

Predicting Travel Behaviour of International and Domestic Tourists using Big Data



N. Padmaja, T. Sudha

Abstract: Tourism is one of the most important sectors contributing towards the economic growth of India. Big data analytics in the recent times is being applied in the tourism sector for the activities like tourism demand forecasting, prediction of interests of tourists, identification of tourist attraction elements and behavioural patterns. The major objective of this study is to demonstrate how big data analytics could be applied in predicting the travel behaviour of International and Domestic tourists. The significance of machine learning algorithms and techniques in processing the big data is also important. Thus, the combination of machine learning and big data is the state-of-art method which has been acclaimed internationally. While big data analytics and its application with respect to the tourism industry has attracted few researchers interest in the present times, there have been not much researches on this area of study particularly with respect to the scenario of India. This study intends to describe how big data analytics could be used in forecasting Indian tourists travel behaviour. To add much value to the research this study intends to categorize on what grounds the tourists chose domestic tourism and on what grounds they chose international tourism. The online datasets on places reviews from cities namely Chicago, Beijing, New York, Dubai, San Francisco, London, New Delhi and Shanghai have been gathered and an associative rule mining based algorithm has been applied on the data set in order to attain the objectives of the study.

Keywords: Associative Rule mining Algorithm, Big Data Analytics, Indian tourists, International tourist, Tourist Behaviour,

I. INTRODUCTION:

An ever-developing number of places globally have opened up to and spent in tourism changing it into a major driver of socio-economic growth through the creation of enterprises and jobs, infrastructure growth and revenues of export. Tourism has faced continuous diversification and expansion to become one of the rapidly developing and biggest economic sectors in the globe. Tourism has boosted uninterrupted development virtually over time despite occasional shocks explaining the sectors resilience and strength (UNWTO, 2017).

The activity of tourism is presently existing against countless barriers that involves presence of disruptive factors namely technology which has revolutionized the sector radically by generating new personalized services and products (Neuhofer et al, 2015) Buhalis and Foreste (2014) have mentioned that events that have been affected by the establishment of information age and the emergence of new multichannel and hyper connect tourist that is linked closely to mobile appliances and the use of ICT. The breakthrough of technology has resulted in the emergence of a world that is dominated by solutions of technology that have been the incentive for interesting models of business (Gretzel et al, 2015a). One of the major features of digital age is the remarkable development of data. People reside in a world where with every action of online a digital trail is generated. The number of data generated by online users nowadays is unabated and information technology professionals evaluate a raise in yearly generation of data by 2020 (Reddy, 2016). The phenomenon of Big data has revolutionized the modern globe and is now the hottest topic of data mining according to the polls with the present trend anticipated to continue into the foreseeable future. Shi (2014) referred big data as a set of data with diversity, complexity, greater importance value and heterogeneity that are critical to examine and process in reasonable time. Gupta et al (2017) has stated that big data has accomplished huge responses in the hospitality sector. In nowadays world almost everyone is linked to online everywhere which in turn creates huge amount of information at a very rapid rate. In nowadays world the main problem each organization faces is handling unstructured data of customer and strives to acquire essential facts from it. It is essential to examine and perceive relationship between different types of data feasible in huge sets of data because they can provide meaningful signs about the choices of customers and support business and offer huge services so that the expectations and demands of customers can be met.

According to FMI (2019) the Big data permits travel operators to not only perceive the behaviour of tourists and travel choice but also supports in perceiving the performance of industry as a whole. Big data supports airline operators in their strategic pricing and revenue management which enhances them to extend their opportunities of income and provides best travel experiences to tourists. The tools of big data support airline service providers to develop their connectivity of network as per the demand of market. With the use of tools of big data, the travel operators and the tourism sector can recognize new patterns developing in the sector and respond with new offerings of product.

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Predicting Travel Behaviour of International and Domestic Tourists using Big Data

