European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.13, No.11, 2021

Business Intelligence and Data Mining: Opportunities and Future

Moaiad Ahmad Khder*
Department of Computer Science, Applied Science University
P.O. Box 5055, Building 166 | Road 23 | Block 623 | East Al-Ekir, Bahrain
E-mail: moaiad.khder@asu.edu.bh

Ibrahim A. Abu-AlSondos, Assistant Professor, Faculty of Business,
Business Intelligence Department, Middle East University, Amman, Jordan
E-mail: abu_alsondos@yahoo.com

Abstract
In the business world, endless streams of information "data" are needed in order to properly initiate the process of an effective business by analyzing different needs that the service has in relation to the needs of the end-customer, by anticipating these needs, the aim of any service creation is to meet customer requirements. In the recent years business intelligence (BI) been an interesting topic in almost every field. Likewise data mining which is a good solution in business intelligence matter, as for discussion, application and business domain. There are various attempts to detect the characteristics of services that are important to the acceptance of the service offered. The quest for attributes that satisfy and excite the consumer is possible through the use of various technological research approaches, but the efforts are enormous. The business is able to collect customer data in a more reliable and simpler way with the use of 'Smart Systems,' which are Information and Communication Technology (ICT) enabled services. The use of data mining and business intelligence to enhance the reversal of consumer needs when designing collection techniques is defined in this paper. The main purpose of this study is to define the importance of business intelligence with it features, how data mining works and some data mining techniques discussed in brief, in addition to exploring the future and opportunities of Business Intelligence and Data Mining.
Keywords: Business Intelligence, Data Mining, Business needs, Data Mining Techniques
DOI: 10.7176/EJBM/13-11-01
Publication date: June 30th 2021

1. Introduction

Businesses are forever striving to find a strategic foothold in the current era, which allows the business to offer products or services at a better cost, higher quality, and better efficiency than their rivals. The path that a business must take to achieve that starts with the quality and amount of knowledge and information that they can obtain (Ali, Bakar, & Omar, 2016; Ali, Omar, & Bakar, 2016).

In business, data governs all aspects of it , starting from the process of manufacture leading to supply chain management all the way until they reach retail sales to consumer experience to post-sale marketing and beyond, data holds the key to making operations more successful, cheaper production costs, higher profit margins and more effective marketing strategies.

But raw data on its own cannot be the answer; it is basically worthless without a way to communicate with the data and gaining useful insight.

Combining online analytical processing (OLAP), intelligence regarding location, enterprise reporting, business intelligence (BI) tools can be a great aid to organizations. Business Intelligence software provides organizations with the ability to link many data springs into a common source, collect and arrange the data intelligently and provide an interface for end users to generate reports that can provide a clear objective for more informed business courses of action.

In this paper we will be discussing how vital data mining is in business intelligence and how an efficient data mining strategy can greatly improve the business model of a company to properly satisfy the needs of its customers.

Business Intelligence (BI) is combination of automation that hand in meaningful information which helps businesses to have a good development and manage decision-making by storing, fetching, preparing, evaluating and presenting data (Yi Peng, 2007) BI is becoming an essential part of any business in view of the fact that it continually growing needs of organizations. The main purpose for business intelligence is to provide the exact data at the right time for a specific user. On the other hand, data mining puts the appropriate approach and mechanism to support business intelligence applications by retrieving proper information from huge data (Sivanandam, 2006). Companies uses data mining as a process to form useful information from a raw data, like businesses will be able to develop better marketing strategies that is suitable to the customer to gain more sales and decrease costs (Hasan, Oudat, Alsmadi, Nurfahasdi, & Ali, 2021).

Machine learning, databases, statistics, computer science, mathematics and many more are all controlled by data mining, it assimilates in different fields from its own context and makes distinct contributions (MUHAMMAD

ADNAN KHAN, 2020).

2. Related Studies

Kano-analysis is considered as one of the techniques to evaluate the satisfaction of customers with the business service or product (Kano & Seraku, 1984).

