

Fostering Oman Tourism using big data Analytics by Mining Weblog and Social Networking Data

Dr Sanjai Gupta¹, Safa Mohsin Hamed Al Busaidi², Hanaa Fadhil Al Hinaai³, Huria khalfan harith al-busaidi⁴

¹Lecturer, Information Technology Department, Nizwa College of Technology, Nizwa, Sultanate of Oman

^{2,3,4} Students, Information Technology Department, Nizwa College of Technology, Nizwa, Sultanate of Oman
Gupta.dr@gmail.com

Article Info

Volume 82

Page Number: 3609 - 3620

Publication Issue:

January-February 2020

Abstract:

Many consumers are currently interacting via social media. The social media sites form platforms from which the consumers express themselves and give relevant feedback regarding their experiences with various brands, products, and services. The data about such interactions could be gained from social media sites such as Facebook and Twitter, translating into sentiments that could be analyzed to predict consumer preferences and trends in their needs. With an increase in the volume of data about these interactions, the concept of big data has evolved and aids in achieving big data analytics for sentiment analysis and trend prediction. In this study, a web mining approach has been employed due to a lack of authentic weblog information. The aim is to get important data regarding the behavior of tourists and their feedback regarding various sites of attraction in the context of Oman. Some of the data collection tools that have been utilized include rapid mine operators and Apache Flume to gain information from Facebook and Twitter. To establish an adequate data mining framework, the study has employed CRISP-DM, eventually achieving various patterns regarding heritage tourism in Oman. To analyze data from Twitter, the study has relied on Apache Hive and Apache Hadoop.

Article History

Article Received: 18 May 2019

Revised: 14 July 2019

Accepted: 22 December 2019

Publication: 20 January 2020

Keywords: Oman's Tourism, CRISP-DM, Social networking, weblog, web mining

I. INTRODUCTION

The aim of this study is to collect, analyze, and present information regarding heritage tourism in the context of Oman. The study relies on social media sites as sources of data, with web content collect from different websites charged with various tourism activities in the country. Of importance to note is that social networking data has been selected and deemed ideal because there is an increasing number of people interacting longer and more frequently by using mobile devices and these social networking sites in the context of Oman [1-5]. Indeed, it is projected that the reliance on such big data will give crucial insight into the subject under investigated, especially with the motivation of enhancing tourism in the region via the presentation of predictive, prescriptive, and diagnostic data.

Persistent global transformations have encompassed changes in the Mainframe, personal computer, internet, cloud computing, and the Big

Data era. Big data refers to sets of data or combinations of data sets that are difficult to capture. The difficulty in capturing data sets arises from variations in velocity, variability and volume of the sets of data (Stonebraker, Abadi & DeWitt et al. 2010). According to Suri and Vassilvitskii (2011), big data is also difficult to process, analyze or manage using conventional tools and technologies contained in visualization packages, desktop statistics and relational databases. Whereas the size required to categorize particular sets of data as big data is yet to be established, most practitioners and analysts consider sets of data that range from 30-50 terabytes as big data (Suri & Vassilvitskii, 2011).

Complexities in the nature of big data arise from majority of data sets' unstructured nature. This disposition is generated by advanced technologies

such as cell phones, smart phones, portable computers, internet searches, vehicles, machinery, device-embedded sensors, radio frequency Id (RFID), web logs, and social networks such as Facebook (Teevan, Ramage & Morris, 2011). Therefore, effective utilization of big data is achieved by combining the data sets with structured data that originates from more conventional business applications. The latter include Customer Relationship Management (CRM) and Enterprise Resource Management (ERP).

Other aspects that pose challenges in the management, use and storage of big data include ubiquitous natures of networks, systems, real-time devices in data capturing, and modern on-line devices. Without a doubt, the growth of big data is expected to proceed to the far future (Yang, Dasdan, Hsiao & Parker, 2007). Growth in big data-related sectors is associated with developments in new technologies and tools. According to Xiao, Wang, Lin and Shang (2009), a significant portion of the new big data technology is dependent on massively parallel processing (MPP) databases. Xiao, Wang, Lin and Yu (2008) affirm that the databases offer simultaneous distributions of large data set processing, beneficial to numerous servers. However, research on specific approaches to effective management, use and storage of big data is yet to be established. In addition, some of the research attempts that examine the nature and operation of big data tend to focus on established firms such as social sites especially Facebook. However, technological advancements demonstrate that some firms are still at the take-off stage — towards big data management. Unfortunately, solutions to the challenges that face firms at the take-off stage have not been proposed vividly.