The tourism sector is turning towards the applications of big data analytics to perceive the flows of tourism and discover much opportunities of investment in their nation. Jha (2018) has stated that big data can help the complete work of the firm as a single functional unit. There is no longer any requirement for silos of data for various functions namely finance, marketing, logistics, etc. The techniques of big data permits to perform from the similar set of data and pull out what they require. Big data permits travel providers to not only perceive the behaviour of tourist and selection of travel but also supports in perceiving the performance of sector as a whole. Big data also supports in strategic pricing and management of revenue which enhances them to expand their opportunities of income and provides better experiences of travel to customers. According to NewGenApps (2018) big data supports travel industry to recognize patterns in tourist behaviour and perceive the ongoing demands of their base of customer to present offerings which they may require in future. A travel booking establishment namely Hipmunk examines the airline information, profiles of tourists, social graphs and reviews to cater search outcomes based on the needs of every tourist and help enhance the shopping process for flights. Hipmunk provides customers what they require while viewing for accommodation of travel by examining entire data given to it averse to the tourists having to predict it on their own. Big data supports travel sector to optimize their effort of marketing and provide targeted provision to their travellers. Big data also supports promoters extend their return on investment through enhanced messages of marketing based on search pattern of online user and their behaviour. Chen (2017) has stated that in the big data era, the tourist firms an examine tourist behaviour with greater accuracy. Similarly, tourist enterprises can rely on analysis of big data to assist strategy development of enterprise to adapt top alter. In the method of formulating the strategy of development on one side the tourist firms can perform customer data mining with special focus on demand of tourist, need of consumption, feedback of consumer and interconnectivity. The firms can make decision about value orientation and consumption behaviour of tourist. On the other side in sales and marketing process tourist firms can utilize big data to supervise respective attention, concern, sharing and action strategy and active contraction. The analysis of big data can direct strategy of tourist business to serve tourists better and extend the share of market. Zhang (2018) has stated that big data analytics are altering the practice and theory of tourism sector. Allied firms and smart tourism are employing these techniques to expect needs of consumers, rewrite how they meet expectations of customer, redefine engagement of customers and accomplish new customer satisfaction levels. In performing so the tourist industries are creating a new basis for the appreciation of loyalty of consumers. Big data analytics recommends that the future may belong to those organizations which are capable best to deliver and shape the travel experience of tourists. In performing so the experience of tourist industries in providing such services will be an additional benefit. This study evaluates the application of Big Data Analytics in Predicting Travel Behaviour of International and Domestic Tourists with respect to a study from Indian Perspective.

II. LITERATURE REVIEW:

Pan and Yang (2015) has mentioned in their study that according to Moore's law of technology growth different electronic devices are used by tourists which provides huge number of big data which can be processed and captured to predict and supervise activities of tourists. This study offers a conceptual structure that links the big data types with the travel stages. This study review on the big data sources use in the tourism sector involving data collection from web analytics, search queries, reviews of customers, social media and location tracking data. Most existing researches have concentrated on constructing models of behaviour and validates correlational relationship between big data and travel behaviour. The study on optimization, resource allocation and personalization is lacking and researches involve big data forecasting for particular businesses or properties are also rare. Nonetheless the integration of numerous sources of data possess huge importance to develop the monitoring and forecasting accuracy. The business boundaries and concerns of privacy may restrict the vast spread adoption, big data sharing and application but as the associated technology matures and productivity of big data develops, its complete effect and importance for the tourism sector will develop. According to the study of Shafiee and Ghatari (2016) as a productive and infrastructural sector tourism is essential in modern economy and involves various functions and scopes. If it is evolved properly economic growth and cultural relations of nations will be provided and extended. The development of web as an applied component in internet plays an essential part in success of tourism and proper use of it can pave the way for much success and growth of this sector. On the other side the amount of information in the present world has been developed and examination of huge number of data is known as big data which has been transformed into a strategic method to enhance the rivalry and set up new approaches for growth, development, enhancement and innovation of several customers. Nowadays Big data is one of the essential problems of management of data in digital age and one of the major opportunities in tourism sector for optimal use of maximum data. Big data can shape smart travel experiences and outstanding development of these sources of data has inspired new strategies to perceive the socio-economic phenomenon in various sectors. The analytical method of Big data emphasizes the amount of data analysis and collection with an unprecedented extent, scale and depth for resolving the issues of real life and employs it. Indeed, big data analyses opens the doors to different opportunities for evolving the modern knowledge or altering their understanding of scope and assists decision making in tourism sector. The main aim of the research is to show big data analysis helpfulness to discover patterns of behaviour in tourism sector and suggest a model for using the data in tourism. Miah et al (2017) has stated in their research that big data produced across sites of social media have made several opportunities for bringing much insights to decision makers.

Some researches on big data analytics have explained the assistance for strategic decision making. Moreover a formal approach for examining social media generated big data for decision assistance is yet to be evolved specifically in the tourism sector.

Using an approach of design science this study intends to evaluate and design a method of big data analytics approach to assist strategic decision making in the destination management of tourism. Using geotagged pictures uploaded by tourists to the social media site of photo sharing Flickr the method applicability in supporting destination management firms to predict and analyse behavioural patterns of tourists at particular places. The developed artefact explains a method for examining unstructured big data to enhance strategic decision making within a real domain issue. The proposed approach is generic and its applicability to other streams of big data is discussed.