(Collins, Poras, & Collins, 2002: Ali & omar, 2016) discuss that when companies need to develop a new service or product, they always look for customers' feedback/response, which aids greatly in delivering the most suitable service; the company 3M uses a free hotline to get feedback from their customers on their products and services which helps the company in improving all if their new developments.

In a conference in France, (Che, Yang, & Jiang, 2017) explained how Business intelligence is simply the use of data warehouse and data mining in all companies' reports and analysis to improve, develop and foresee all of their products through the analysis of the customers reviews and feedback.

(Surajit Chaudhuri, 2011) goes in depth in explaining how businesses use data in developing their work and becoming more efficient using (OLAP, RDBMS, ETL,OLTP, etc..) which insures a better and more reliable data collection. They also discuss how cloud data services are facilitating the data acquisition and the reduction of main memory usage impacts backend data warehouses.

In 2010 (Roger S. Debreceny, 2010) made a study of 29 organizations' data sets for fraud detection and trying to find any irregularities in their digits, where usually last digits should have a logarithmic distribution. The result was that only 24 of the accounts had low occurrences and one only out of 3 accounts that had the same recurring last digits sequence was low.

(Rage, 2010) studied how mining data using association rules "with the single minimum support-based approaches" like (Apri-Ori and FP-growth) finding high-level, needed user behavior patterns using Knowledge Data Discovery, which resulted in showing that these rules with minimum support-based approaches lack performing up to expectations, where they propose some improvements in addition to their experiments.

(Nguyen, 2012) goes deeply explaining how the usage of datamining and data warehouse works in businesses using customers interactions in collecting and analyzing their needed data.

3. Characteristics of Business Intelligence and Data Mining

Business intelligence is an umbrella term that indicates a computer based group of processes that is used to apprehend and inspect data that are similar to a certain company (Kolker, 2012), it enables business owners and entrepreneurs to understand their business better and benefit from business intelligence model in which it comprises particular operations that can convert raw data to meaningful and applicable information to help support business decisions that allied to select a new business opportunity (Wael M. S. Yafooz, 2020).

Some characteristics of business intelligence are, rapid data processing where business intelligence access data in any time, intelligent correlation analysis that builds mathematical map, release venture's managements and supply scientific decision-making material. Besides multidimensional analysis target that merges analysis of item goods whey it generates statistics of multidimensional data structure (Loureiro, 2020). Business intelligence in some applications enables decision-making data by constant analysis and progressive selection. Frequently BI evaluate the current state of business and authorize actions by employing key performance indicators (KPI). (Francisca Castelo-Branco, Business Intelligence and Data Mining to Support Sales in Retail, 2020)

For example, a customer went to a store to buy an item and once the customer has purchased the item the store has already gathered someone data about the item the customer bought exactly the time and price. So the director of the item will supply for that shop, after he figures out the size of the wanted item that should be ordered, his only way to make a well-read assumption about it is when he knows the exact quantity of items are being purchased by the customers. So as each data being processed own a day the director of the item can review every transaction being made in a day to detect the purchased quantity, but this method is not time efficient, considering that the director will repeat this method every week, so to improve this and make it more cost efficient and time flexible the director can use a business intelligence tool to provide the exact information wanted. Businesses uses strategies to leverage data and achieve a sustainable contentious advantage, according to (Parama Fadli Kurnia, 2018) research the developing a BI for a company has to go through process that consists of four phases: analysis, design, planning, implementation and control. Fast data processing, Intelligent correlation analysis, Multidimensional analysis, Progressive analysis result are the top features of business intelligence (Seokjin Ahn, 2019). Fast data processing in BI can access data in any time wanted, it processes the data fast and it configure the data array function, and also data format (Ali, Bakar, & Omar, 2016; Ali, Omar, & Bakar, 2016).

Business intelligence Data mining is essentially a method for locating and extracting specific business rules from a wider group of data using sophisticated equipment.

