

Application Of Big Data & Iot On Personalized Healthcare Services

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Abstract: These Information is very vital any organization and betterment as there would be developments which are dynamic. Health care organizations like any other sector produce huge data that has many advantages and challenges. In today's dynamic and rapidly growing situations in all sectors including Health care Sector there is huge data. Every sector whether it is industry or academics there is lot of data which is generated for numerous purposes. In the current era of digitalization all the health records of the health care system are standardized. With this the medical history of the patients related to the past, present or future is used to capture, transmit, store and retrieve the data for the main purpose of providing health care and health related services. The merging of wireless communication, digital electronic devices and microelectronic mechanical systems technologies are developed which led to the evolution of Internet of Things(IoT). Computers, smart phones, tablets and Wi-Fi devices, sensors, wearable devices and house hold appliances are all items of IoT components

Index Terms: Minimum Big Data, Internet of Things, mHealth, Supervised learning

1 INTRODUCTION

Information is very vital for any organization as there would be developments which are dynamic. Data is important for any organization as it can be used to predict based on the current trends and certain parameter. In today's scenario there is huge amount of data from every aspect of the life such as social activities, work, health etc., Due to this there are advances in the technology which helps in generating more data may be tons of data which becomes unmanageable even with the current skills. This directed to the concept 'Big Data' which is large and uncontrollable. This creates a situation to develop new approaches in order to arrange the data in a proper way and extract eloquent patterns and has to encounter the current and forthcoming societal requirements. Health care organizations like any other sector produce huge data that has many advantages and challenges. In today's dynamic and rapidly growing situations in all sectors including Health care Sector there is huge data which is available and requires advanced technologies. Every sector whether it is industry or academics there is huge amount of data which is generated for numerous purposes. Managing this huge data whether it is organized or unorganized is a major challenging task for the organizations. In these situations, there is a need for advanced technologies, applications and software's that are cost efficient with high computational power. There is need for implementing Artificial intelligence and necessary to achieve automated decision-making system. This can be achieved using machine leaning techniques such as Neural networks and other artificial intelligence techniques. Nevertheless, if the suitable software and hardware backing is not available and big data can become explicit.

With suitable storage capabilities and analytical tools the information and acumens derived from big data can make the critical social services like health care, safety or transportation more attentive, interactive and efficient for the development of the society [1]. Health care is a system which is derived with the objective of anticipation, finding and dealing of health-associated problems of humans. The main stakeholders of a health care system physicians or nurses, health services such as clinics, hospitals and other diagnosis or treatment technologies and a funding organization. Depending on the seriousness of the health problem, health care requires several levels. The initial point of consultation is the primary attention, the secondary attention is the acute care which requires skilled professionals. And the tertiary attention is at the advanced medical investigation. All these levels, the professionals require patient's information such as medical background, medical and clinical statistics and other individual medical data. The most traditional way of storing the data in the earlier days is hand written or typed reports [2]. The case records of the patients is stored as an episode of illness in which the patient, family and doctors share the scheme [3]. In the current era of digitalization all the health records of the health care system are standardized and are of extensively in practice. With this the medical history of the patients associated with the past, present or future is used to capture, transmit, store and retrieve the data for the main purpose of providing health care and health related services. In these situations, the merging of wireless communication, digital automated devices and microelectronic machine-driven systems technologies are developed which contributed to the evolution of Internet of Things(IoT). The devices such as computers, smart phones, tablets and Wi-Fi devices, sensors, wearable devices and household appliances are all items of IoT components [4]. The Internet of Things means the generation of huge amount of smart data. The Big data analytics is used on this huge data generated by IoT [5]. The massive growth in the usage of internet along with the smart phones and machine to machine (M2M) communication has transformed the big data [6]. As the Internet of Things (IoT) model develops more predominant, a swarm of innovative prospects have arisen. Various knowhows such as tiny wearable bio sensors through the developments in big data led to the services such as eHealth and mHealth that are more tailored and accurate which improves the return on investment. Technologies like mini wearable biosensors,

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coupled with advances in Big Data – especially in regard to efficient handling of large, multiscale, multimodal, distributed and heterogeneous data sets – have opened the floodgates for eHealth and mHealth services that are more personalized and precise than ever before. But the IoT hints at an even greater change in health care paradigms: it promises greater accessibility and availability, personalization and tailored content, and improved returns on investments in delivery. With the usage of mobiles in all aspects of life, there is a necessity for the health care to accommodate the mobile services.

