Business Value of Telecom Operators’ Big Data

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Abstract. Big data is one of the infrequent resources in the 21st century, especially for Internet & Mobile Internet industries. Telecom operators have large amount of precious data. Through analysis of the features of telecom operators’ data, this study highlights the value of telecom big data in business and classifies it into two major categories. The first one is enhancing existing business to optimize traditional telecom services, like customer experience, telecom product design and network management. The other is developing derivative business such as advertisement, marketing, financial or credit services based on the strength of telecom big data. This preliminary research provides insights into the value development of telecom operators’ data on account of targeted discussion about practical application for telecom big data.

1. Introduction

1.1 Big Data

With the rapid development and popularization of Internet, Mobile Internet, Internet of Things, as well as Artificial Intelligence, the amount of data collected has been growing exponentially. There is an obvious potential value in these huge data, however, extracting and transforming the data for practical applications has been challenging to scientists, entrepreneurs, and administrators. In this study, the definition of big data and related technologies has been presented. Wikipedia describes big data as “a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools”. Gartner defined it as “high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making”. Even though novel definitions have been presented in a short time, big data has attracted unimaginable attentions due to its extensive usage. Big data has been viewed as one of the buzzwords since 2012, and defined as the next disruptive technology, or next big thing in innovation. Big data has shown great potential in accurate business control, effective operation in production, smarter planning, and preventing threats, thus is likely to improve human life, business, and governance in the near future[1] Big data is beneficial to existing business/management as it can be used in decision support systems [2], decision making processes[3], e-commerce[4], business intelligence[5], or public administration. On the other hand, since big data can handle large-scale variety of data in short time, create value from social connections, logs, images and other resources [6], it may create new businesses or commerce models internally or externally that never existed before.
1.2 Challenges and Opportunities in Telecom Sector

Telecom operators have been facing fierce challenges since the 21st century. The emergence and rapid development of OTTs (Over The Tops), such as Google, Facebook, Tencent, Alibaba, present great challenges to telecom operators. OTTs provide superior customer experience with more flexibility in action and operation, while many of their services play a replacement for telecom operators' traditional telecom services, such as Facetime to phone, WeChat to SMS. Besides, along with the development of fourth/fifth generation (4G/5G), popularization of smartphones, as well as the rising number of APPs, the competition among telecom operators has changed to some extent.

Fortunately, big data brings light to telecom operators, for they have the advantages of big data usage in nature. Telecom operators have unrivalled advantages than other entities in telecom ecosystem, and they have the ability to collect and store big data based on their complete automatic business support system. Besides, telecommunication services, especially mobile phones, have become essential necessities of life in many countries, and telecom big data can cover most of the population [7]. Mobile network big data can provide individual behavioural insights in large scale than ever before [8].

2. Telecom Operators Big Data

2.1 Telecom Data Analysis and Implications

There are already many previous researches on analysis of telecom data, and the mostly used one is CDR (Call Data Record), which records subscribers' mobile phone usage each time. CDR is a useful tool in optimizing telecommunication infrastructure, such as cell tower distribution, and cell tower service zone matching [9]. Besides CDR, there are also many other types of researches that have used telecom data [10], while some of them introduced big data technology in recent years. For example, to solve network problems in SDN (Software Defined Network), Kuang et al (2016) constructed models for automatically monitoring the network state, recommend routing paths and predict network traffic [11]. Inspite of deep packet inspection (DPI) and deep flow inspection (DFI), Hu et al. (2016) provided a framework based on deep semantics inspection (DSI) to describe sufficient insight into users’ behaviour and preferences [12]. Some researchers also explored telecom data usage in network automatic diagnosis, they introduce big data technology into self-organizing networking defined by the 3GPP [13], or even got into self-healing function [14].

2.2 Telecom Data System

To provide high quality communication services to consumers, telecom operators have built complex information systems which complement their ability in management, operation, and billing. The typical ones include BSS (Business Support System), OSS (Operation Support System), MSS (Management Support System), and CRM (Customer Relationship Management). Based on these systems, telecom operators collect and store important data during their regular operations, such as CDRs, customer demographic information (ID, age, gender), handset information (Mac address, IMEI), location data (GPS, latitude/longitude of cell tower), billing/payment history, and so on..

