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Big Data from Business Perspective

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Abstract: *Big Data is a revolutionary phenomenon that has become one of the most popular subjects to talk about in the modern day and is certain to do so for the foreseeable future. By identifying and reviewing the issues, opportunities, obstacles, and most crucially the associated applications, we give a thorough assessment on the use of big data for forecasting in this work. The main difficulties that are impeding the process of deriving meaningful forecasts from Big Data include skills, hardware and software, algorithm architecture, statistical significance, the signal-to-noise ratio, and the nature of Big Data itself. An overview of big data-based forecasting research is provided in this study, along with information on the what (concerning data types and sources), where (forecasting hotspots), and how (analysis and forecasting methods used) big data improved prediction. It also provides insights into potential future directions.*

Keywords: Big Data

I. INTRODUCTION

A variety of data in unstructured or semi-unstructured formats have evolved and collected with the development of Internet technologies and computer science, creating big data that describes the world from a range of viewpoints. Big data have always been described by the 5Vs, or volume, variety, velocity, value, and veracity, even in the absence of a standardised definition. Big data have been incorporated into a variety of academic domains throughout the past few decades, promoting advancements to the related theories and technologies. One the one hand, new knowledge and information have been made available by instructive big data, supporting a fresh or improved understanding of the issues being studied and, as a result, challenging and even modifying the fundamental hypotheses that were based on traditional data. Big data has enabled significant advancements in forecasting research, a key scientific field that spans almost all research areas and captures both past and future dynamics. Big data used in forecasting research often originated from three main sources:

- Internet Users
- Activity Log
- Surveillance Equipment

Big Data's rise is a thing of the past. What matters is how businesses creating the tools and methods required to respond to and take advantage of the Big Data that is becoming more and more accessible. The issues surrounding Big Data projections as well as their possibilities are covered in the section that follows. a survey of statistical and data mining methods that have been tested for predicting with big data.

II. LITERATURE REVIEW

Traditional analytics are different from big data analytics. Due to the significant rise in data volume, several academics have recommended commercial DBMS, however they are not appropriate for handling large amounts of data. Traditional relational database management solutions cannot handle this kind of data. A processing technique known as MapReduce was used by Google to create the new cutting-edge technologies that were required. Although there are more Big Data management options, Hadoop, an open source project built on Google's MapReduce and Google File System, is the most popular. Yahoo, Facebook, Citrix, Google, Microsoft, IBM, HP, Cloudera, and many other companies are among the project's major backers.

2.1 Objectives and Scope

Many people believe that Big Data can help us make better forecasts if we can analyse and find hidden patterns, and [76] agree that data-driven decision making can help us make better predictions. According to [29], Big Data is most

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frequently used for creating predictive models in a world where forecasting continues to be a crucial statistical problem [46]. Tucker [91] predicts that Big Data will soon be able to foresee our every move. This, according to [3], is caused by these data sets' lack of organisation. Rey and Wells [75] and [92] both agree that data mining techniques can be used to forecast using big data. It should be noted, nonetheless, that time series data has not typically been the focus of Data Mining approaches in the past (see, for instance, [11, 39, 74]; [58]; [45]). It's interesting to note that [22] blames Big Data for the recent financial crisis, arguing that the financial models used at the time couldn't handle the massive volumes of data being inputted into the computers, leading to erroneous forecasts Big Data forecasting offers a variety of options for advantages. The use of big data to generate accurate weather forecasts is currently the subject of expanded research, and early findings indicate that big data will have a significant positive impact on weather forecasts [44, 55]. In reality, one of the main uses of Big Data has been for weather forecasting, but the forecasts are still unreliable for periods longer than a week [84]. The fashion sector is also making use of big data forecasts, with organisations like EDITD (http://editd.com/) gathering information from social media to estimate the future of fashion using big data [53]. [4] asserts that the airline sector is another area where big data forecasting is essential.

Netflix's use of big data forecasts for decision-making prior to starting production of its own TV show, "House of Cards," is an intriguing success story for forecasting using big data. This decision-making led to higher revenue for the company. The potential of Big Data forecasts is truly astounding and occasionally "scary," as was demonstrated by one person's experience described in a story by [27], in which an irate customer enters a "Target" store in Minneapolis to complain about the store sending coupons for pregnancy products to his high school daughter. A few weeks later, the same client apologises to the manager because it was discovered that his daughter was in fact pregnant after a conversation with him [27].

2.2 Challenges for Forecasting with Big Data

This section primarily focuses on the difficulties that must be overcome while forecasting with big data. It is crucial to remember that the existence of Big Data alone does not spell the end of issues [4]. A good illustration is the abundance of data on earthquakes but the lack of a trustworthy model that can properly predict earthquakes [84]. While [95] notes the lack of theory to accompany big data as an additional worry, some current challenges are connected to hypothesis, testing, and models used for big data forecasting ([72, 84]. In addition to this, we've identified a number of other difficulties with Big Data forecasting that should be taken into account.