2 MANAGERIAL BUSINESS PROBLEM

As the humans are moving more towards the internet and mobile technology in practically all facets of life, the healthcare set-up requires transformation to accommodate mobile devices [7]. This exercise of medication and communal health using the portable devices is known as mHealth or mobile health which influences diverse stages of health care particularly in the cases of chronic illnesses such as diabetes and cancer [8]. These applications need backing continuously and maintain collaboration with several customer devices and implanted instruments for data amalgamation. These applications support the clinicians to have direct contact to the individual's complete data of wellbeing. The patient and their clinicians will be able to know the instantaneous position of an individual. These type of applications and smart devices contribute to the improvement and the wellness preparation and reassuring healthy lives. The handlers or patients can become promoters for their own health.

2.1 Research Question

- How IoT driven wearables helps in handling the needs of health care ?
- How Big data along with the IoT impacts the mHealth enhances health care in the case of chronic diseases

2.2 Research Objective

- To study the impact of IoT wearables helps in handling the needs of health care.
- To study the impact of Big data along with IoT on mHealth in analyzing the patients data in case of chronic diseases

3 LITERATURE REVIEW

The clinical examinations and medical records in the health care systems are standardized with the arrival of computers in the recent times. The electronic health records are maintained for the benefit of the patients and clinicians to provide better health care by capturing, transmitting, receiving, storing, retrieving the data for providing health care and health related services. With this the health care professionals have better quality access to the complete medical history of a patient. This includes medical detects, medicines, data associated with the known allergies, demographics and the results from lab examinations. With this there was a substantial decrease in the redundant and further inspections and there is a better coordination between multiple health care providers. The health care professionals stated accessing internet driven and automated platforms to progress in their medical practice by using auto prompts about immunizations, cancer detection and other intermittent inspections. This helped in immediate approvals of insurance due to less paper work and allowed

quick retrieval of data and providing crucial health care excellent gauges to the administrations and also help in improving health observation and instant reporting in case of epidemics. It also helps in eliminating delays in the billing and claims managing. With the usage of internet these electronic health records offer admittance to heaps of health-related crucial medicinal evidence of a patient.

3.1 digitization of Healthcare and Big data

The big data in health care consists of data related to electronic medical reports, dispensary preparation and coverage accounts along with the data obtained from smart web of internet of things. In order to manage and use this type of health care data requires information technology. The wellness monitoring devices generated and shared health data with the respective health care providers which led to the real time biomedical and health intensive care structure. [9] The electronic health records aid to advanced analytics and benefit the decisions taken by the clinicians with vast data. But most of this data is unstructured which is the information that does not follow any definite model or administrative background. The data which is obtained many be recorded in numerous setups. This unstructured data can even capture composite data. The numerous forms of this unstructured data are from various sources such as patient's medical doubts, socio-economic data, the choices of the patient, the major life style features. It is a challenge to cluster such diverse data. It is necessary to group the data in spite of these challenges into an integrated form so that the information generated can be understood using algorithms for supplementary investigation and control the patient's health. However, the health care sector has to use this rich information to improve the understanding of the patient. This leads to proper care, efficient management and provide treatment economically [9].

