Managing Healthcare Data for Improved Patient Care Using Crowdsourcing and Managed Services

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Abstract—The purpose of this paper is to propose a conceptual healthcare data distribution service for improving the usefulness of user-generated data on the internet. The smart paradigm has dramatically changed the way individuals find data and information. It introduces many advantages, including real-time information and sharing experiences with large groups of people. Thereby, we can now access information easily and quickly with a smart device on the web. However, issues of accuracy and reliability are raised; many resources from the web, with the most egregious example being the SNS (Social Network Service), contain biased information. For example, in the healthcare, doctors and pharmacists need to verify the data that is being distributed over the web because individuals can suffer greatly if the wrong information gets disseminated. As a result, it is necessary to establish data distribution mechanisms, including a process of data verification and data quality control, on the internet. In this paper, the proposed conceptual service model based on Crowdsourcing and Managed Services aims to secure the reliability of healthcare information on the internet. The results of this study emphasize the importance of cooperation among government, managed services providers and experts.

Keywords—Managed Services, Crowdsourcing, Healthcare Data, Improved Patient Care

I. INTRODUCTION

Nowadays, a great number of individuals all over the world are using SNS (Social Network Service) with smart devices such as mobile phones, smart pads, and so forth. These smart devices and SNS paradigm have dramatically changed the way individuals interact and receive information. The emergence and expanded use of the SNS allow individuals to share knowledge and their own experiences with others on the web. This trend has created a platform capable of acquiring new and additional knowledge. The increase in the sharing of information has been a growing trend in the information age, but the beginning of the “smart era” through the smartphone and SNS has resulted in a change of paradigm in the distribution of information. This new paradigm of information sharing has the possibility to create value through the development of new services and businesses. The restaurant finder which recommends restaurants through the collection of individual opinions and real-time information exchange services can be a good example of this new information distribution network. These changes have created advantages such as the quick and diverse dissemination of information, but they have also introduced negative side effects. Even though a lot of information available online is useful, the verification of information by the experts is necessary to assure the reliability of information. For example, if unverified information is created and disseminated by non-experts in sensitive fields such as medical information, it could pose risks to the lives of individuals, and critical and fatal situations could arise. But there is a limit to this approach as it is expensive to verify information through specialists. To address these shortcomings, we propose a systematic management and distribution service for the corresponding data as a source of new value creation, as there is high demand for the sharing of individual experience and knowledge in the field of medical information. If a system is capable of providing meaningful information and benefits from the knowledge of informed individuals, it could be the opportunity to create a new information business.

Accordingly, it would be important for the created data to be verified through specialists such as doctors and pharmacists so that meaningful data could be distributed more effectively. At present, the government is providing medical and/or healthcare information in its government possession to individuals, but many are unable to utilize the service because of a lack of publicity and difficulty accessing it. If the specialists verify the medical information produced by individuals and link it with government medical information, it may be a new model of business in this new era of information sharing. This study addresses the following research topics: First, we explore how to connect meaningful services with sensitive information such as the medical information being distributed on the web. Second, we suggest a plan to improve the distribution and management of the information produced by individuals. We propose a service using Crowdsourcing, which is the utilization of collective intelligence, and Managed Services through professional corporations to improve the reliability of online medical information, and the distribution and management of the information.

The following section will discuss the proposed concept of the service framework and analyze the related issues.
II. THE PROPOSE SERVICE

A. Understanding of Healthcare Information

In this study, a framework for the systematic management of healthcare information produced and disseminated by the general public is proposed. The side effects of biased information may differ according to the relevant fields. Especially in the medical field, verification by specialists such as doctors and pharmacists is necessary as many could suffer if wrong and/or false medical information is distributed. Therefore, the government has to systemically manage the distribution of healthcare information produced and distributed by individuals.

