uncover trends in data, we use data analysis methods, methodologies and hypotheses. When company records are first placed on servers, this process started. It also offers consumers the ability to access their data in real-time [\[6\]](#).

There are other criteria for instruction to take into account for a DNN, such as the scale (amount of layers and number of units per layer). This paper is primarily aimed at explaining the usage of deep neural networks for financial time series data to identify the course of financial market movement. Usually, deep network classifiers are larger in layers and utilize more attributes and different performance statements or groups. The goal of learning is to find the weight at each edge that minimizes the calculation of the missed item [\[3\]](#).

2 The application of (data-driven) algorithms in the financial industry.

Financial services firms will build on emerging growth trends that are data enabled by collecting and exploiting large data volumes. The first step in achieving this goal is to build a stable framework for data processing to enable the study of both business data and big data. If you have developed this base, you can introduce machine learning algorithms that facilitate automatic process management and decision-making – allowing you to create insights that deliver improved service for consumers, increase operating performance and lead sales [4].

Thus far, the paper has explored the deep neural network's predictive property. The implementation and training of DNNs are defined in this paper "Classification-based Financial Markets Prediction using Deep Neural Networks". The paper shows that DNNs have significant predictive potential as classification when co-trained through a variety of markets on labelling data for a large sample of 5-minute mid-prices with various CME futures contracts. The usage of DNNs to check a basic trading technique to display the accuracy of prevision and its connection to productivity in the technique is illustrated. The programming is done in C++. Moreover, the application of data has driven algorithms in the financial industry is immense, these include:

2.1 Improving consumer service and promoting the development

The personal financial planner automates, and offers a holistic perspective of consumers' investments and guidance for the future. Identify investment opportunities depending on the company risk profiles and funds accessible, suggest transfer or usage of historical expenditure details clarify changes and promote enhancement in company saving patterns[7].

2.2 Optimize monitoring of threats and market outcomes

Identified financial offences such as bribery, money evasion, finance operations and irregularities.

2.3 *Automated market processes*

To learn why consumers query, recognise disgruntled customers, discover root causes of complaints and quickly react to distressed customers.

2.4 *Improve Efficacy*

Deep Neural Networks will assist you in forecasting the operating conditions dependent on past and projected events.

2.5 *Self-service analytics for all financial services*

Companies to use self-service technologies to bring data into the hands of employees. Because they gain value from data-driven analytics [4].

Present and potential profitability in financial services companies are determined by data-driven analytics. They are only the beginnings of an ambitious surge of data-based research and even more[5].

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