Sinha et al (2017) has mentioned in their research that India is the 2nd biggest tourism sector after China in Asia from the BRICS nations. The revolution of technology has added dimensions to the way technologies being employed in entire fields. Also, the use of electronic devices leaves data trail which is large in size this data i.e. Big data is used by each field for offering good services and acquiring competitive edge. This trend grabbed industry and researcher's attention for the growth of much optimized techniques and tools. There are several general structures proposed by the field and the authors for implementation of Big data in the field but there is no structure suggested for tourism industry. In this study the authors suggested unified Information technology infrastructure structure referred as advisor for efficient data analytics method for developing the productivity in tourism industry. The different barriers and problems associated with Big Data Analytics implementation is also explained in this study.

In the study of Sheoran (2017) tourism sector is a promising and productive in modern economy not only from the revenue generation view point rather also to nurture cultural and social relations. In tourism sector the data of customer is very useful because they offer data about the choice of user, pattern of tour, hot tourist places and allied activities, etc. With the familiarity of online web-based techniques smart phones, social media and other hand held devices of computing the data collection of tourism has become simpler. Nowadays a voluminous information is generated by different stakeholders which cannot be managed with traditional techniques of data. The techniques of Big data have a promising characteristic to manage with such huge number of datasets. Big data is capable to examine this information from tourist sector and make a prediction for further development of the sector. Since Big data and tourism have been flourished as two immiscible disciplines of academics and their cumulative strength is harnessed. This study has explored the weird importance of big data techniques innovatively and suggested a model for use in tourism sector.

Song and Han (2017) proposed a study on predicting tourist demand using Big data. Big data is one of the essential new components that have influenced the travel sector in the world. It also plays an essential part in deciding the ways in which the NGOs and tourism businesses formulates their

policies and strategies. However restricted research of academics has been conducted into forecasting of tourism using Big data due to the issues in collecting, capturing, modelling and handling this kind of data which is usually described by its essential commercial value and privacy. In this study Big data is defined in tourism forecasting content and discuss the alterations it has brought about in decision making of tourism business and a tourism forecasting framework is presented using Big data. Del Vecchio et al (2018) research aims to contribute at the argument on open innovation in big data age by shedding new light on the role where social media can have in operating as enhancing platforms for involvement of tourists and sources for the management and creation of valuable assets of knowledge. Big data encloses entire sectors but they become similar particularly for knowledge intensive ones such as tourism where their emergence is regarded as the basis of smart design of the sector and a chance for nurturing the process of open innovation of tourism places and firms. The huge number of data produced on social media by tourists and associated to their experiences of travel can assist open innovation in the provision of tourist place. This study presents the proof of an individual case study as resulting from longitudinal examination of experience of digital tourism and a place of developing familiarity. Based on interviews and analytics of business with major factors the case targets to explain the social big data role for the process of open innovation of local offering of a destination. In the study of Qin et al (2019) regarding the rapid growth of tourist leisure sector and the surge of tourist amount inadequate data regarding tourists has placed huge pressure on traffic in scenic regions. In this study the author utilizes the CDR (call detail record) and Big data technique with the mobile phone real time location data to supervise the flow of tourists and examine the tourists travel behaviour in scenic regions. By gathering call detail record information and implementing a modelling examination of data to reflect the tourist hot spots distribution modelling analysis in tourist places, movements of tourists, origins of tourists, resident data and other information the results offers big data assistance for enhancing the pressure of traffic at tourist routes and tourist places in the city and allocate resources of traffic. The examination reveals that the method of big data analysis based on the call detail record data of smart phones offers real time data about the behaviour of tourists in an effective and timely way. This data can be used for the scenic areas operation management and can offer real time support of big data for smart tourism. The below table shows the reviews of the use of big data analytics in forecasting the travel behaviour of tourists:

Table 1: Reviews of the use of big data analytics in forecasting the travel behaviour of tourists
Source: Author

S.No.	Author	Year	Findings of the research
1	Pan and Yang	2015	Forecast and monitor activities of tourists and explains the essential sources for forecasting of big data

2	Shafiee and Ghatari	2016	Shapes the smart travel experience and assists decision making in tourism sector.
3	Miah et al	2016	Enhances strategic decision making within a real domain issue
4	Sinha et al	2017	Increases the productivity in tourism sector
5	Sheoran	2017	Big data is essential for hearing the customer voice, shaping the experience of customer and moves from rewards to sustained and loyalty in the tourism sector
6	Song and Han	2017	Enhances the privacy and commercial value
7	Del Vicchio et al	2018	Nurtures open innovation process of tourism places and firms
8	Qin et al	2019	Offers real time data about the behaviour of tourists in an effective and timely way and also offers real time support of big data for smart tourism