First, the government should intervene in the distribution and management of healthcare information due to its special characteristics [1], [2]. In this study, healthcare information is defined as general disease information, not specialized information such as personal medical treatment records. In Korea, the individual medical treatment record is open to the general public in accordance with the policy of making public information available to the public. The Korea Centers for Disease Control and Prevention, the National Health Insurance Corporation, and the Health Insurance Review and Assessment Service are the principal agents of production for primary health information of Korea. The Korea Centers for Disease Control and Prevention, an institution with 360,000 data resources of the human body, ensures the collected data is being utilized for the development of a disease index and early diagnosis of disease [3]. The National Health Insurance Corporation stores and manages the data warehouse. The data for health checkups, medical treatment protection, and the qualification and payment of insurance premiums are stored and managed in the system. The Health Insurance Review and Assessment Service stores and manages information for the medical treatment agency and payment information data [3]. Each institution is open to the private sector and systematically manages digitalized information. However, this information is not utilized well by the general public because generally the public is not fully aware of who provides the information, and there is a gap between the provided information and necessary healthcare information required in everyday life.

As demand from the general public for necessary healthcare information for everyday life increases, there is a greater need to manage this information over specialized information. Key areas of information demanded by the public include disease, medicine and practical case experiences. To respond to this demand, we propose a system in which the general public would ask a question online and request to share and acquire the related information. The knowledge shared would derive from his or her own experiences as well [4]. If this information is used for the development of the medical field, it is expected to create more positive effects as it includes real-time information and individual experiences rather than information created by the government. This more practical information flow is created by the increase in interest in individual health and the development of media for the sharing of information through the smart phone and SNS. These devices have the advantage of being able to share information instantaneously, but possibledownfalls include the exposure of extremely sensitive personal information and unverified information from non-experts. For example, in the healthcare field, individuals could suffer gravely if wrong information gets disseminated because incomplete or misinformation could pose health risks. To prevent the misuse of sensitive information, the systematic management and distribution of the data on the web is essential. This process may be the source of new value creation as there is high supply and demand for individual experiences and knowledge in the field of healthcare information. Accordingly, it is important to develop a systematic framework to manage this information and improve its distribution rather than limiting it.

B. The Introduction of Crowdsourcing and Managed Services

The systematic verification, distribution and management of healthcare information are necessary, but the required time and financial expenditure of the government to manage the large volumes of private data would render this process ineffective. Therefore, the possibility of success for this approach would be extremely low if the service were being provided at the government level. However, if the development of a system capable of managing all aspects of information distribution and reliability is entrusted to the private sector, this could be the opportunity to further create new businesses while improving the reliability of information.

The most important issue is the process for the verification of healthcare information. A process for verifying sporadic individual healthcare information flows is necessary; this stage must be executed by specialists such as doctors and pharmacists. But if the volume of the information is considered, excessive time and financial expenditure would be required. As a result, the voluntary participation of the doctors and pharmacists during the verification stage would be crucial. This could be accomplished through Crowdsourcing. A compound word comprised of Crowd and Outsourcing, Crowdsourcing is a method of enhancing efficiency through the participation of many and unspecified public individuals for the production of specific services and/or solutions to problems [5], [6]. If the healthcare information is verified with Crowdsourcing by the specialists – doctors and pharmacists – quality, tangible data can be developed.

The second issue is the management of healthcare information. This stage deals with how to manage the data produced by individuals and verified by the specialists. The introduction of the Managed Services model for the professional management of information is proposed at this time. Recently, the government has been employing specialized professional enterprises to better manage increased amounts of data and improve the efficiency of operation. This hands-off process of outsourcing to specialists is called Managed Services, which are used to improve the efficiency of service operations. The Managed Service model is similar to Outsourcing as the corporation’s tasks are being entrusted to others. The difference is that improving overall business efficiency is the main objective by approaching outsourced services from an organizational operations efficiency point-of-
While the main objective of Outsourcing is the cost-savings of the organization, the main objective of Managed Services is to improve the overall efficiency of the business [7], [8]. Accordingly, to improve efficiency, the Managed Services Provider should be responsible for the overall operation of the task as it is more likely to ensure the efficient management of continuous tasks, compared with a one-time deal. Additionally, Managed Services could be secured from portal enterprises capable of collection, data management and the systematic distribution of healthcare information. If this Managed Services system is carried out, it may prevent harm caused by the distribution of false healthcare information; a new business could be created as well, around the new platform for the distribution of healthcare information.