3. Business Value of Telecom Operators’ Big Data

3.1 Enhancing Existing Businesses Based on Telecom Operators’ Big Data

3.1.1 Customer Experience Promotion. While facing hyper competition of OTTs, telecom operators are paying more attention to delicacy management, and gradually transform focus point from tech-centric into customer-centric. For instance, telecom operators need to establish mechanisms and operation processes aimed at improving the lifetime value of customers, tap into the high valuable subscribers, the price insensitive ones, thus study their attitudes and make necessary actions in real time.
Fortunately, big data is essential in promoting customer experience as well as in eliminating perceived deficiencies, for it provides a forceful tool describing subscribers’ experiences and identifying what really matters to them, thus make rapid prevention or remedy action on behalf of subscribers. For instance, by monitoring telecom usage data (call completing rate, download/upload rate), telecom operators can identify the high value/class subscribers/subscribers in emergency who are subject to poor telecom connection (e.g. dropped call, low download speed) just in time, thus adjust and allocate necessary network resources to the special ones. With the use of text and speech semantic analysis of call centre transaction logs, the hotline staff and automatic answer system can discover customers’ dissatisfaction and uncomfortable motion in real time, thus provide compensation actions on first contact and reduce potential defection.

3.1.2 Consumer Upgrading. Since traditional telecom markets have been saturated in many countries, it is much difficult to get additional subscribers from competitors, as a result, many telecom operators started upgrading existing subscribers as an effective way of increasing profitability. Up-selling is a win-win game for both operators and subscribers, telecom operators can get more revenues from up-selling while the cost is almost unchanged, while it is much cheaper for subscribers to update their package than buying additional services. The usage of big data opens a door for telecom operators to implement consumer upgrading more easily, while up-selling potential detection is an important application of big data.

Firstly, based on subscribers’ data such as demographic information, telecom usage habits, and order package history, telecom operators can make portrayal for each individual subscribers, describe his/her hobbies and telecom usage custom, thus make accurate customer segmentation, find out the potential up-selling ones. Secondly, by building a model based on telecom usage history and changing trends, combined with real time data analysis, telecom operators can tackle the biggest challenges faced by subscribers, thus identify the next best actions to increase their sales and services in time.

3.1.3 Fraud Detection. Another problem faced by telecom operators is fraud detection, which relates to credit check, customer prequalification, and cloned SIM cards. Big data can provide an effective way for telecom operators to detect fraud just in time. Based on data from across telecom consumers and billing history records, telecom operators can construct model for predicting the risk of certain subscriber quitting without fulfilling the contract terms, thus prepare differentiation contract policy for them. This is much useful when cooperating with partners, for example, telecom operators can cooperate with financial enterprises such as banks to make deposit assurance for high churn risk contract subscribers. Besides, by analysing data collected from normal operation, telecom operators can greatly promote the ability for quick fraud detection, as well as prevent unauthorized phone usage and cloned SIM cards.

3.1.4 Customer Relationship. With the saturation of traditional telecom markets, it is hard to maintain high rate of growth for new subscribers, the operation focus then changes into current customer competition to some extent. This calls for ensuring that a satisfactory customer relationships with subscribers are established and maintained as a strategic scheme for most telecom operators. Along with the popularization of big data and its analysis technology, many researchers and scholars have discussed about the usage and applications of big data, and customer care is a representative one. Data captured by telecom operators can be used in customer relationship management, and it is very useful in subscriber attraction and retaining. Big data can provide support in some perspectives for telecom operators in customer relationship management. Firstly, it can confirm key drivers to customer satisfaction more precisely. Secondly, big data can be used in tracking unsatisfied subscribers’ complaints. Thirdly, it is a tool for supervising subscribers’ attitudes, especially the attitude of leaders. Through big data, telecom operators can monitor the attitudes of leaders in SNS websites, WeChat, then discover their attitudes changes in advance, so as to make remedial measures before more subscribers are impacted.
3.1.5 Telecom Product Design. Big data can also be used in telecom product design, not only in normal group package of voice, SMS and data, but also in the exclusive service package. By analysing big data collected and stored from routine operation, the telecom operators can improve the accuracy of the subscribers segmentation, make profile descriptions for each group or even each individual subscriber, then design a suitable package for them.