II. Proposed Insights & Methodology

- A. In this stage, data collected from Twitter was analyzed. The tool of analysis was the Hadoop system. Also, the data was collected via the use of Apache Flume because this approach was projected to provide real-time information. It is also notable that the analysis of big data was achieved through Apache Hive. The steps were summarized as follows:

Build external table for stacking the information got from twitter as key and esteem utilizing Hive.
Split every tweet into words
Make lexicon content record that contain a large number of positive and negative words with their rating.
Mapping the words split from tweets with words in the lexicon to check what number of positive and negative words.
Tally the level of positive and negative opinion
With additional KPI's, visualize the outcome utilizing suitable application.

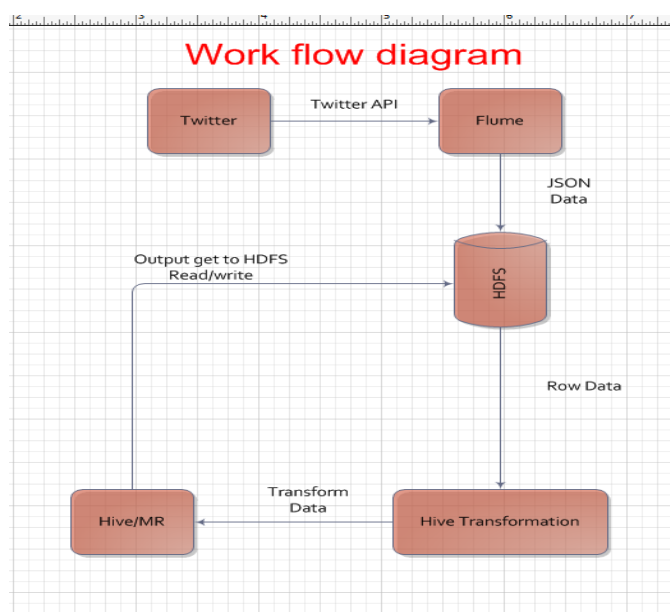


Fig.1. twitter data analysis workflow diagram via Hadoop ecosystem

B. This step involved the analysis of Facebook interactions regarding tourist activities and experiences in Oman. The procedure relied on the Rapidminer [6]. Initially, there was the compilation of Facebook links associated with tourism operations in Oman. The information was recorded on a worksheet. In turn, some operators were used in developing an ideal model for collecting data from different Facebook sites. The next step entailed analyzing big data based on text mining and web mining approaches. For opinion mining, API AYLIEN was used, especially by focusing on natural text. At the end, Rapidminer aided in outcome visualization [7, 8].

C. At this stage, the motivation was to establish the relationship between variables of economy, job, and tourism in Oman. From the selected websites, web mining was conducted after identifying the target Facebook pages associated with different sites of tourism activities in Oman. As mentioned earlier, a worksheet had been developed after identifying the target sites. The next step involved implementing web mining operators to develop a relevant framework through which data from different web pages linked to social media could be collected. To establish a correlation matrix explaining the intersection among the selected variables of economy, jobs, and tourism in this country, correlation operators were utilized. The eventuality is that Rapidminer aided in outcome visualization.

D. This step constituted tourist site ranking relative to the findings that were obtained from customer reviews on Twitter. Indeed, Rapidminer analytics aided in achieving this objective. Hence, comments from customers interacting on Twitter were collected regarding different tourist attraction sites in the selected country. To collect and analyze data effectively, Twitter API was used (for data collection) alongside text mining and web mining approaches (for data analysis). To gain insights into natural text and the resultant analyses, the study employed API AYLIEN. The eventuality is that Oman's tourist attraction sites were ranked relative to the site users' neutral, negative, and positive comments about their experiences in the respective sites. Similar to most of the previous steps, Rapidminer was employed for the purpose of outcome visualization [8].

III. Experiment and Result

A. Data Collection:

Some of the systems that were used to collect data included Rapidminer, Apache Fume, and Apache Hadoop. Particularly, there was the collection of primary data from selected social media or social networking sites such as Facebook and Twitter, as well as certain tourism websites.

In this research project we have used various tools and technology such as Apache Hadoop, Apache Flume, and Rapid miner for the data collections. The following figures summarize the various approaches that were used to collect data.