III. DESIGN OF THE SYSTEM:

3.1 Proposed System:

This part describes the Application of Big Data Analytics in Predicting Travel Behaviour of International and Domestic Tourists with respect to a study from Indian perspective. In the proposed system the data has been gathered from the small start up database. The data is obtained from the reviews provided by travellers in the set up of online platform by the firm. The tourists sentiments have been examined in the existing method to recognize whether the tour has rendered the happiness of tourists or not and also recognizes to what extent the male tourists reviews sentiments differ from that of female tourist reviews. The below figure shows the proposed system flow diagram:

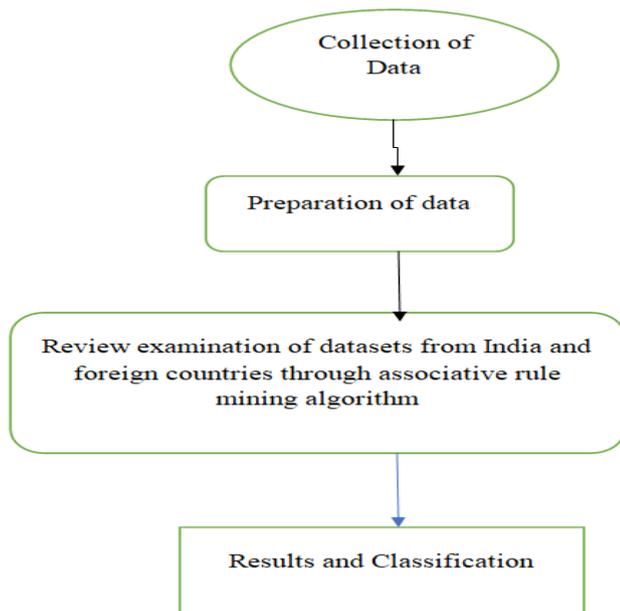


Figure 1: Proposed System Flow Diagram
Source: Author

From the above figure the proposed system employs dataset of online reviews from certain online social platform for tourist travellers all over the world to review and rate their experiences which they faced in a specific place. For implementation the language used is Python. Python is a strong multi purpose programming language and it has simple syntax making it the perfect language for users to learn the computer programs easily. NLTK (Natural language toolkit) would be employed to implement the algorithm of classification algorithm. NLTK is a major platform for constructing programs of Python to perform with human language data. It offers easy to use interfaces to around 50 lexical and corpora resources. This research will make use of associative rule mining algorithm for categorizing the choices of the domestic and international tourists respectively.

3.2 Data collection Plan:

The online datasets is reviewed in cities namely Chicago, Beijing, London, Dubai, Shanghai, New York, New Delhi and San Francisco will be gathered.

3.3 Assumptions:

Since this research is from an Indian perspective the assumptions are that:1)Domestic tourists are considered from allIndian tourists to Delhi; and 2) international tourists are considered from all Indian tourists to other places. Similarly, entire reviews for New Delhi will be considered as reviews of domestic tourist and analysis will be carried out to decide the factors that impact the tourism. For other places namely Chicago, Beijing, London, Dubai, Shanghai, New York, New Delhi and San Francisco reviews will be considered as reviews of international tourism and analysis will be carried out to decide the factors that impact the tourism.

3.4 Algorithms to be used:

In this research work an associative rule based mining approach has been adapted in order to categorize the tourists and find their behaviour of travel. Rule based Association Algorithm is to be implemented on the dataset collected in this research. A comparison of the features of different cities will be done based on the results obtained in order to predict tourist's preferences and the results would be presented in the form of graph.

3.5 Benefits of proposed system over existing system:

The already existing system does not enclose the tourist classification namely international and domestic. The proposed system goes a bit further in categorizing the tourists based on whether they visit places in other foreign country or within their own country and what is the reason behind the same. Further the proposed system acquires datasets from many countries across the world unlike the existing system that has considered data from a single online United Kingdom based forum of review.

1.6 Association Rule Mining:

Association rule mining is a process which is meant to predict frequent correlations, patterns, casual structures or associations from sets of data predicted in different types of databases namely transactional databases, relational databases and other types of repositories of data.

In a given transactions set association rule mining targets to predict the rules which enables to find the existence of a particular item based on the existences of other transaction items.