The conceptual framework of the health information model proposed in this study is shown below in Fig. 1. The source of data is the healthcare information created in the private sector; these data are collected by the portal where the healthcare-related collective intelligences are gathered. The reliability of the collected data is verified by the specialists (doctors and pharmacists) participating in Crowdsourcing. The specialists (doctors and pharmacists) assemble high quality data by responding to the request for the healthcare information and the verification of information. The Managed Services Provider carries out the filtering of false information together with the specialists through social data management and continuous management and analysis. The Managed Services Provider also ensures that continuous healthcare information is created through a series of courses and auto-updates, and healthcare information-related professional portals could be created.

III. THE INTRODUCTION OF MANAGED SERVICES

The main purpose of the proposed service framework is to prevent the utilization of mixed individual information with false healthcare information produced by individuals. Accordingly, it is necessary to manage the flow and content of information at the government level. In this Chapter, how the Managed Services are introduced when the service is built, and the role of the government, and Managed Services Provider at each stage will be discussed and analyzed.

A. The Phased Flow and the Task

The first stage addresses service planning and involves the following steps: service planning, establishment of the strategy, system construction, service provisioning, and management and improvement of the service. Please refer to Fig. 2.

In these processes, the following tasks take place: 1) the planning of healthcare information service utilizing the user-generated data on the web, 2) the establishment of strategy, 3) the development of services and the construction of the system, 4) the provision of smart healthcare services, 5) the management of services, and 6) the improvement of services. In stages 1 and 2, the government plays a leading role in planning the service to establish the strategy and objectives of the healthcare service. The main tasks in this stage are materialization of the service, making guidelines for the refreshment of data, and the development of the overall guidelines for service operation. The tasks to be carried out by the Managed Services Provider are stated in 3) to 6). They thoroughly examine the possibility of the introduction of managed services or not. Also they consider the Managed Services level, service quality management, continuous service updates, and the active distribution of data.

The second stage based on data flow involves the following steps: the collection, integration, analysis and application of data. Please refer to Fig. 3. In this phase, 1) the securing of healthcare data produced by individuals, 2) the verification and the analysis of the various user-generated healthcare data, 3) the application of analyzed data and the management of quality diagnosis are carried out. In 2), the Managed Services Provider helps the specialists such as doctors and pharmacists to verify the information through Crowdsourcing. In 3), The Managed Services Provider prepares a distribution system so various individuals can utilize the information from the data produced on the internet.

In this process, the preparation for participation in Crowdsourcing, verification of the produced data by individuals, establishment of data filtering guidelines in the course of application, and plans to protect individual information are required.

Fig. 1 Conceptual Framework

Fig. 2 Service Flow and Tasks

Fig. 3 Data Flow and Tasks
B. The Roles of the Main Participants

The main roles in the proposed service framework may be classified as 1) planning and design, 2) construction and operation of infrastructure, and 3) analysis and visualization. The planning and design stage are under government leadership. The government should design the integration of the platform for the application of healthcare data produced by individuals in the private sector such as through SNSs and web portals. In particular, the objective for utilizing the healthcare knowledge and information produced by the private sector should be clarified and a concrete service design developed. The stage of construction and operation of the infrastructure requires professionals in data management and reprocessing (i.e., the role of the Managed Services Provider). Furthermore, the participation of the specialist medical group to ensure the reliability of healthcare information and quality evaluation are required. They provide professional knowledge for the construction of infrastructure, tools. It is essential for the updates and reprocessing of healthcare information produced by individuals. The stage of analysis and visualization are the roles of the Managed Services Provider. The Managed Services Provider examines and visualizes the data types and attributes. The provision of this service lets the users more easily access and understand the data produced by individuals. The systematic connection of each level becomes more important, and the role and authority of the government and Managed Services Provider can be classified in the course of the analysis and the management and updating of data.