1. Twitter data collection using Apache Flume:

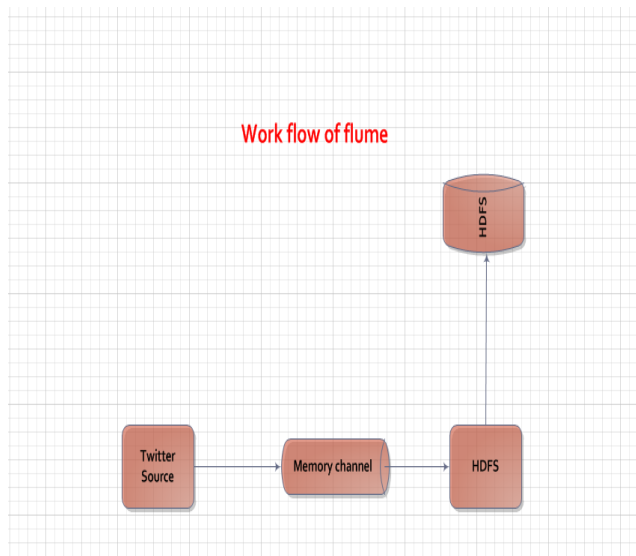


Fig.2. Workflow of Flume to establish connection between HDFS and Twitter.

```
File Edit Format View Help
TwitterAgent.sources = Twitter
TwitterAgent.channels = MemChannel
TwitterAgent.sinks = HDFS

# Describing/Configuring the source

TwitterAgent.sources.Twitter.type = com.cloudera.flume.source.TwitterSource
TwitterAgent.sources.Twitter.consumerKey = WECEAcRVLxn2D4bnF0jshYxRE
TwitterAgent.sources.Twitter.consumerSecret = LMqnxUYq1VskqsPgc7zcBSMw64JwQmsqgtLWszDOR0trK8
TwitterAgent.sources.Twitter.accessToken = 970556655376261120-r26q8YEBJFzQ1rpdIhrOggazMLt1EHV
TwitterAgent.sources.Twitter.accessTokenSecret = QanvSLR4TPzfHeMC11Xs13WXZ1fIQh5JTr87d16kQOP5
TwitterAgent.sources.Twitter.keywords = oman, tourism, muscat

# Describing/Configuring the sink

TwitterAgent.sources.Twitter.keywords= oman, tourism, muscat
TwitterAgent.sinks.HDFS.channel=MemChannel
TwitterAgent.sinks.HDFS.type=hdfs
TwitterAgent.sinks.HDFS.path=hdfs://localhost:9000/tourism
TwitterAgent.sinks.HDFS.hdfs.fileType=DataStream
TwitterAgent.sinks.HDFS.hdfs.writeFormat=Text
TwitterAgent.sinks.HDFS.hdfs.batchSize=1000
TwitterAgent.sinks.HDFS.hdfs.rollSize=0
TwitterAgent.sinks.HDFS.hdfs.rollCount=10000
TwitterAgent.sinks.HDFS.hdfs.rollInterval=600

TwitterAgent.channels.MemChannel.type=memory
TwitterAgent.channels.MemChannel.capacity=10000
TwitterAgent.channels.MemChannel.transactionCapacity=1000

TwitterAgent.sources.Twitter.channels = MemChannel
TwitterAgent.sinks.HDFS.channel = MemChannel
```