3.2 Internet of Things (IoT)

The usage of big data in the healthcare sector is still in its embryonic stage as it is not been fast to adapt to the big data in comparison with other sectors. In order to measure the individual's health position biomolecular and clinical data sets want to converge which is possible with internet of things(IoT). IoT has gained importance in all industries including health care. The common objects such as cars, watches, refrigerators and health monitoring devices are furnished with processors and sensors so that the data can be collected and transmitted using internet [1]. The data collected and analyzed from these sensors provide crucial information for the improved lifestyle and health care. These devices provide continuous data while monitoring the health of the patients. They also offer a dependable, operative and smart health care services to ageing and patients with long-lasting ailments [10]. A doctor can measure and monitor the patients' health from any location with the IoT devices. By doing this there can be an early treatment with which the patient need not be hospitalized or visit the doctor and by this there is a significant cost reduction in health care expenses. Most prominently used IoT devices are fitness or health tracking wearable devices, biosensors, clinical devices for monitoring. These IoT devices produce huge quantity of health-related data and if this data is integrated with prevailing health care data, the doctors can predict the health status of the patient. [9]. This data generated using IoT is helpful for better investigation and predictions, modeling the spread of a ailment and discovering the disease

occurrence. In order to analyze the data from IoT updated software's are required to organize the data from IoT devices in present and should be able to analyze every minute. This can be achieved by using advanced analytics like supervised learning to the data which can be both internal and external. Based on the extant literature the following proposition can be made.

Proposition 1: The use of Internet of things with Supervised learning can lead to mHealth

3.3 Big Data

Data Analytics can be used for changing the approach of the treatment and many of the health related decisions. The health field generates large amount of data which may be even historic in the form of genetic factor, medicinal pictures, electronic health records, clinical notes, epidemiologic data, which may be used to advance treatments and investigative representations. This transformation requires advancement in technologies in the mobile technology which helps in collecting health related data from various sources. The five characteristics of big data differentiates it from ordinary data such as volume, velocity, variety, veracity and value [11] According to [12] big data can suggest certain important opportunities in the mHealth area such as Point of Care Diagnostics, Wellness, Patient Monitoring, Compliance, Behavior Modification, Education & Reference, Efficiency and Productivity and Environmental Monitoring. We will now refer to a case study on Dignity Health were the usage of big data has helped in the patient care

A case study on Dignity Health: Analytics helps prevent deadly infections [13] Sepsis is a life-threatening septic health issue which causes infection that harms the tissues, organ failure leading to death. This ailment travels very rapidly, and around quarter million individuals die in the US every year. It is very difficult to identify especially in frantic surroundings like emergency rooms. Dignity Health is the fifth leading health system in US and the huge hospital facilitator in California. They use Big data and advanced analytics to forecast probable sepsis patients in the early stages when the involvement is very much required. They use Sepsis Bio-Surveillance Package and monitor 120,000 cases per month spread across 34 hospitals and manage the possible 7500 sepsis case per month. The data is collected from the medical records of the patients and solved using natural language processing, the reasons that leads to a sepsis infection are continuously monitored. In the cases of higher chances then the chief nurse or physician is indicated with this. With the implementation of big data and predictive analytics there is a substantial improvement in the mortality. The mortality rate has dropped at an average of 5% in 28 hospitals of Dignity Health. The patients had to stay in ICU for a lesser amount of time which led to the treatment at low cost. Based on the literature review the following proposition can be made.

Proposition 2: The Big data with Supervised learning can lead to mHealth

3.4 Machine Learning

The introduction of machine learning tools in the clinical medicine helps in improving health care delivery drastically. The companies are moving towards the incorporate machine