Although the concepts of business intelligence and data mining are distinct, when used in combination, the two techniques perform effectively as there is a great deal of overlap. When it comes to cleaning, standardizing, and using business data, data mining is an essential component of business intelligence. It can also contribute to

making more reliable and efficient forecasts using the information which will enable the user to function at a higher level rather than only depending on previous data and guessing about potential outcomes.

In essence, data mining is the procedure of gathering, analyzing, and summarizing data from various sources providing the business reports that can help companies obtain a clearer overview of their activities and ultimately their services and products. Data mining is the processor which turns the raw data into intelligently gathered reports for an organization.

Business intelligence (BI) focuses mainly on analyzing and observing data sets and showcasing data against the goals of a company and their business. The data mining technique is often used to evaluate data sets to help identify trends and patterns.

And since the demand for higher quality services or products is ever increasing, the valuation of such services has come in the spotlight, with the use of BI and DM it has become possible to both report and analyze unstructured data and figures and their output is shown as a report for a predictive market analysis (forecasting), as Data mining provides a plethora of algorithms which can be applied to recognize patterns that in turn lead to reporting or analyzing output.

Business Intelligence requires proper stored data in the form of organized figures to base the intelligence on as they can be used to provide the required analysis and to report the findings of such analysis, since the value of a service or product correlates to the quality of it, that value can be increased by providing the business with systemic feedback that can be processed intelligently.

Table 1. Comparison between Business Intelligence and Data Mining

Business Intelligence	Data Mining
- Mainly used for interpreting and presenting data to stakeholders to inform data-driven decisions	- Mainly used for exploring and formatting data to find answers to business problems
- Processes relational databases to track enterprise-level metrics	- Processes small, specific datasets for focused analysis
- Gives results in the form of dashboards, graphs, charts, reports	- Gives results in the form of unique datasets in a usable data format
- Focuses on demonstrating the key performance indicator's progress	- Focuses on identifying new key performance indicators

4. Techniques Used in business intelligence

Business demand comes in different form of interpretive or non-interpretive model, it is important to know which technique is going to be used by deciding on which is more applicable modeling style (Osei-Bryson, 2009; Ali, Bakar, & Omar, 2016; Ali, Omar, & Bakar, 2016).

(Liwen Vaughan, 2009) proposed a method for business intelligence and examine two collected data set using the method and other one using another method with co-link search to testify which is better, and the resulting is both data got different results, so each method has a different purpose for BI for example the second method generates a model of whole competition of an industy which is perfect for macro-level analysis of business competition, while the proposed method generates a model of whole business competition with its sector which is better for micro-level analysis.

5. Data Mining Techniques

Data mining can be simply defined as gathering of related data to retrieve it based on aspect relations that process of relational database sets (G. S. Ramesh, 2020), Its important to be concern at data quality like is it insufficient data, not clear, lacking values, data enhancement and data shift (Mrazek, 1999; Ali, Bakar, & Omar, 2016; Ali, Omar, & Bakar, 2016), particularly It is an important to choose data mining technique that is suitable for a business, by applying these techniques there are some approaches to follow, like to enhance the relative costs of the outcome and efficiency in which it gives better result (Salameh, Abu-AlSondos, Ali, & Alsahali, 2020). For this reason, some of these techniques were discussed in this section, such as detection, “Association Rule, Classification, Clustering, Decisions Tree, and the Neural Networks are profoundly practical and successful” (Wael M. S. Yafooz, 2020).

5.1 Association Rule

Association rules are to extract the similarities and common formations in groups of items in database, it's a dependent associated variables in order to determine the interaction with items in similar action. In this case

applying association technique, developers can gather data on how user's build their websites and uses it, developers can use the data association technique to enhance the user experience of the website by evaluating where users points and clicks for instance what exactly engages the user to do such an action. (Abazeed & Khder, 2017).

5.2 Classification

"Classification is the most deliberate and generally practiced supervised learning data mining task" (Wael M. S. Yafooz, 2020). It identifies which set of groups a new data belongs to, it helps enhance business intelligence taking decisions (G. S. Ramesh, 2020). Classification is a two step process, where in the first step the training set is outlining the training set data within predefined groups using extraction, while the second step using the outline to classify and new data introduced and might as well extract more authentic classification rules. (6) As an example, Random Forest classifier and Naïve Bayesian classifier used to decide and manage classifiers with efficiency and parameter processing.