3.6.1 Terminology:

Let $A = \{b_1, b_2, \dots, b_m\}$ be a set of m attributes of binary referred as items

Let $C = \{x_1, x_2, \dots, x_t\}$ be a set of t transactions referred as database

Every transaction in C has a distinct ID of transaction and comprises an items subset in A . A rule is referred as an implication of the form:

$$I \Rightarrow J, \text{ where } I, J \subseteq A$$

3.6.2 Support Calculation:

Let I, J be sets of items, $I \Rightarrow J$ a rule of association and t set of transactions of a given database. Support is a representation of how always the rule has been predicted to be true. The support of I with respect to t is referred as the ratio of t transactions in the set of data which comprises the set of item I .

$$\text{Support}(I) = \frac{|\{I \subseteq s; s \in t\}|}{|s|}$$

3.6.3 Confidence Calculation:

The confidence is the representation of how always the rule has been predicted to be true. The value of confidence of a rule, $I \Rightarrow J$ with respect to t set of transactions is the ratio of the transactions that comprises I which also comprises J . Confidence is referred as:

$$\text{Confidence}(I \Rightarrow J) = \frac{\text{Support}(I \cup J)}{\text{Support}(I)}$$

The algorithm proposed in this study reduces the number of item sets being regarded by only describing the sets of items whose count of support > minimum count of support and the confidence > minimum_confidence. The steps used for the proposed algorithm is:

- Step 1: First the reviews are taken for each city.
- Step 2: Then the reviews are considered specifically for every hotel in that city.
- Step 3: The reviews are stemmed, tokenized and stop words are eliminated.
- Step 4: Then the reviews are passed to POS tagger to recognize phrases of adjectives and adjectives.
- Step 5: Then the adjectives are gathered into the file of transaction on which the association rule mining is used to recognize the most frequent features/.
- Step 6: After these the top 50 most frequent features are counted and gathered for every city.
- Step 7: Lastly the features percentage is evaluated with respect to the total number of reviews for every city and it is sorted.

After all the above steps the data comparison is reported across entire cities based on few negative and positive features. The negative and positive features are tagged manually. Then the New Delhi city is analysed and taken as the base for domestic tourism and other cities are analysed and taken as a base for international tourism. The factors not working and working for international and domestic tourism is then evaluated.

IV. RESULTS AND DISCUSSION:

4.1 Result:

The result of this study will be the factors that persuade travellers towards international and domestic respectively. In addition to that this study will forecast travel behavior of specific tourists based on the ratings and reviews made by that tourist traveller in online tourist review platform. The feature wise charts for all cities are depicted below:

4.1.1 Positive Features:

1. Excellent:

The first feature to be considered in positive features is excellent:

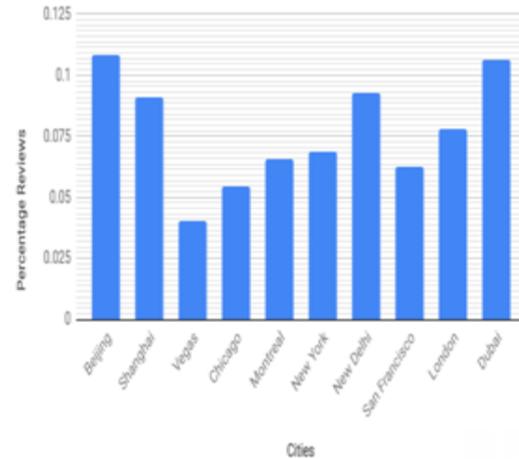


Figure 2: Excellent Feature

Inference:

From the above figure Beijing and Dubai is considered as the excellent positive feature for travelling.

2. Clean:

The second feature to be considered in positive features is clean:

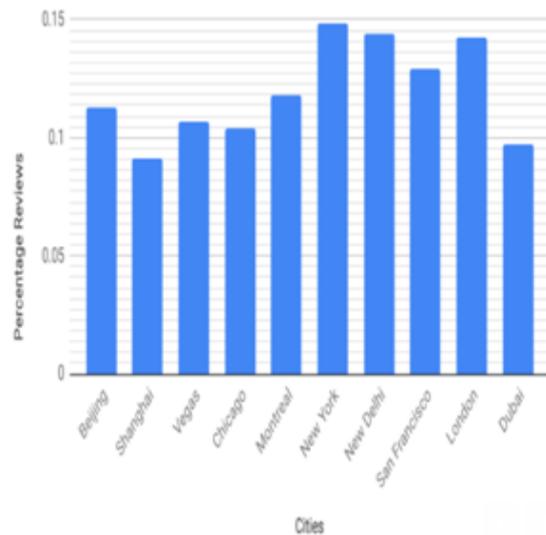


Figure 3: Clean Feature

Inference:

It was known from the above diagram that New York, New Delhi and London has clean feature.

3. Comfortable:

The third features to be considered in positive feature is comfortable.