Fig.3. Flume code to establish connection between HDFS and Twitter

2. Data Collection using Web mining operators in Rapid miner:

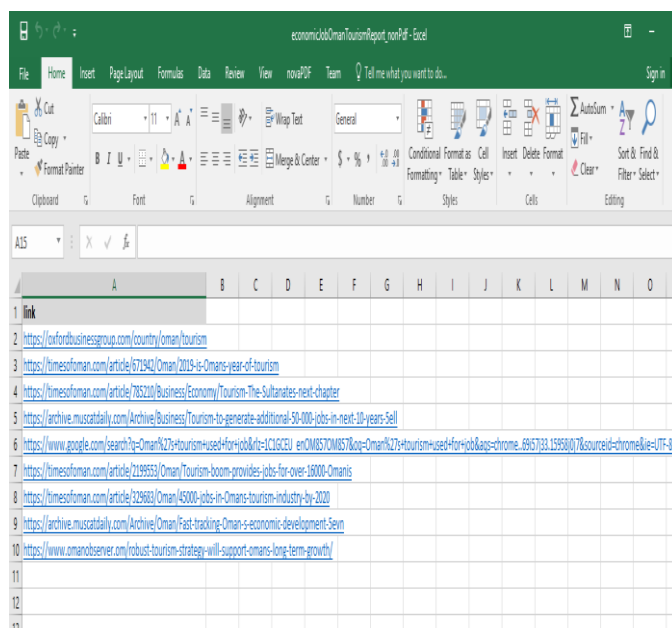


Fig.4. Compiled links of different related web page

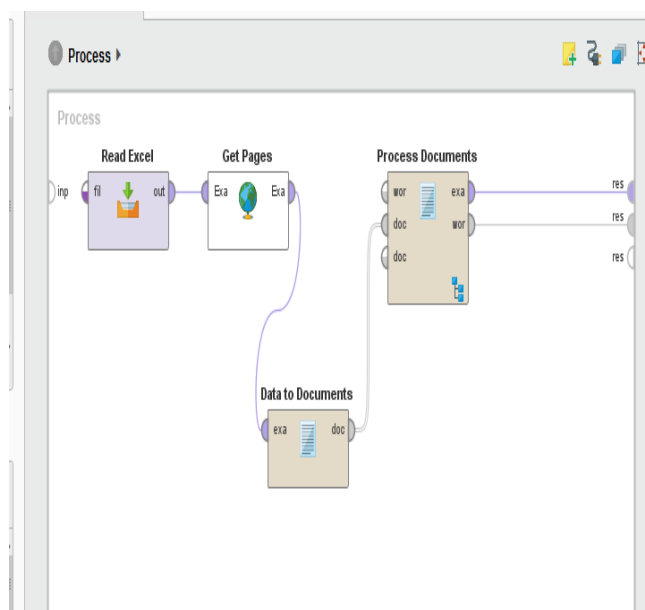


Fig.5 Web mining & text mining operators to extract web contents

3. Facebook Data Collection using Web mining operators in Rapid miner:

	A	B	C	D	E	F	G
1	links						
2	https://www.behance.net/gallery/61647341/Sultan-Qaboos-Grand-Mosque?fbclid=IwAR2UR0pQhUlygWAXagpd380-05AaK_MGSSZWS3UJ7-RPXK7ZZbNucWUul						
3	https://www.facebook.com/pages/Wahiba-Sands-Oman/206770549730508?ref=br_rs						
4	https://www.facebook.com/pages/1000-Nights-Camp-Wahiba-Sands/337815040310550?ref=br_rs						
5	https://www.facebook.com/pages/Wahiba-Sands/102613743126764						
6	https://www.facebook.com/places/Things-to-do-in-Salah-Oman/106024436104245/						
7	https://www.facebook.com/sidabotours/						
8	https://www.facebook.com/omandolphinocean/?ref=br_rs						
9	https://www.facebook.com/NizwaFortOm/						
10	https://www.facebook.com/pages/Nizwa-Fort/119405681439723?ref=br_rs						
11	https://www.facebook.com/Nizwa-Fort-183201895570246/						
12	https://www.facebook.com/nizwa.fort.336						
13	https://www.facebook.com/pages/Bahla-Fort-Oman/870537602983286?ref=br_rs						
14	https://www.gigaplace.com/en/place-bahla-castle/weather-and-season/?fbclid=IwAR2AbLQVh6mIAHK74WpIMCbbielEu6UAmfmMLRy7W46QU738sN09xdpjp						
15	https://www.gigaplace.com/en/place-bahla-castle/weather-and-season/?fbclid=IwAR2AbLQVh6mIAHK74WpIMCbbielEu6UAmfmMLRy7W46QU738sN09xdpjp						

Fig.6.Compiled Facebook page links of Tourism sites of Oman

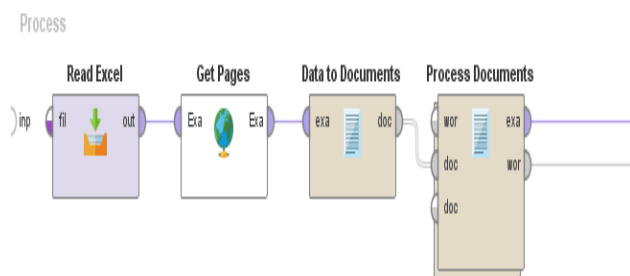


Fig.7. Web mining & text mining operators to extract Facebook page content

4. Twitter Data Collection using Twitter API in Rapid miner:

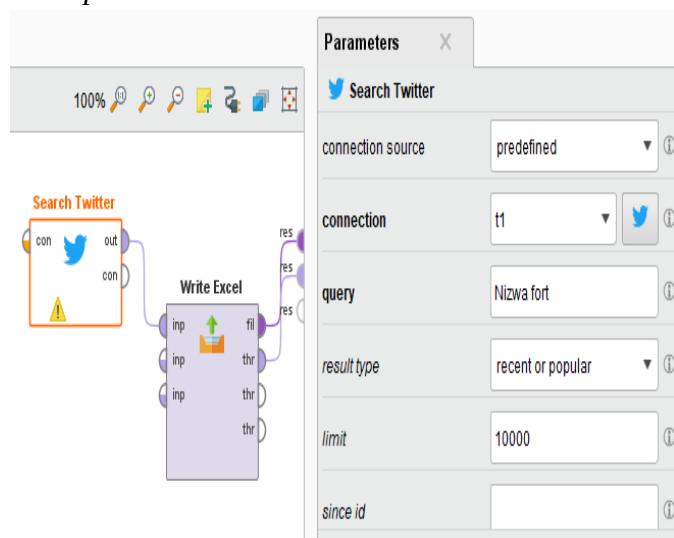


Fig.8. Model to collect twitter data for major tourism sites of Oman

B. Data Analysis:

Data analysis was conducted in four stages.