Naive Bayes can estimate unfamiliar limited anticipations to recognize groups, its known to deliver a great successful results in different Fields such as banking, marketing, medical-diagnosis and many more. On the other hand Random Forest can achieve building efficiency of performance and decreasing variance which makes it an excellent training model (Ramesh, 2020; Oudat, Ali, & Qeshta, 2021 ;Oudat, & Ali, 2021).

To demonstrate Classification, business owner needs to check the feasibility before starting a project, by using a classifier which requires to anticipate labels for groups like 'safe' label and 'risky' for further improvements that the project needs.

5.3 Clustering

Clustering is a method that merge objects together forming a group according to their similarity. Unlike classification, clustering shapes to any changes which eases identifying favorable features that differentiate different groups (Jian Pei, 2009), Clustering can detect relevant material for analysis that is beneficial in investigation areas in any form of "machine learning, pattern matching, information retrieval, image processing, and big data analysis" (G. S. Ramesh, 2020).

5.4 Detection:

Detection is a method that detects unnatural action, outliers, antithetical intuitive data values and uneven patterns in group of data, detection pursues these irregularities and explains them (Indranil Bose, 2001).

5.5 Decisions Tree:

The most popular technique for prediction is decision trees technique, it is simple to learn, perform as integral of adoption patterns to reach the suitability and choose specific data that stats with an easy question with more than one reply. It used in various practices like science, mathematics, law and business professions to help decide the best course of action.

Using historical practice to get some predictions that supports the framework of the decision tree, always practiced with classification techniques to accomplice the ideal information and predictive methods. The quality of Decision tree correlates classification efficiency and the size of the tree on training database, it comes in two phase technique: First, Building phase where data set are repeatedly separated as far as all items will be in a specific group. Secondly, Pruning phase in this phase to obtain a tree with higher efficiency and to avoid overfitting, nodes will be pruned.

6.Business intelligence and Data Mining: Opportunities and Future

6.1 Business Intelligence Web Applications

Web based application can be used to implement Business Intelligence applications as (A.V. Krishna Prasad, 2011) analyzed some of these applications in their article, these applications uses assimilation of specific technologies like such as: Agile modeling which is a method to model software systems by creating different models of their solutions, and integrate the user feedback during the whole process. Likewise, Web 2.0 which refers to tick web applications like search engine optimization and web services, which helps decision-makers observe patterns in web 2.0 applications that can be reused in economic deals (Ali, & Omar, 2016). These can improve the understanding of web engineering applications.

6.2 IoT

As companies continue to generate more and more data over time, we are likely to continue to use larger and larger datasets as Business Intelligence Advisors to efficiently store, process and analyze the data. It is not as if massive data were not previously stored, processed and analyzed. Indeed, companies around the world, including renowned household names like Netflix, Facebook and Google, do this every day. The impact of IoT and the overall increase

in information will require us to familiarize ourselves with environments of building, maintenance and tuning that are able to handle this load effectively. Technologies will continue to spur this innovation and this should excite us as Business intelligence consultants and make us want to develop our knowledge and skills further.

(IoT) technologies incorporate the devices' collected data with customer service systems, business analytics instruments, vendor managed inventory systems, and business intelligence apps. (Khder *et al*., 2021).