Besides, based on third-party surveys and own operation experiences, telecom operators gradually realize that the websites/APPs mostly used by certain subscribers are limited. Therefore, they design and provide exclusive service packages of cooperated OTT partners to subscribers for profitability, while the upgrade of network technologies makes it attainable.

3.1.6 Network Management. With the popularization of mobile internet and smart phones, mobile networks are becoming increasingly complex while classical network deploy/optimize techniques are seen as costly and ineffective. What’s more, since telecom operators are asset-heavy, capital expenditures (CAPEX) and operational expenditures (OPEX) take a great portion of the cost expenditure. The way of balancing between CAPEX and OPEX so as satisfy the customers’ request without excessive network investment has become the main problem each telecom operators have to face.

Big data offers a chance to further deal with network management problems. Network big data can be collected from the user’s equipment, the radio access network (such as NodeB), as well as core network, while in forms of various equipment logs, signalling data, streaming data. It provides a complex but fundamentally efficient support for the construction and development of reliable and scalable network, effectively improves network management, and in particular, it can be integrated with the upcoming fifth generation (5G) communications. Firstly, network big data analysis can be used in the network design/planning and resource allocation. Secondly, network big data is essential for network optimization, especially for the intelligent network in 5G. Many researchers point out that not only is the data itself in big data important, but also the analyses and operation process are very important for the optimization mobile networks. Finally, big data greatly enhances the monitoring of the network condition. Big data can help telecom operators monitor and analyse various networks indicators as well as anomalies alert messages in real-time, make the network more elastic and strong (e.g. self-healing) in 5G.

3.2 Derivative Business Based on Telecom Operators’ Big Data

3.2.1 Advertisement and Marketing. Since telecom operators’ big data is one of the important resources which reflects individual time-space information in real-time while covering most of the population, the results of telecom operators’ big data analysis have an extra-economic value for businessmen or commercial companies (e.g. advertisement service providers, supermarkets), especially in retail and advertisement/marketing industry [15]. The features of the retail industry determine whether it needs to discover or adjust the changes in customers’ preference as quickly as possible, which is consistent with the features of real-time and whole coverage of telecom operators’ big data by nature. As a result, the retail industry inherently ought to cooperate with telecom operators and exploits their big data. Besides, telecom operators can also be used in marketing, which mainly includes tailored marketing campaigns and marketing action results evaluation. For instance, mobile data can reflect the usage action of websites or APPs of subscribers who just pass by certain outdoor advertisement or outdoor commercial screens. This can useful in describing her/his later actions and evaluating advertisement results.

The mostly commercialized big data business model for telecom operators is advertisement and marketing, which based on smart data analysis, and has been successfully tried by many pioneers (e.g. Telefónica, Verizon). For instance, Telefónica set up a special department (Telefónica Dynamic Insights) with an aim of developing big data business in 2012, and provided its first big data service named as “Smart Steps” in cooperation with its partner, GFK. “Smart Steps” services mainly contain
analyses of movement trends of groups of people, movement of crowds at a given place by hour, day, week or month, searches on an area by footfall, demographic or address. Based on the results from data analysis from “Smart Steps”, Telefónica, it can provide a description of passengers’ features in range of spots (e.g. certain avenue, road crossing), thus helping retailers to evaluate target customers/revenue increase rate/consumption potential when investing in a new shop or supermarket. This service is very useful for third parties who want to understand their potential customers before making investment decision, and is a supplement tool for traditional market consult survey.