1. Opinion Mining about Oman tourism using Twitter data by using Hadoop ecosystem:

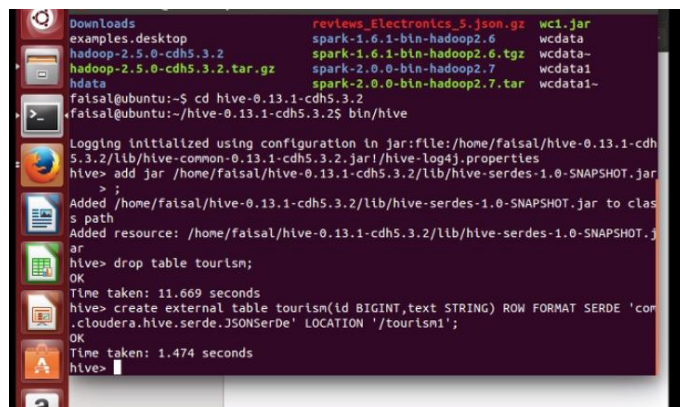


Fig. 9. Hive commands for creating external table

After creating external table we have used dictionary text file containing positive and negative words with their rate. As shown in the given Figure-12

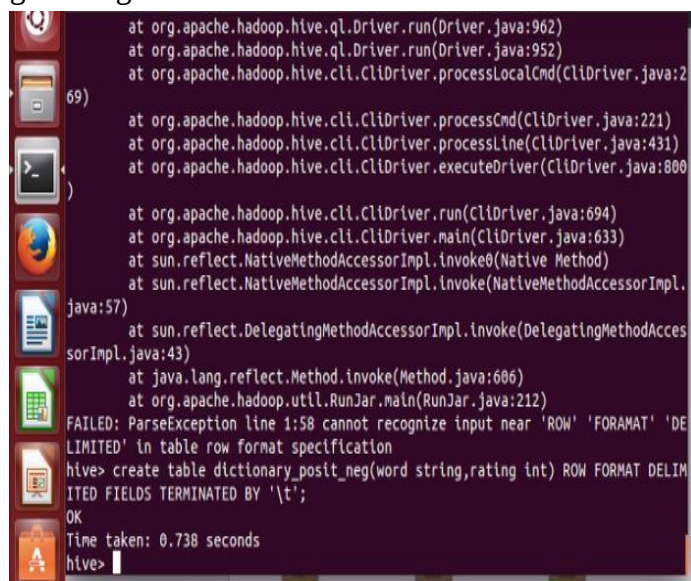
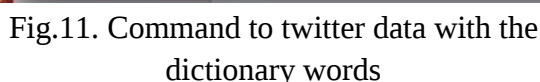


Fig.10. Hive commands for creating dictionary table

After this we have used hive commands for mapping the words with data that we got from Twitter application. As shown in given Figure-11.



PEOPLE OPINION ABOUT OMAN TOURISM

■ Negative ■ Positive

Opinion	Count	Percentage
Negative	98	20%
Positive	384	80%

Published by: The Mattingley Publishing Co., Inc.

Various operators of data mining were used at this stage with the intention of obtaining information about the correlation among tourism-related variables of economic and job factors. The following steps were employed towards the achievement of these processes:

[illegible]

Step-2: To design a model to get different attributes from the related websites using appropriate Rapidminer operators.



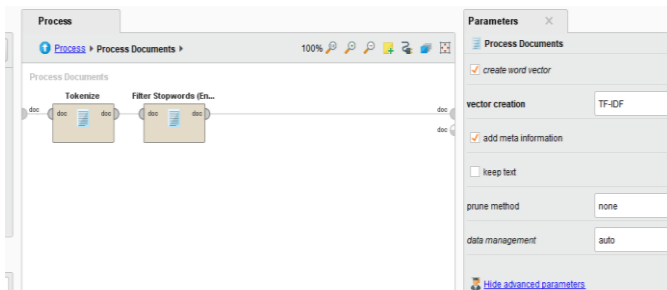


Fig.14 Model to extract and mine web contents

Step-3: To filter these attributes using required keywords

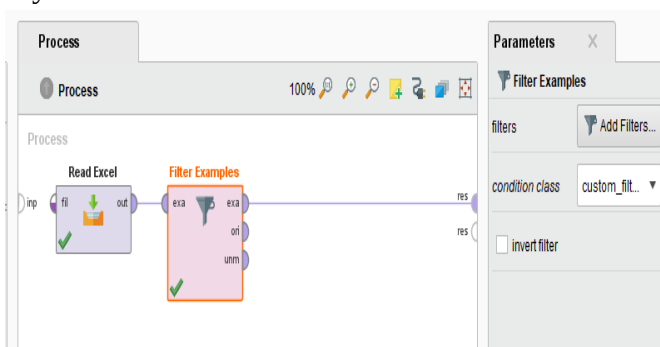


Fig.15. Model to filter the attributes based on the desired requirements

Step: 4 To find correlation matrix among the Oman's tourism, Jobs and economic development of Oman.

