The Application of Big Data Analytics in Business World

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Abstract— **There are huge amounts of data produced and accumulated in the business world. Current computer techniques have made it possible to store, process and analyze the big data. Business firms and other organizations are interested in discovering new business insight through Big Data Analytics (BDA) to increase business performance. This paper will discuss the application of BDA in various business situations and possible challenges.**

Index Terms— **Big data analytics, Business analytics, Social network analysis**

I. INTRODUCTION

IBM data scientists have defined four dimensions of Big Data, i.e., volume, velocity, variety, and veracity (4-Vs). The volume dimension refers to the scale of the data, while velocity refers to the frequency of creation or updating of data. For example, Walmart handles more than 1 million customer transactions every hour, which are imported into databases estimated to contain more than 2.5 petabytes (2560 terabytes) of data. The variety dimension means the data have different formats and are from different sources. And they could be structured, unstructured or semi-structured. Last, the data accuracy and quality (veracity) are very important for decision support [1]. Beside these dimensions, "value" is also recognized as an extra feature of Big Data, because it is one of the most important things for innovative enterprises to extract value from uncertain data [2].

Current computer technologies have made Big Data Analytics (BDA) possible [3]. MapReduce, Hadoop and NoSQL techniques have supported distributed data storage, parallel data retrieval and processing. Many analytical methods and algorithms are designed for business analytics, such as K-means clustering, Association rules, Linear/logistic regression, and Time series. Many software companies have developed their BDA products. For example, IBM has a series of software to support BDA

including InfoSphere, PureData, Cognos and SPSS modeler.

In the past ten years, BDA is widely used in the business world. It leads to the optimization in various aspects including marketing, customer management, visibility and communication [4], which enables operational transformation, innovation and better service [5]. Specifically, the prediction method of BDA benefits the advertising and recommendation on web. The streaming data analysis, social networks analytics and web page link analytics can be completed by description method. BDA is also beneficial to presenting unstructured data in the financial service which is a critical procedure of online transaction [6]. Furthermore, BDA enhances the autonomous information processing ability and data centralization of Internet platforms. This improvement reduces the information uncertainty and variability [7]. In the following parts, we will discuss various business applications of BDA and the current challenges.

II. CURRENT BUSINESS APPLICATIONS

Nowadays, there are many big data analytical tools available, such as predictive analytics, descriptive analytics, and survival analysis. Many methods and techniques are designed, such as linear regression, logistic regression, neural networks, and support vector machines. They are applied in many business areas, some of which are discussed below.

A. Retail:

The changes of the marketplace and the diverse demands of consumers lead to the increasing complexity of data volume and data type. One reason is that the personal opinions contained in the raw data collected for analysis are unstructured data frequently. Other contributors including online shopping, social media and collaboration also intensify the burden of data analyzing [5]. Walmart handles more than 1 million customer transactions every hour, which are imported into databases estimated to contain more than 2.5 petabytes of data. The Chinese E-commerce companies, for example, Alibaba (http://www.alibaba.com/) and Jingdong (http://www.jd.com/) , have similar stories [8]. Big Data Analytics can efficiently monitor and obtain insights of customer behavior data, which allows companies to improve performance, reduce costs and make strategic decisions [9]. The buying behavior analysis discovered from original digital footprints of customers is also useful for online marketing [10]. Due to these benefits, some Internet-based companies, such as Google, Amazon and Facebook, are

continuously investing in Big Data Analytics to maintain the competitive position [11].

B. Marketing:

Customer classification is helpful for designing campaigns and customizing promotion. For example, a telecommunications provider has segmented its customer base by service usage patterns, categorizing the customers into four groups. If demographic data can be used to predict group membership, we can customize offers for individual prospective customers. These can be done by applying logistic regression or neural networks.

C. Fraud detection:

Fraud detection is used in many areas including credit card fraud, insurance claim fraud, money laundering and tax evasion. Basically, it is to detect anomalies from data and transactions. Supervised, unsupervised, and social network learning can be used for fraud detection. For example, in banking industry, FICO Card Detection System protects accounts world-wide.

D. Customer relationship management:

The cost of retaining customers is significantly lower than the cost of replacing them, making the ability to identify customers at risk of churning vital. Key Performance Indicators are used to describe customers, including demographic information and recent call patterns for each individual customer. Predictive models based on these fields use changes in customer call patterns that are consistent with call patterns of customers who have churned in the past to identify people having an increased churn risk. Customers identified as being at risk receive additional customer service or service options in an effort to retain them.