learning to medical decision making. They are predicting that these tools for analyzing the big data in the health sector is the basic necessity for the next generation physicians [14]. In the field of Medicine, machine learning has just started. A machine learning algorithm is developed by Google to recognize cancer growths on mammograms. The diagnosis of diabetic retinopathy in retinal images is carried out by machine learning algorithms. The algorithms can be trained to recognize the anomalies by looking at the images and identifying the areas which require care. This can health care practitioner in long run by improving efficiency, reliability, and accuracy [15]. Machine learning accomplishes this through pattern recognition, rule-based logic, and reinforcement techniques that help algorithms understand how to strengthen "good" outcomes and eliminate "bad" ones. The pattern recognition, rule based logic and reinforcement techniques help algorithms to understand and strengthen the good results and eliminating the bad ones. Machine learning algorithms are categorized as supervised, unsupervised and reinforcement learning. Supervised learning can be applied on what has been learnt in the past to current data to predict future events. In the case of health care the trained data can be the samples of pathology slides that contain cancerous cells as well as slides that do not. The algorithms are trained to recognize cancerous tissue that distinguishes among healthy and non-healthy images in the future. When the computer correctly identifies a cancerous image, that positive result is reinforced by the trainer and the data is again fed into the model, which gives more accurate identification of complex samples [16]. According to Fatima Paruk, CMO of Chicago-based Allscripts Analytics, said in 2017. "AI will affect physicians and hospitals, as it will play a key role in clinical decision support, enabling earlier identification of disease, and tailored treatment plans to ensure optimal outcomes," Paruk explained. "It can also be used to demonstrate and educate patients on potential disease pathways and outcomes given different treatment options. It can impact hospitals and health systems in improving efficiency, while reducing the cost of care." Based on the extant literature the following proposition can be made

Proposition 3: the machine learning and Supervised learning can contribute significantly to mHealth

3.5 mHealth

Now a days everyone is passionate to track their fitness and health and are using mobile and wearable devices such as smartphones, smartwatches, tablets and so on and huge as the society is moving fast to these devices, the healthcare need to gear up to capture the data generated from these devices [17]. This part of medical practice and public health using mobile devices is mHealth or mobile health which encompasses various levels of health care mostly in the cases of chronic diseases such as diabetes and cancer [8]. These platforms can develop healthcare by fast-tracking collaborating message among patients and healthcare providers Apple and Google established dedicated platforms like Apple's ResearchKit and Google Fit in order to develop research solicitations for fitness and health [18]. These applications provide continuous communication with numerous customer devices and entrenched instruments for data integration which help the doctors to have straight admittance to overall health data of an individual. Both patient and the doctor will have the real-time position. These apps and smart devices are also

successful in enlightening the wellness scheduling and boost to strong lives. The users can become supporters for their own health. There is huge amount of clinical data which is generated with this fast growing digitalization. This when combined with machine learning helps in facilitating clinical decision process. In this tool we need to obtain a set of predictor variables from the input data. In case of health care the input data can be age, gender, hemoglobin levels, sugar levels, bp levels etc. Machine learning algorithms can be used to analyze huge data and patterns can be identified and predictions can be made [19]. mHealth helps the health care practitioners to provide treatment to these patients in an efficient way by monitoring and consulting remotely and provide immediate access to the medical information of the patients and suggest medicines immediately. Smart phones, mobile biomedical sensors, remote monitoring products, social media, electronic health records can be used in this regard. The data which is collected by these sources can provide meaningful inputs for more personalized treatment especially in the cases of mental health, diabetes, cancer, heart rate, blood pressure and other ailments [20]. The healthcare providers can track the patients continuously and identify the indications at an early stage to treat them efficiently. Furthermore, the Internet of Things (IoT) deals with a persistent health situation by interconnectivity of several portable devices. This way of environment helps in monitoring and analyzing the health-related data at an individual level so as to give extended assistance. Based on the extant literature the following proposition is made.

Proposition 4: mHealth improves the efficiency, reliability and accuracy of treatment provided to the patients. The proposed model (fig1) for the propositions made from the literature. This framework can help the health providers to understand how the health a patient can be tracked, analyzed and provide treatment using IoT devices and improve the efficiency, reliability and accuracy of the treatment provided to the patients.