C. The Issue of the Management of Personal Information

The important issue in the use of healthcare data is the management of personal information. In the process of utilizing social data produced by an individual on the web, issues related to personal information disclosure will be raised. Guidelines to utilize and refresh the data should be established under clear objectives as healthcare information contains sensitive individual information. As it would be difficult for people to fully utilize the information from a SNS, it is important to develop plans to minimize the harm that could derive from the exposure of personal information online. Thus, systematic guidelines for the implementation of data are necessary. Mainly, the establishment of concrete rules pertaining to the removal of personal identification and encryption, such as the principles of a clear objective, numeric limits and an act on the protection of personal information are necessary. Plans to minimize potential harm to individual information will be necessary in accordance with the use of healthcare information.

D. Quality Control of Verified Data

The most important issue in the service proposed by this study is the improvement in quality and management of user-generated data from the web. In the case of private social data, the appraisal of the accuracy and reliability of information is the most important. The ripple effect would be substantial if inaccurate and false information are disseminated as the number of people producing and distributing the information through social media is massive. As a result, programs such as spam filters and text mining to interpret the social data and identify false information are necessary. Investigation procedures for specialists such as doctors and pharmacists will be necessary as the proper use of healthcare information is critical. The Managed Services Provider should continuously conduct evaluations to ensure the reliability of information. To summarize, the planning and cooperation on a governance system among governments, individuals, medical specialist groups, and the IT enterprise professionals is suggested as the optimal way to filter errors from information, and manage the selection and distribution of useful data.

IV. Conclusion

Recently, lots of people have interested in the utilization of data produced by individuals based on the SNS is rising. The creation of new businesses based on this social data is becoming a reality. In this study, a conceptual framework for the optimal use of healthcare information produced by the private sector has been proposed. Furthermore, the use of Crowdsourcing by medical specialist groups and the introduction of Managed Services for the management and distribution of reliable healthcare information have been proposed. It has been found that the combined role of the government and corporations during each stage of service development should be separated by outsourcing the management of data to a professional Managed Services Provider. Following are the major issues being raised in the course of the development of the service proposed in this study.

First, the stages of service planning and development include the establishment of data management and filtering guidelines. The establishment of the filtering system is significant as the healthcare information produced by individuals contains personal information and possibly false information. In this stage, it is imperative to verify the information through the participation of the medical specialist group through Crowdsourcing. Providing incentives for these groups to voluntarily participate in this stage also needs to be considered. Overall, the establishment of a mechanism to support the objective of implementing the data is essential.

Second, the main issue being raised during the stage of service operation is the absence of the professional Managed Services Provider. At present, few corporations are equipped with the capability to collect and manage the various types of data professionally produced by the SNS. Establishing and maintaining these professional corporations should be a priority. Also, the issue of responsibility has been emphasized. In the case damage has been done by false information during the course of the management and supply of services, there could be disputes of responsibility between the government and the corporations. Thus, guidelines on responsibility should be discussed in the initial planning stage.

Third, the improvement of data quality management may be a major issue during the stage of service management. The government should do its best to ensure the integrity of the data governance system by utilizing the medical specialist group for the improvement of data quality. The medical specialist group should make efforts to improve the reliability of social healthcare data above all. If the proper
countermeasures are used, new value may be created utilizing the healthcare information produced by the private sector.

This study proposed that it is feasible for healthcare service providers to utilize new personal data aggregation tools such as SNSs and cooperate on a healthcare information system through Crowdsourcing and Managed services.

In a future study, the following topics will be studied. A better understanding of the level and current status of personal healthcare data produced in Korea should be developed. Furthermore, each stage of service planning, development and management in Managed Services should be analyzed with a view to developing a system and structure for each stage of the process. In the service operation stage, the data governance system and content development plans for the quality diagnosis guidelines for the improvement of data quality should be extensively examined. Finally, plans for a continuous performance management and monitoring system should be analyzed in the service management stage. This study should be the first step in the development of a more concrete and detailed service development plan in future studies.

REFERENCES