Result History

Correlation Matrix (Correlation Matrix)

Attribut...	Econom...	Job	Tourism
Economic	1	0.981	0.979
Job	0.981	1	0.998
Tourism	0.979	0.998	1

Data

Pairwise Table

Fig.16. Correlation matrix of Economy jobs and tourism in Oman.

Based on the figure above, which summarizes the correlation among variables, this study established that there is a positive and strong relationship among factors of economic development, jobs, and tourism in Oman.

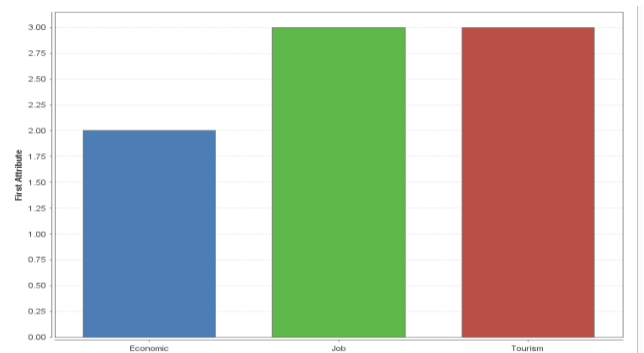


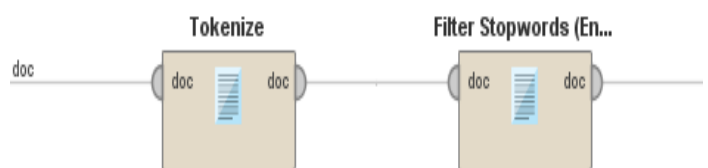
Fig.17. Relationship among Job, Tourism and economy.

3. To get Facebook data insights form various tourism related Facebook pages of Oman:

From the Facebook sites involving customer interactions about their tourist experiences in Oman, the following insights were gained:

- Number of Likes of particular Facebook page.
- Number of peoples visited particular Facebook page.
- Number of people commented on particular posts.
- Review comments posted by the peoples.

Process Documents



Process Documents

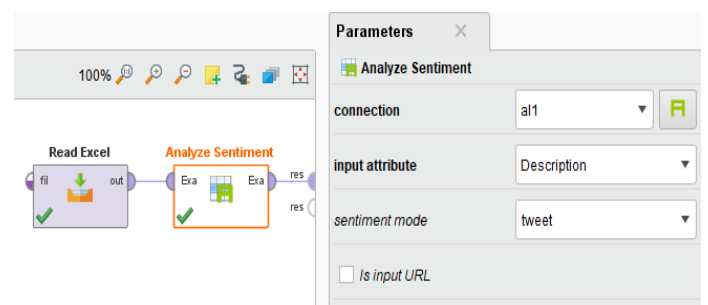


Fig.18. Model for sentiment analysis of Facebook data

- Visualize the outcome utilizing suitable application. As shown in the given

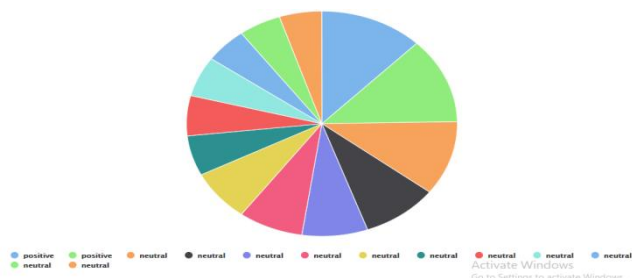


Fig.19. Graphical view of sentiment analysis of Facebook reviews and comments for various tourism pages of Oman

4. Ranking of tourism sites of Oman based on twitter's review data using Rapid miner Analytics:

Twitter information aided in rating Oman's various tourist attraction sites. However, conducting sentiment analysis proved somewhat challenging because some information was subjective while other customer opinions were objective.