4 OPPORTUNITIES

The data obtained from electronic health records is huge and enables advanced analytic techniques to help clinical decision making. The health care sector is required to use this rich data to enrich patient experience and also helps in providing low-cost treatments. There is an opportunity to analyze this big data in a systematic manner. These mHealth technologies are useful at individual, community and regional levels [21]. The real time data related to heart rate, blood pressure, sugar levels etc can be monitored at the individual level and can be stored in groups. The main sources of this data are smart phones, smart watches, tabs etc., From the point of view of an individual patient a decision support system can bring the relevant and high quality information based on the previous medical history as well the current medical condition [22]. With this a list of medical experts of that specialization can be recommended [23]. These IoT wearables can support such systems at any point of time and from any location. mHealth devices can also offer supplementary environment associated to people in the form of sleep patterns, readings maintained from heart beat monitor and so on. Anticipatory care provision can be increased by mHealth with the usage of IoT wearable monitoring systems, smartphone-based applications, Internet connected exercise machines [24]. If this type of data is issued

to a multifaceted event treating system, some risks can be exposed in the early stages and the reports can be sent to appropriate health care providers in real time and the lives of the patients can be saved [21].

5 CHALLENGES

There would be social and technical challenges in the acceptance of mHealth applications and the IoT devices used by the patients in their everyday lives. The usage of these technologies by the medical practitioners is also a challenge. The medical staff/practitioners need to be trained along with acquiring the skilled workforce and the required technical infrastructure all of which increases cost. Moreover, the data generated by these devices is unstructured and unstandardized which needs processing. This is an intricate and time-consuming job which may affect the accuracy and efficiency of the analysis which would be crucial for the life of the patient. The analysis also should be offered in an appropriate way to the participants who may not have sufficient technical background. Further the information in the health care sector should be accurate, precise and in time. The health care data generated by these IoT devices are diverse and there are no proper formats. The data needs to be prepared and processed before analyzing. In order to simplify the analysis, standardized data need to be warehoused in a common data storage [25], [26]. At an individual level the data need to be understood correctly otherwise the evidence may deceive patients and confuse them or produce wrong sense of safety [21]. The IoT and mobile devices are affordable, smaller and abundant they are extensively adopted in the health care sector. Huge data is generated by these devices which is supported by Big data and the machine learning algorithms. Further there is huge data that is generated by mHealth devices and the technologies. This is creating an opportunity to analyze the real time data. The health care sector is linked with cost and the procedures in many developing and developed countries. The humanity remains unproductive if there is no proper health care. Because of this there would not be progress in the economy. The Government must endure or withstand the health sector how much ever costly it is. The expenditure on health can be minimized with proper spread of mhealth technologies along with machine learning and supervised learning. With this technology the expenditure can also be forecasted. So, we can understand from the literature that the proper usage of IoT and related technologies can help the society.

6 IMPLICATIONS

These applications provide continuous collaboration with numerous IoT devices and embedded sensors for data amalgamation. These applications help the doctors to have straight admittance to the individual's complete health data. Both the patient and their doctors get to know the current status of a person. These apps and smart devices also help by enlightening the wellness preparation and cheering strong existences. The users or patients can become supporters for their own health. Use of Machine learning and supervised learning can give predictions to the medical practitioners, improved handling can be provided to the patients. By using these devices, the doctors can monitor the health of the patient continuously and remotely and can provide treatment without any loss of time. The data can be stored in a common

data warehouse so that meaningful patterns can be obtained using the machine learning algorithms which will help in better treatment and decision making.

7 LIMITATION AND FUTURE STUDY

Since the implementation of Big data, IoT and the advanced technologies are still in the nascent stage based on the extant literature the factors which influence mHealth are identified. This study proposed the frame work based on the constructs developed from the extant literature which influence mHealth and how this helps the medical practitioners in treating the patients efficiently and accurately. The future study may include developing the scales for these constructs and carry out empirical research to validate the propositions. There is also scope to convert the propositions into feasible hypotheses and empirically validating them for establishing a stronger linked framework. There is also a scope for a large-scale empirical validation using EFA followed by CFA & SEM to establish the path association and understanding the contributing factors in detail.

8 CONCLUSION

This paper provides a conceptual frame work in understanding the constructs and how the big data will have an impact on mHealth with the machine learning algorithms. It also gives an understanding how IoT will have an impact on mHealth with the help of machine learning and supervised learning. It also provides an understanding on how the mHealth can provide efficient and accurate treatment using these machine learning algorithms and get appropriate predictions.

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