2.3 Hardware and Software

While Arribas-Bel [3] noted the potential requirement for supercomputers to perform Big Data projections, he was of the opinion that current statistical tools cannot manage this problem. Recently, [51] developed automatic forecasting methods that may generate results in just a few seconds. Their dependability in the face of Big Data has not yet been put to the test. Another problem that directly relates to hardware and software is that, in our own experience, statistical programmes have crashed when faced with a small number of observations due to flaws in random access memory or the corresponding software. As a result, it is prudent to acknowledge that in order to successfully handle the increasing data intake, processing capabilities and the structure behind statistical software will need to be improved.

2.4 Big Data

Due to its fundamental qualities, Big Data itself presents a problem for predicting. First of all, because Big Data develops and transforms in real time, it's crucial that the methods used to forecast it can convert unstructured data into structured data [79], effectively record these dynamic changes, and anticipate transition points. Second, the extremely complex structure of Big Data presents difficulties. For example, [29] notes that it is difficult to construct forecasting models without producing subpar out-of-sample forecasts as a result of the "over usage" of possible predictors. A potential solution to this problem is factor modelling, which is detailed in the section below. However, more thorough research is required to fully resolve the problem.

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2.5 Applications of Statistical and Data Mining Techniques for Big Data Forecasting

This section identifies current statistical and data mining applications for big data forecasting. In order to give the reader a more satisfying experience, we have summarised these depending on the relevant field and topic (where applicable). It is important to highlight right away that [34] and [87] are intimately related to the advancement of econometric techniques for Big Data analysis and forecasting.

2.6 Forecasting with Big Data in Economics

Major users of Big Data for anticipating various economic factors include researchers in the field of economics. In order to forecast a sizable dataset comprising Spanish diffusion indicators, which they define as an entire picture of the Spanish economy, Camacho and Sancho [17] employed a dynamic factor model (DFM) based on the methods provided in [87]. DFM models, which are an extension of [87] factor models, are frequently employed in big data forecasting. The use of DFM for macroeconomic Big Data forecasting, according to [24], is incorrect since it is based on linear models and also because Big Data is more likely to be nonlinear. The DFM approach was enhanced over time by the work of [88], [35], and [54], making it more suitable for handling Big Data.

2.7 Forecasting with Big Data in Population Dynamics

In order to conduct a population census by fusing administrative data with information acquired through sample surveys, an imputation based on Neural Networks model was applied to the Norwegian population census data of 1990 [68]. By utilising the Spanish Population and Housing Census, as well as the Family Expenditure Survey, a method based on neural networks was employed by [36] to anticipate trends in Spanish economic indicators by home and censal section. Using statistics from the 1991 Census, Bayesian regression was utilised by [71] to predict long-term sickness in Stockport, UK. By analysing the 2007 census donor pool screening in [65], cluster analysis was employed as a technique for anticipating missing data. According to [38], Classification Trees have been used to forecast the unlikely appearances of farming operations in the initial Census mail list. According to Gilary [40], the US Census Bureau used the Decision Trees technique by combining a Stepwise Regression with the Classification and Regression Tree Concept for Recursive Portioning of Finite Classification Cells. Additionally, the work of [66] provides evidence that Decision Trees are used to predict survey non-respondents.

2.8 Forecasting with Big Data in Energy

For anticipating Big Data derived from China's electricity usage, Wang [93] employs Support Vector Machines as an auxiliary technique in addition to Neural Networks and "MapReduce" technology. In terms of processing Big Data pertaining to power, he discovers that the constructed prediction model can offer good portability and feasibility. By utilising Big Data from the British energy markets, Nguyen and Nabney [69] assess the use of the wavelet transform (WT) in conjunction with a number of models, including GARCH, linear regressions, radial basis functions, and multilayer perceptrons (MLP), to forecast UK gas prices and electricity demand. They discover that employing WT and adaptive models can significantly raise predicting accuracy. Based on the lowest mean squared error, it is concluded that adaptive models combining WT with either MLP or GARCH are the best models for predicting gas prices and electricity demand.

2.9 Forecasting with Big Data in Environment

To improve the precipitation forecasts for northern Switzerland utilising BigData from a numerical weather prediction model, Sigrist et al. [80] use stochastic advection diffusion partial differential equations (SPDEs). They discover that when SPDE is used, the forecasts are significantly better than the unprocessed projections produced by the numerical model.

2.10 Forecasting with Big Data in Biomedical Science

Theoretical support for Multivariate Boosting's application to predicting with Big Data is provided by Lutz and Buhlmann [61]. They suggest a multivariate L2 boosting technique that can be utilised with multivariate regression and a VAR series. The suitability of the suggested strategy is demonstrated by an application to 795 Arabidopsis thaliana genes.

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2.11Forecasting with Big Data in Media

An ARMA model with Singular Value Decomposition can be used to analyse and predict video access patterns, as demonstrated with data from thousands of YouTube videos ([43]). They discover that Hierarchical Clustering can produce superior forecasts for infrequently accessed films, whereas PCA can produce a reliable forecast for often accessed videos.