E. Social network analysis:

The increasing use of social networks, such as Facebook, Twitter, and Weibo (http://www.weibo.com/) , has produced and is producing huge volume of data. Twitter posts more than 500 million tweets every day. Weibo is reported to have over 766 million active users per day in 2014. Business firms and other organizations are interested in discovering new business insight to increase business performance. By using advanced analytics, enterprises can analyze big data to learn about relationships underlying social networks that characterize the social behavior of individuals and groups. Using data describing the relationships, we are able to identify social leaders who influence the behavior of others in the network, and on the other hand, to determine which people are most affected by other network participants. We can also use diffusion analysis to identify the individuals most affected by the group leaders and target the marketing to them.

III. CURRENT CHALLENGES

Although there are many benefits brought by the use of big data, many issues and concerns have caught people's attention, among which are privacy and security problems [12].

In e-business environment, people's viewing history and purchasing transactions are recorded. With GPS function of smartphone, people's location and movement are exposed to third-party. The inappropriate inclusion and predictive analysis of an individual's personal data may occur without their knowledge or express consent. For example, mass surveillance programs, such as MATRIX and PRISM, exists on the premise that rich intelligence gathered through such programs is useful in enhancing counter-terrorism efforts. But how to balance national security against a citizen's right to privacy? Civil liberties are not just limited to a citizen's right to privacy but also extend to "social justice".

The potential security issues that relates to big data and big data analysis include being a target for attackers as it stores great volume of aggregated data from a wide range of sources and being compliant with regulatory, especially the data protection laws. The infrastructure must have strong security measures built in to guard the organization against internal and external threats.

Other challenges of big data analysis include the lack of intelligent big data sources, the short in scalable real-time analysis capability, the need of network support for applications, the demand in necessary expansion for peer-to-peer networks, the concerning of data privacy and information security regulations, the problems with data integration and fragmented data and the rethinking on cost effective storage subsystem of high performance. Also, requiring expensive software and huge computation infrastructure to do the analysis also get in the way of implementation [11].

IV. CONCLUSION

In the past ten years, we have witnessed the wide application of big data analytics in the business world, as well as an exponentially increasing number of papers in this area. These business applications have dramatically changed our everyday life. Inevitably, they also bring some problems, such as security and privacy problems. There are also many technical and social challenges, which need more exploration of researchers and practitioners.

REFERENCES

[1] P. Setia, V. Venkatesh, and S. Joglekar, "Leveraging Digital Technologies: How Information Quality Leads To Localized Capabilities And Customer Service Performance," *MIS Quarterly*, vol. 37, 2013, pp. 565-A4.

[2] M. Schroeck, R. Shockley, J. Smart,D. Romero-Morales, and P. Tufano. *Analytics: the real-world use of big data: how innovative enterprises extract value from uncertain data*, Executive Report, IBM Institute for Business Value and Said Business School at the University of Oxford, 2012.

[3] P. B. Goes, "Big Data and IS Research," *MIS Quarterly*, vol. 38, 2014, pp. iii-viii.

[4] S. Fan, R. Y. K.Lau, and J. L. Zhao, "Demystifying Big Data Analytics for Business Intelligence Through the Lens of Marketing Mix." *Big Data Research*, vol. 2, 2015, pp. 28-32.

[5] S. Mithas, M. R., Lee, S., Earley, Murugesan, S. and R. Djavanshir, "Leveraging Big Data and Business Analytics [Guest editors' introduction]." *IT Professional*, vol. 15, 2013, pp. 18-20.

[6] Y. Zhao, D. Li, and L. Pan, "Cooperation or Competition: An Evolutionary Game Study between Commercial Banks and Big Data-Based E-Commerce Financial Institutions in China." *Discrete Dynamics in Nature and Society*, vol. 8, 2015.

[7] C. K. Velu, S. E. Madnick, and M. W. Van Alstyne, "Centralizing Data Management with Considerations of Uncertainty and Information-Based Flexibility." *Journal of Management Information Systems*, vol. 30, 2013. pp.179-212.

[8] J. O. Stanworth, C. A. Warden, and R. S. Hsu, "The voice of the Chinese customer Facilitating e-commerce encounters." *International Journal of Market Research*, vol. 57, 2015, pp.459-481.

[9] O. Kwon, N. Lee, and B. Shin, "Data quality management, data usage experience and acquisition intention of big data analytics." *International Journal of Information Management*, vol. 34, 2014, pp. 387-394.

[10] J. K. Gerrikagoitia, I., Castander, F. Rebón, and A.Alzua-Sorzabal, "New Trends of Intelligent E-marketing Based on Web Mining for E-shops." *Procedia - Social and Behavioral Sciences*, vol. 175, 2015. pp. 75-83.

[11] H. Chen, R. H. L. Chiang, and V. C. Storey, "Business Intelligence and Analytics: From Big Data to Big Impact." *MIS Quarterly*, vol. 36, 2012. pp. 1165-1188.

[12] K. E. Martin, "Ethical Issues in the Big Data Industry." *MIS Quarterly Executive*, vol. 14, 2015. pp. 67-85.