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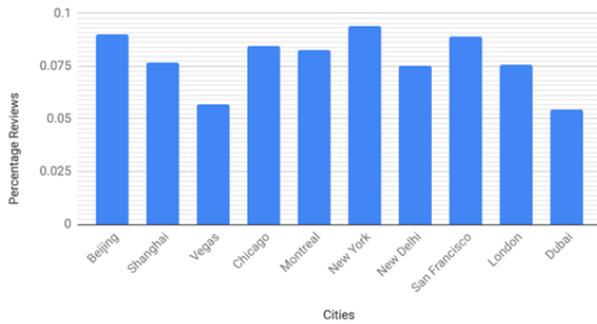


Figure 4: Comfortable Feature

Inference:

From the above graph Beijing, New York and San Francisco has comfortable feature:

4. Friendly feature:

The below figure shows the friendly positive feature:

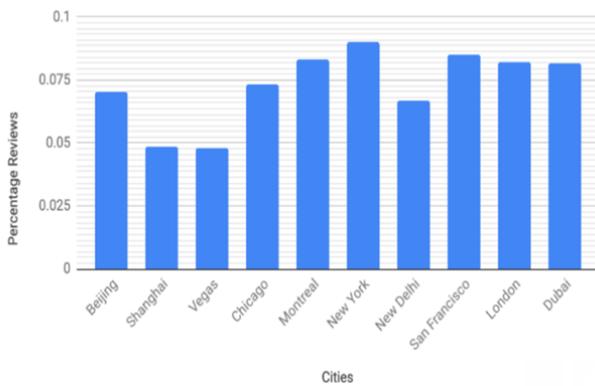


Figure 5: Friendly feature

Inference:

It was found from the above paragraph that Montreal and New York have friendly feature.

4.1.2 Negative Features:

1. Bad feature:

The first feature to be considered in negative features is bad features:

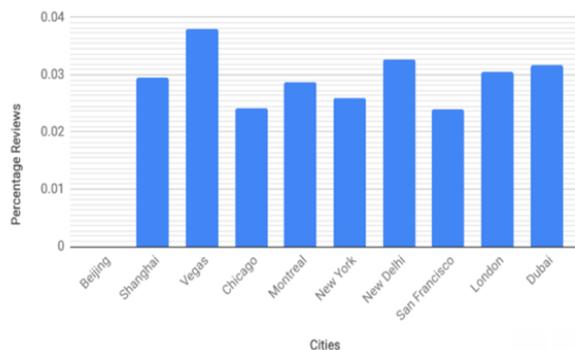


Figure 6: Bad Feature

Inference:

From the above figure it was found that Vegas and New Delhi has bad features.

2. Expensive:

The next feature considered is the expensive feature:

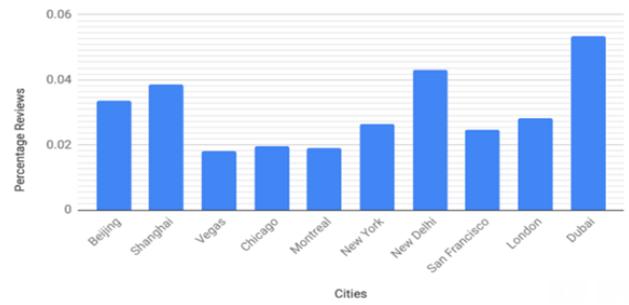


Figure 7: Expensive Feature=

Inference:

It was found from the above graph that Dubai has greater expensive features.

3. Small:

The below figure depicts the small feature:

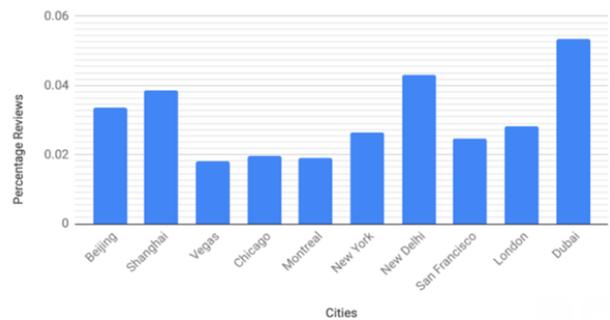


Figure 8: Small Feature

Inference:

From the above graph it was found that Dubai has small feature than other reviews percentage.

From the above all graphs it can be inferred in positive features New Delhi is in top 5 cities being clean and excellent whereas New Delhi is in bottom 5 cities for hotels being comfortable and friendly. Similarly, in negative features New Delhi is in top 5 cities for hotels being bad and expensive and New Delhi is in bottom 5 cities for hotels being small.