2.12 The Big Data Value Chain

The value chain idea was first established by Porter [11] as a basic framework for strategically considering the operations in any firm and evaluating their relative costs and roles in differentiation. The value chain is built around a number of key processes that deal with the conversion of raw materials into completed goods or services, as well as with marketing, sales, and customer support. Figure 1 depicts the value chain as a visual.

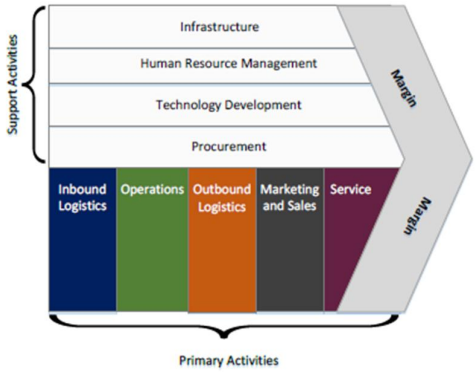

Fig. 1. Porter's value chain model

By creating a unique value chain for data, Miller and Mork [12] extended Porter's value chain to big data. Data discovery, data integration, and data exploitation were listed as the three core activities in their framework, which was centred on the fundamental tasks. The following tasks are part of the data discovery phase:

- Gather and annotate: Compile a list of data sources together with the meta information that describes them.
- Get ready: Enable sources' access and establish access-control policies.
- Organize: Identify each data source's syntax, structure, and semantics.

There is only one task in the data integration phase:

- Integrate: Create a standard way for all data to be represented, and preserve data provenance.

Three tasks are performed during the data exploitation phase:

- Analyze: Examine combined data.
- Visualize: Show decision-makers the analytical findings in the form of an interactive application that encourages exploration and improvement.
- Make decisions: Choose what actions (if any) to take based on the outcomes as they have been understood. Curry [13] also used big data to apply Porter's value chain. By concentrating on primary tasks, he used a similar strategy and employed the following activities: data collecting, analysis, curation, storage, and utilisation.Although Miller and Mork [12] and Curry [13] found significant data value chain activities, their value chains did not account for all of big data's complexity.Our approach encompasses Porter's support actions and fills in certain gaps.

Secondary Activities

The ancillary operations comprise purchasing and managing human resources. technical advancements, as well as business infrastructure, Outsourcing may be an option for auxiliary tasks. When a firm outsources, it does so by purchasing services from another organisation rather than offering those services directly. In addition to being advantageous economically, outsourcing may help you build expertise and resilience. Specialized services that can be challenging to perform internally might be provided through a service provider. Companies who seek to develop

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specialised competence inside a certain specialty and provide this competence to other organisations might find new business prospects through outsourcing.

Procurement

An essential task that calls for specialised knowledge of contract law and intellectual property rights is the acquisition of raw data. Due to the requirement for specialised skill, such support operations are frequently outsourced. It's possible that a smaller business won't be able to retain experts in these disciplines. In other situations, it's required to enter into contracts with data suppliers. A contract might include service level standards, such as those for availability/uptime and data quality, as well as rules on data use and payment terms.

Human Resource Management

In addition to the fact that regulatory environments are making human resource management more specialised, organisations may also seek some distance from human relations management tasks during periods of downscaling.

Technological development

Technological advancements might be crucial for big data's competitive advantage. If the company depends on staying ahead of its rivals, outsourcing technological advancements might be risky. However, it is expensive to design your own software. Software modules can be purchased from developers and merged with internally created software.

Firm Infrastructure

Structures, computers, networks, etc. make up infrastructure. Infrastructure is crucial, but it can also be costly. A frequent candidate for outsourcing is infrastructure. Outsourcing will frequently concern storage, networking, and computing power for big data firms. High availability and scalability may be achieved with cloud computing.

In order to distinguish between main and supporting operations, we have so far examined Porter's value chain model.

III. CONCLUSION

Big Data will only continue to expand in the coming years, and companies that are unwilling or unable to accept the challenges it presents as well as to acquire and use the necessary skills will soon find themselves in a precarious situation. In this assessment, which is focused on forecasting with big data, we first highlighted a number of challenges and then described the potential that big data has to provide and produce profitable results, given that we invest enough time and energy into resolving the identified problems.

The accuracy and efficiency of Big Data projections are therefore hindered by a number of major constraints that are now in place.Based on previous research, it is clear that factor models are now the most common and popular method used for big data forecasting, with neural networks and Bayesian models being the other two most popular options. The research also reveals that the use of big data for forecasting important variables is most common in the field of economics, with the issues of GDP and monetary policy receiving the majority of the focus. According to published research, the second and third most popular areas are Population Dynamics and Energy.

It is clear that there is still a great need for study into forecasting using big data, and that this research has the potential to produce more effective methods that will improve predicting accuracy. For instance, it would be intriguing to consider evaluating the use of a noise filtering technique for forecasting with Big Data, such as Multivariate Singular Spectrum Analysis, as this could help in overcoming one of the major challenges at present, which is the increased noise distorting the signal in Big Data.

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