6.3 Data Science Applications

Data science has been outstanding in commercial applications such as shopping and film credit rating, recommendations, stock trading techniques, and ad placement. (Khder *et al*., 2021)

Some data science application that it might affect the business intelligence:

- Internet search
- Digital Advertisements
- Recommender systems

6.4 Big Data

The phenomenon of big data, volume, diversity and speed of the data have affected the intelligence of business and the use of data. As part of business intelligence new trends like rapid analytics and data science have emerged. This paper addresses the evolution of agile principles and practices with corporate intelligence and its challenges and direction in future. (Larson, and Chang, 2016)

6.5 Cloud Computing

In self-hosted environments, business intelligence (BI) was eventually in the face of a crisis of resources due to the constant expansion of data warehouses, and the demands on the underlying networking for online analytical processing. New hopes have been brought to life in the field of BI with cloud computing.(Al-Aqrabi *et al*. 2015, Jalamneh & Khder. 2021)

6.6 Industry 4.0

The analysis of Internet-of-Things (IoT) data with BI technologies has become highly relevant in the context of industry 4.0. However, for a number of reasons it is hard to design and implement IoT-based BI applications. (Plazas *et al*, 2020)

For many years, data collection and analysis were at the core of business intelligence (BI), but for the large volumes of data from industry 4.0 (I4.0) techniques, conventional BI needs to be adjusted. They create large quantities of data to be processed and used to produce value for companies in decision-making. Value generation from I4.0 is still a new research subject through data analysis and integration in strategic and operational activities. This research uses a systematic literary review with two goals in mind: the interpretation and identification of key research contributions and gaps through the creation of value via BI. The results show that most studies focused on the integration of large and unstructured data with real-time applications. More is needed in corporate research on transformation of business model, methodologies for managing technology implementation and frameworks for training people. (Bordeleau *et al*, 2018)

7.Conclusion and Future Work

This paper discussed literature study about business intelligence and data mining, briefly explains the importance of BI in business and web applications in which discussed about agile business intelligence and its way to help developing projects. Data mining techniques were discussed shortly with simply explained that using such techniques, business intelligence gain revamped decision-making, cost efficient, new profits, services and better market understanding conditions.

Data mining in business, in general is conducted through a variety of ways mainly focusing on collecting data from online media, direct feedback or studies made on/from customers to improve the quality of their services and products.

To decide why it is necessary, data mining can be used by businesses to find the data they need and to use for nosiness intelligence and analyzing.

Data mining is playing a vital role studying customers' feedback in order to improve quality of an organizations' service, but it also actually provides all kinds of analysis and studies needed for organizational management. Some organizations have used data mining in order to detect faulty sections in their organization, studying different business trends and even efficiently reducing and improving the work of their employees.

Evidently it becomes clear that a company's use of data mining strategies within the structure of business intelligence can have large positive effects on the company, its products and services and the industry itself, so if a company decides to become more data oriented, testing BI software is the next move in order to further improve the business' flow-of-work in an efficient and concise manner while optimally going through their business model.

Some association rules need to be improved in order to provide us with the best mined data for different processes in order to make an optimal use of the data making the process more time efficient and cost-effective, as data mining alone isn't sufficient but how the data is mined and what data is mined show an importance as well.

In future work, more business intelligence techniques to be discussed in depth and some data mining applications that are used for business intelligence are to be implemented.

References

A.V. Krishna Prasad, S. R. (2011). 1 Designing Dependable Business Intelligence Solutions Using Agile Web Services Mining Architectures.

Abazeed, A., & Khder, M. (2017). A Classification and Prediction Model for Student's Performance in University Level. J. Comput. Sci., 13(7), 228-233.

Adduci, R., Blue, D., Chiarello, G., Chickering, J., & Mavroyiannis, D. (2011). Big data: Big opportunities to create business value. Massachusetts: EMC Corporation.

Al-Aqrabi, H., Liu, L., Hill, R., & Antonopoulos, N. (2015). Cloud BI: Future of business intelligence in the Cloud. Journal of Computer and System Sciences, 81(1), 85-96.

Ali, B. J., Bakar, R., & Omar, W. A. W. (2016). The Critical Success Factors of Accounting Information System (AIS) And It's Impact on Organisational Performance of Jordanian Commercial Banks. International Journal of Economics, Commerce and Management, 4(4), 658-677.

Ali, B. J., Omar, W. A. W., & Bakar, R. (2016). Accounting Information System (AIS) and organizational performance: Moderating effect of organizational culture. International Journal of Economics, Commerce and Management, 4(4), 138-158.