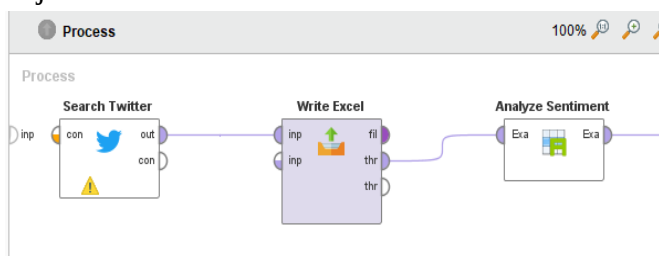


Fig.20. Model for sentiment analysis of twitter opinions

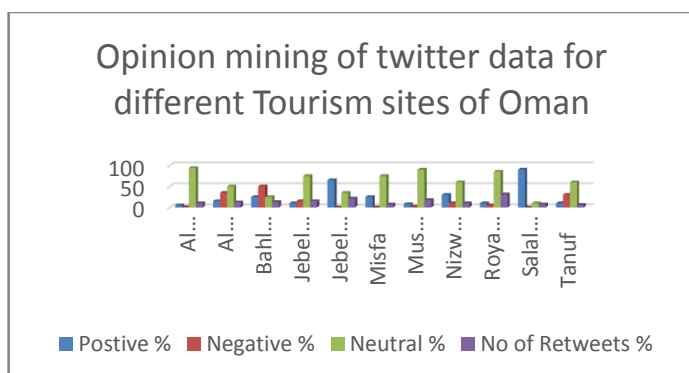


Fig.21. Opinion mining of twitter data of different Tourism sites of Oman

As per our findings ranking of these tourism sites are as follows:

1. Salalah Khareef Season
2. Jebel Shams
3. Nizwa Fort
4. Misfa
5. AL Hoota cave
6. Jebel Akhdar
7. Royal Opera house Muscat
8. Tanuf
9. Bahla Fort
10. Muscat Fort

IV. DISCUSSION

Companies benefit by completely understanding business operations, consumer needs, product quality, and competitor abilities upon establishing effective and efficient capturing, processing, analysis and management of big data. In so doing, big data enables the firms to exhibit improvements in efficiency, increase their sales, reduce the cost of products, and enhance customer service. Yoon and Kim (2011) documented that big data is useful towards product and service improvement, responsible for enhanced firm performance in sectors such as Information Technology (IT).

In the heritage culture sector, sensors are deployed to ensure that streams of telemetry are returned. Other services that big data serves in the tourism sector include service delivery through OnStar, upon which navigation, security, and communication services are delivered. It is also crucial to highlight that in the tourism firms, big data serves to reveal patterns of usage, rates of failure, and related opportunities towards the improvement of products; achieved by means of telemetry. In fact, big data is significant in the tourism sector because of its ability to reduce the assembly and development costs (Suri & Vassilvitskii, 2011).

The significance of big data arises further by offering opportunities to the target users of particular products who may be in proximity to restaurants, coffee shops or stores. The advertisements opportunities are achieved through GPS devices and, smart phones. It can be inferred

that in business sectors, the role of big data is to open up new revenues towards the provision of services whereby new customers are targeted (Stonebraker, Abadi & DeWitt et al. 2010). However, such an observation gives insight to the positive implications with which big data is associated. Then again, it does not account for economic disparities that imply that, only individuals who have supportive devices such as smart phones can access information provided through big data.

The tourism sector gains additional merit from the emergence of technologies in big data. Through the adoption of web log files and social media from e-commerce sites, tourism operators can understand trends in the purchase of particular products. Therefore, big data aids in establishing factors that dictate consumer choices regarding particular products' purchases (Yoon & Kim, 2011). The establishment of trends in consumer preferences at tourism levels is beneficial to the business sector.

However, the cost of trend management using e-tourism sites tends to increase operation costs. What remains a dilemma is that, whereas big data helps in monitoring the trends and reasons for buying particular tourism products, a cost-effective analysis that compares returns with the cost of business management through big data is yet to be established. The implication is that on one hand, big data aids in improving efficiencies on the supply chain. On the other hand, increased cost of business management has not been compared to the returns upon using big data specifically.

Other areas that have profited from the use of big data include the application of IT logs towards the improvement of troubleshooting and detection of security breaches, use in the monitoring of IT application speed, effectiveness and prevention of future occurrences of security risks (Yoon & Kim, 2011). Furthermore, big data has been cited to expand application in other fields such as quick access to voluminous historical calls for

improving customer satisfaction and interaction, and application of social media towards quick and better understanding of customers. Fraud prevention and detection have also been achieved through big data, significantly applied in cases of online financial transactions that include health care claims, insurance, investing, banking, and shopping. Through big data, financial transaction information has been accessed in real-time, upon which corrective actions against fraudulence could be taken (Xiao, Wang, Lin & Yu, 2008).

However, subjectivity arises in observations that emphasize on the benefits that accrue from big data usage at the expense of perceived challenges. Whereas big data management aids in the detection of fraudulences such as system hacking in online transactions, daily growth in technology implies that the hackers are likely to device counter-mechanisms that exceed big data's device abilities to provide real-time detection that necessitates timely corrective actions. Nonetheless, whereas the emergence of big data is useful in system correction, fraudsters, who intend to counteract its capabilities, are monitoring big data abilities. Therefore, it can be extrapolated that the efficiency of big data is commendable, but frequent monitoring is crucial to ensure that fraudsters do not compromise the system.