3.2.2 Financial and Credit. In recent years, researchers [16] have investigated the correlation between movement level and wealth level, and the results show that there is a significant positive relationship. Therefore, telecom big data can be seen as another tool for differentiating between the poor and the rich without personal income records. What’s more, telecom big data (such as the billing payment history, movement range, credit record) provides a way of describing individual life condition (current or trend) and is an efficient supplement for defining financial credit for the poor who do not have credit records in financial entities and cannot get loans from big financial companies or banks. Researcher Kumar (2012) pointed out that the telecom operators’ big data provides new measure of creditworthiness for the microfinance institutions whose main customers are the unbanked poor, while some big data companies (e.g. Cignifi Inc.) have already established new business model based on data and have made attempts in some regions (e.g. Tanzania, Brazil)[17].

The most common and simple approach used by telecom operators to enter into the financial industry is to provide credit information query services, which can be realized by opening API connection to financial institutions. The API connection scope can include subscribers’ billing history and credit score, usage features (e.g. package subscribed), handset type /change frequency, and so on. Notably, all the data connected by API should be anonymized, in other words, telecom operators should ensure the financial institutions cannot directly get the individual’s data in any case. As a result, most telecom operators have made some alternatives to provide the Boolean value as query service results.

3.2.3 Optimization of Telecom Industrial Chain. Holistic telecom services not only contain telecom operators’ services (e.g. network, customer support), but also products from the telecom’s industrial partners, such as handsets, services of SP/CP, APPs/applications. In the traditional business viewpoint, the data of each participants are always independent and are not to be shared among companies, especially for the telecom operators who are in the core of telecom industrial chain.

Big data provides an opportunity to create an end-to-end framework by data cooperation, thus optimizing the whole utility of telecom industry chain. For example, one of the problems that has troubled terminal manufacturers all the time is how to tracing their customers’ usage, so as to find the product design deficiencies and inconvenience in usage. At the same time, the telecom operators monitor the network operation in real-time, collect subscribers’ usage features in nature, if they can provide results of the data analysis to terminal manufacturers, both entities can get priority. For the terminal manufacturers, they can optimize their handset design gradually based on the customer data analysis with minimum expenses; for the telecom operators, they can make a profit from additional data traffic which is derived from the improved handset and service. Except the terminal manufacturers, the telecom operators can also make data cooperation with participants in telecom industry chain, such as SP, CP, APP providers.

4. Concluding Comments
As shown in this paper, big data has become one of the irresistible trends in the world. It provides solutions that can greatly improve data processing performance and support the lower hardware and software investment [18], and it can also increase its influence in human beings anywhere. As the core in the telecom industry, the telecom operators possess and controls large amount of data by nature, and have the privilege of exploiting and utilizing big data, thus enjoying the value from telecom’s big data.
Aiming at reflecting the value of big data to telecom operators, this study analyses the business usage of telecom big data. By combining the values and the business models of big data of telecom operators mentioned above, our study provides an implication roadmap.

In conclusion, as for as business value, the telecom operators’ big data can be used in two ways: (a) enhancing existing business, and (b) derivative business. When used in enhancing existing business, the telecom operator’s big data can play help to optimize the traditional telecom services, such as: (1) customer experience promotion, promoting customer experience and eliminating perceived deficiencies; (2) consumer upgrade, such as detecting up-selling potential/opportunities in time and increasing usage; (3) fraud detection, such as detecting unauthorized phone usage and protecting the subscribers’ rights; (4) customer relationship, such as confirming key drivers to customer care or improving their satisfaction and loyalty; (5) telecom product design, such as optimizing normal group package and designing exclusive service package for OTTs; (6) network management, such as providing sufficient information in network design/planning, network resource allocation, network optimization, and network condition monitoring. When used in derivative business, the telecom operator’s big data provides an opportunity to derive new insights and business. This includes: (1) advertisement and marketing, such as exploring novel services for retail and advertisement/marketing providers based on telecom big data; (2) financial and credit, such as cooperating with financial institutions and providing credit query services which is helpful in eliminating credit risk; (3) optimization of telecom industrial chain, such as sharing some information with participants of the telecom chain to improve the telecom usage experience.

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