Ali, B., & Omar, W. (2016). Relationship between E-Banking Service Quality and Customer Satisfaction in Commercial Banks in Jordan. American Based Research Journal, Vol-5-Issue-12, pp 34-2.

Andrea Ahlemeyer-Stubbe, S. C. (2014). A Practical Guide to Data Mining for Business and Industry. John Wiley & Sons.

Bordeleau, F., Mosconi, E., & Santa-Eulalia, L. A. (2018). Business intelligence in industry 4.0: State of the art and research opportunities. Proceedings of the 51st Hawaii International Conference on System Sciences. doi:10.24251/hicss.2018.495

Bose, I., & Mahapatra, R. K. (2001). Business data mining—a machine learning perspective. Information & management, 39(3), 211-225.

C. Soares, R. G. (2010). Data Mining for Business Applications. Amsterdam: IOS Press.

Che, L., Yang, X., & Jiang, F. (2017). Application and research on business intelligence in audit business. MATEC Web of Conferences. Les Ulis.

Collins, J., Poras, J., & Collins, J. (2002). Built to Last: Successful Habits of Visionary Companies. Harper Business Essential.

Francisca Castelo-Branco, J. L. (2020). Business Intelligence and Data Mining to Support Sales in Retail. Marketing and Smart Technologies, Smart Innovation, Systems and Technologies.

Galit Shmueli, P. C. (2016). Data Mining for Business Analytics: Concepts, Techniques, and Applications with XLMiner. John Wiley & Sons.

Han Jiawei, M. K. (2012). DATA MINING: Concepts and Techniques. In M. K. Han Jiawei, DATA MINING: Concepts and Techniques (pp. 84-99). Beijing: Machinery Industry Press.

Hasan, H., Oudat, M. S., Alsmadi, A. A., Nurfahasdi, M., & Ali, B. J. (2021). Investigating The Causal Relationship Between Financial Development and Carbon Emission in The Emerging Country. Journal of Governance and Regulation/Volume, 10(2).

Inmon. (2013). Big data implementation vs data warehousing. J. E. Plazas et al., "A Conceptual Data Model and Its Automatic Implementation for IoT-Based Business Intelligence Applications," in IEEE Internet of Things Journal, vol. 7, no. 10, pp. 10719-10732, Oct. 2020, doi: 10.1109/JIOT.2020.3016608.

Jalamneh, A.A, & Khder, M.A. (2021). Challenges of Implementing Cloud Computing in the Arab Libraries Environment. Information Sciences Letters, 10(1), 10.

Kano, N., & Seraku, N. (1984). Attractive Quality and Must-Be Quality; International Academy for Quality. The Journal of the Japanese Society for Quality Control, 39-48.

Khan, M. A., Saqib, S., Alyas, T., Rehman, A. U., Saeed, Y., Zeb, A., ... & Mohamed, E. M. (2020). Effective demand forecasting model using business intelligence empowered with machine learning. IEEE Access, 8, 116013-116023.

Khder,M.A,Fujo,S.W and Sayfe,M.A. (in press). A Roadmap to Data Science: Background, Future, and Trends.Int. J. of Intelligent Information and Database Systems.

Kiran, R. U., & Reddy, P. K. (2010, June). Improved approaches to mine rare association rules in transactional databases. In Proceedings of the Fourth SIGMOD PhD Workshop on Innovative Database Research (pp. 19-24).

Kolker, A. (2011). Healthcare management engineering: What does this fancy term really mean?: The use of operations management methodology for quantitative decision-making in healthcare settings. Springer Science & Business Media.

Kurnia, P. F. (2018). Business intelligence model to analyze social media information. Procedia Computer Science, 135, 5-14.

Larson, D and Chang, V. 2016. A review and future direction of agile, business intelligence, analytics and data science. Int. J. Inf. Manag. 36, 5 (October 2016), 700–710. DOI:https://doi.org/10.1016/j.ijinfomgt.2016.04.013

Loureiro, N. M. (2020). Business Intelligence: Use of Data Mining Techniques for the Prediction of Internment Times.