One of the major challenges that face organizations that adopt big data involves utilization and understanding the data. According to Suri and Vassilvitskii (2011), most of the companies and industries that adopt big data are encountered with the aggravating task of using the immense amount of data available. It is also tricky to understand ideal approaches to the best use of data, based on the tactics, strategies, and industry of the companies (Xiao, Wang, Lin & Shang, 2009).

Another challenge facing big data involves new technologies that are continuously emerging. Given that much of the information from big data is new to the parent firms, the firms are expected to learn at ever-accelerating paces to ensure that

they are engaged with various partners and providers of technology (Teevan, Ramage & Morris, 2011). Such a step implies that the expenditure is required to keep abreast with technological adjustments that enable companies to strive towards enhanced performance.

An additional challenge facing big data encompasses cloud-based solutions. With technological advancements, company data can be stored and managed in data sets on a global scale; that is, through cloud based solutions. However, this technique brings about safety concerns pertaining to company information. Whereas solutions towards data storage are provided in the form of tremendous flexibility at company level, upon which costs are saved, new dimensions regarding data security emerge (Thusoo, Sarma & Jain et al. 2009).

According to Xiao, Wang, Lin and Shang (2009), other considerations such as disposal and archiving of big data pose significant challenges. Given that big data is likely to decline in value (based on on-going decision-making processes), it becomes necessary to utilize new methods, technologies and tools towards the deletion and archiving of data. Nevertheless, care should be taken to make certain that the effectiveness that is associated with the use of big data is not sacrificed; deemed to pose benefits to the current business needs. Lastly, the need for management resources, data analysts, and IT is a challenge that faces the management, use and storage of big data. According to Xiao, Wang, Lin and Yu (2008), it is approximated that 140,000 to 190,000 more workers are needed to ensure that big data is managed effectively. In addition, the workers should have deep analytical expertise. Yoon and Kim (2011), maintain that a lot of data-literate managers may also be required for hire or retraining.

In big data management, usage and storage, value estimates are nearly as impressive as the trends in underlying growth. For instance, it is projected that the health care sector in the US is likely to

save \$ 300 billion per year; upon adopting Big Data (Teevan, Ramage & Morris, 2011). In addition, effective leveraging of Big Data is associated with improved margin operations among tourism operators. Therefore, it is noteworthy that Big Data does not pose a level playing field. On one hand, large market opportunities exist regarding the performance of Big Data. On the other hand, some firms are inherently data-rich. Therefore, diversified operators gain access to massive amounts of information regarding sale points, providing unique insight pertaining to product preference, consumer behavior, trends in sales, and intelligence on the market (Thusoo, Sarma & Jain et al. 2009). The implication is that Big Data enables the players in the market to outsmart their competition. Additionally, Big Data cannot be likened to a one-way street. Whereas its application may lead to greater satisfaction of product users through novel and lower prices, better quality, and on-time delivery, the cost of gaining access to Big Data sets and maintaining them is relatively high.

V. CONCLUSION

In conclusion, companies that wish to grasp opportunities in the Big Data phenomenon should begin by transforming their competitiveness at organizational level. The firms are also expected to disrupt established markets by combining the existing and novel approaches to industry-specific data acquisition. Upon achieving ready sensitizations of unstructured and structured Big Data, companies are likely to enjoy benefits of compelling new products and, achieving near real-time decision-making processes.

Of importance to note is that web mining and natural language processing procedures in this study were achieved using Rapidminer, as well as the Hadoop system. Also, the sentiments of tourists were gained by using opinion mining across Oman. Also, Apache Hive aided in text data analysis while Apache Flume aided in text

data mining, especially in relation to the information that was obtained from the customers' Twitter interactions. From the findings, this study established that over 80 percent of customers rate their tourist experiences in different sites of Oman positively, suggesting that the tourism sector is a promising industry and, if well invested in, could increase the country's revenue and overall economy significantly.

Indeed, as much as numerous notable successes have been reported in the business sector, many organizations are still not well positioned to utilize opportunities that Big Data offers. It is projected that aspects of limited access to visualization tools and data discovery, insufficient hardware and database performance, poor data management, and fractured information systems are responsible for the failure of most organizations effectively exploiting opportunities that Big Data presents — towards competitive advantage establishment. The doubling of Big Data after every passing year implies that, organizations that fail to utilize new information paradigm are unlikely to find it possible to catch up with emerging business trends towards enhanced performance and customer satisfaction.

VI. Acknowledgement

Gratitude goes to various parties that aided in conducting this research successfully. They include Dr. Khalifa Alshaqsi who guided the research progress and arranged for training sessions online, Asma Salim and Afrah Zahran for the massive support, and the TRC-Oman-funded Faculty Mentored Undergraduate Program.

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