4.2 Implementation Results:

The output results for the implementation for both domestic and outbound tourism are depicted below:

4.2.1 Domestic Tourism of New Delhi Hotels:

The below figure shows the domestic tourism of New Delhi hotels:

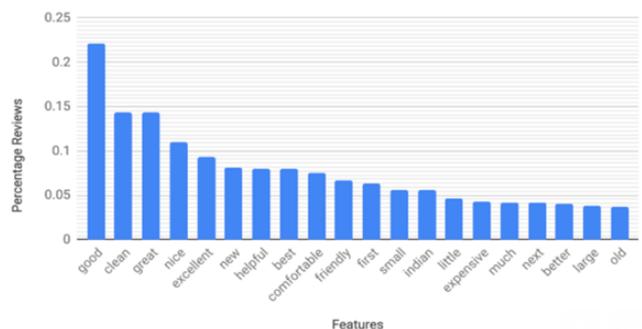


Figure 9: Domestic Tourism of New Delhi Hotels

4.2.2 Outbound Tourism of Beijing Hotels:

The below figure shows the outbound tourism of Beijing hotels:

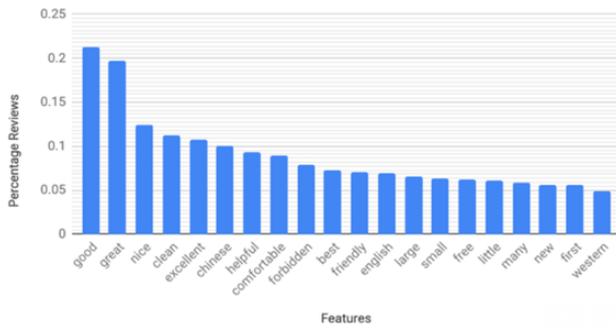


Figure 10: Outbound Tourism of Beijing Hotels

4.2.3 Outbound Tourism of Chicago Hotels:

The below figure shows the outbound tourism of Chicago Hotels:

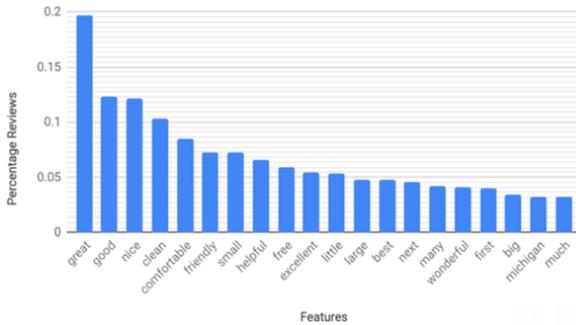


Figure 11: Outbound Tourism of Chicago Hotels

4.2.4 Outbound Tourism of Dubai Hotels:

The below figure shows the outbound tourism of Dubai Hotels:

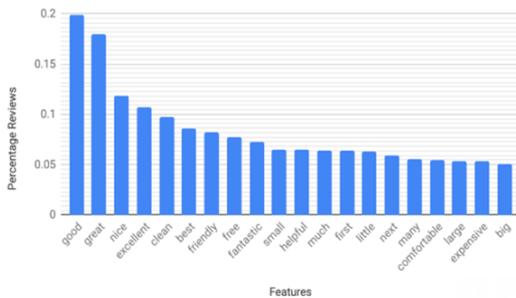


Figure 12: Outbound Tourism of Dubai Hotels

4.2.5 Outbound Tourism of London Hotels:

The below figure shows the outbound tourism of London Hotels:

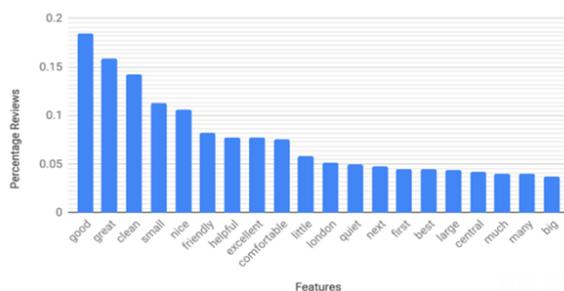


Figure 13: Outbound Tourism of London Hotels

4.2.6 Outbound Tourism of Montreal Hotels:

The below figure shows the outbound tourism of Montreal Hotels:

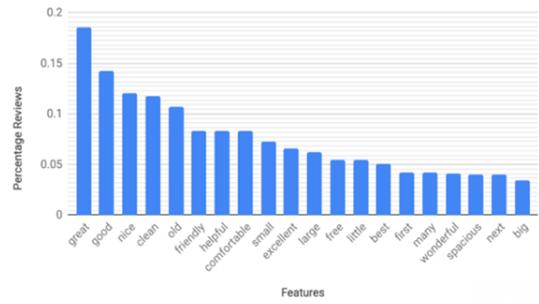


Figure 14: Outbound Tourism of Montreal Hotels

Figure Outbound Tourism of New York Hotels:

The below figure shows the outbound tourism of New York Hotels:

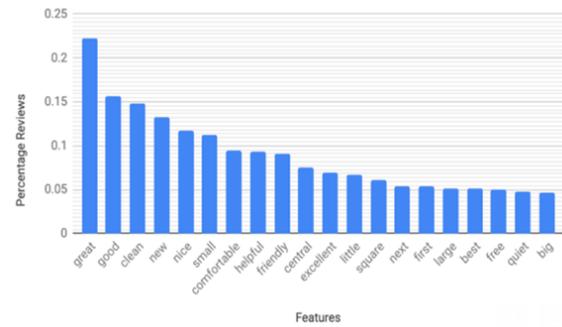


Figure 15: Outbound Tourism of New York Hotels

4.2.7 Outbound Tourism of San Francisco Hotels:

The below figure shows the outbound tourism of San Francisco Hotels:

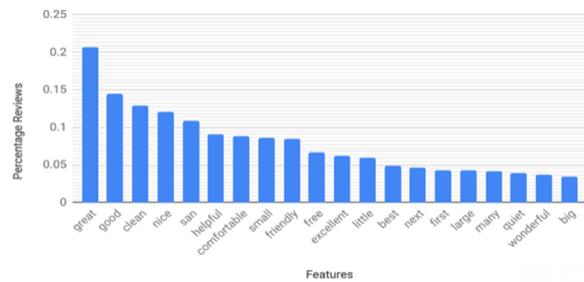


Figure 16: Outbound Tourism of San Francisco Hotels

4.2.8 Outbound Tourism of Shanghai Hotels:

The below figure shows the outbound tourism of Shanghai Hotels:

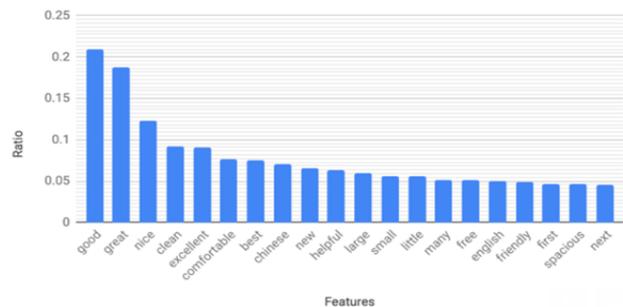


Figure 17: Outbound Tourism of Shanghai Hotels

4.2.9 Outbound Tourism of Vegas Hotels:

The below figure shows the outbound tourism of Vegas Hotels:

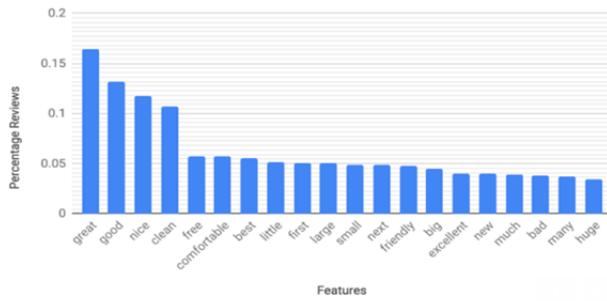


Figure 18: Outbound Tourism of Vegas Hotels

From the above graphs it can be inferred that features working in favour of inbound tourism is excellent and clean for New Delhi hotels. Whereas features working in favour of outbound tourism is comfortable and friendly hotels. Similarly features not working in favour of inbound tourism for New Delhi hotels is bad and expensive. The features not working in favour of outbound tourism is small.

The screenshots result for the implementation is given below:

Step 1: The outbound tourism results of Beijing, Shanghai, Las Vegas and Chicago Hotels



Figure 19: Outbound tourism results of Beijing, Shanghai, Las Vegas and Chicago Hotels

Step 2: The outbound tourism results of Montreal, New York, New Delhi and San Francisco hotels



Figure 20: Outbound tourism results of Montreal, New York, New Delhi and San Francisco hotels

Step 3: The outbound tourism results of London and Dubai hotels



Figure 21: Outbound tourism results of London and Dubai hotels

V. CONCLUSION:

This study mainly intends to discuss how big data analytics is used in forecasting Indian tourists travel behaviour based on domestic and international tourism. The revolution of technology faced by the tourism sector has enhanced the tourism demand behavior, the tourism design and the marketing processes supplied. The new age of information is generating huge number of data so that the technological infrastructure of smart tourism places can handle with smart solutions namely Big Data. Big Data Analytics is used in this research to predict the behavior of tourists based on tourism. Big Data is a strong tool that can change the entire business strategy, drives innovation and growth nowadays. Big Data seems to be the change of cultures in organization, the requirement to spend essential amount of money and have specialized technical profiles to develop in the future.

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