Mrazek, J. (1999, September). Data mining for robust business intelligence solutions. In European Conference on Principles of Data Mining and Knowledge Discovery (pp. 580-581). Springer, Berlin, Heidelberg.

Nguyen, P. V. (2011). Using data warehouse to support building strategy or forecast business tend. arXiv preprint arXiv:1205.0724.

Oudat, M. S., & Ali, B. J. (2021). The Underlying Effect of Risk Management On Banks' Financial Performance: An Analytical Study On Commercial and Investment Banking in Bahrain. Ilkogretim Online, 20(5).

Oudat, M. S., Ali, B. J., & Qeshta, M. H. (2021). Financial Performance and Audit Committee Characteristics: An Empirical Study on Bahrain Services Sector. Journal of Contemporary Issues in Business and Government| Vol, 27(2), 4279.

Pei, J., Zhang, X., Cho, M., Wang, H., & Philip, S. Y. (2009). On Mining Maximal Pattern-Based Clusters. In Data Mining for Business Applications (pp. 31-52). Springer, Boston, MA.

Peng, Y., Shi, Y., Li, X., Chen, Z., & Kou, G. (2006, December). E-business intelligence via MCMP-based data mining methods. In International Workshop on Web Intelligence Meets Brain Informatics (pp. 443-453). Springer, Berlin, Heidelberg.

Ramesh, G. S., Kanth, T. R., & Vasumathi, D. (2020). A Comparative Study of Data Mining Tools and Techniques for Business Intelligence. In Performance Management of Integrated Systems and its Applications in Software Engineering (pp. 163-173). Springer, Singapore.

Roger S. Debreceny, G. L. (2010). Data mining journal entries for fraud detection: An exploratory study. International Journal of Accounting Information Systems, 157-181.

Rud, O. P. (2009). Business Intelligence Success Factors: Tools for Aligning Your Business in the Global Economy. Hoboken, New Jersey: Wiley & Sons.

Salameh, A. A., Abu-AlSondos, I. A., Ali, B. J., & Alsahali, A. F. (2020). From Citizens Overview: Which Antecedents' Can Assist to Increase Their Satisfaction Towards the Ubiquity of Mobile Commerce Applications? International Journal of Interactive Mobile Technologies, 14(17).

Seokjin Ahn, S. V. (2019). A Fuzzy Logic Based Machine Learning Tool for Supporting Big Data Business Analytics in Complex Artificial Intelligence Environments

Sharma, S., & Osei-Bryson, K. M. (2009). Role of human intelligence in domain driven data mining. In Data mining for business applications (pp. 53-61). Springer, Boston, MA.

Sivanandam, S. S. (2006). Data Mining in Business. Studies in Computational Intelli- gence (SCI).

Surajit Chaudhuri, U. D. (2011). An Overview of Business Intelligence Technology. Communications of the ACM, 88-98.

Valsamidis, S., Kontogiannis, S., Karakos, A., & Kazanidis, I. (2010, September). Homogeneity and enrichment: Two metrics for web applications assessment. In 2010 14th Panhellenic Conference on Informatics (pp. 48-52). IEEE.

Vaughan, L., & You, J. (2006, December). Keyword enhanced Web structure mining for business intelligence. In International Conference on Signal-Image Technology and Internet-Based Systems (pp. 161-168). Springer, Berlin, Heidelberg.

Wielki, J. (2013, September). Implementation of the big data concept in organizations-possibilities, impediments and challenges. In 2013 Federated Conference on Computer Science and Information Systems (pp. 985-989). IEEE.

Yafooz, W. M., Bakar, Z. B. A., Fahad, S. A., & Mithun, A. M. (2020). Business Intelligence through Big Data Analytics, Data Mining and Machine Learning. In Data Management, Analytics and Innovation (pp. 217-230). Springer, Singapore.

Yong-li, Q. X. W. (2012). Multi-granularity Temporal and Spatial Approximate Aggregate Query on RFID Data Warehouse. Computer Science, 06.