

Convergence of Big Data and Internet of Things - Study and Analysis

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ABSTRACT

IoT and Big Data are buzzing the technology world for quite a time now, and these are no longer a “nice to have” technology but a necessity. There is a drive to adopt big data within organizations which has triggered the use of big data analysis tremendously in the past few years. Hence, businesses are also rapidly catching on to what they need for it. At the same time, the Internet of Things (IoT) has sparked the world by showing what a fully interconnected world can offer us. Though IoT and Big data evolved independently, they have become interrelated over the period. Furthermore, the relation between big data and IoT has shown a convergence of the two technologies which is aligning the technologies in the best possible way. Hence, if IoT big data combination separately gives plenty of reasons for excitement, then combining the two technologies multiplies the anticipation. In this paper, we will discuss how IoT and big data go hand in hand and how organizations are obtaining benefits by using the internet of things big data together.

Keywords: IoT, Big Data, Data Mining.

I. INTRODUCTION

In ICT era, more devices and objects are now linked to the internet and transmitting the data they gather back for the purpose of analysis. Here, the goal is to utilize this data to learn more about trends and patterns that can be utilized to make a positive impact on our lifestyle, energy conservation, transportation, and health. Nevertheless, the data itself doesn't create these objectives, but rather its solutions that emerge from examining it and locating the answers we need.

In relation to this future, two terms that have been discussed are the Internet of Things(IoT) and big data. These are closely intertwined and although they are not the same thing, it is very hard to talk about one without the other. Before we analyze their connection, let us take a much closer look at these two practices.

Internet of Things (IoT) refers to a system of connected physical objects via the internet. The 'thing' in IoT can refer to a person or any device which is assigned through an IP address. A 'thing' collects and transfers data over the internet without any manual intervention with the help of embedded technology. It helps them to interact with the external environment or internal states to take the decisions [1]. Big data means a large set (petabytes or gigabytes) of structured, unstructured or semi-structured data and analyzing those data to get the insights of the business trend.



Fig 1. Overview of Big data and IoT

II. LITERATURE STUDY

Bashir and Gill [2] propose an IoT big data analytics framework to overcome the challenges of storing and analyzing large amount of data originating from smart buildings. The proposed framework is composed of three components which are big data management, IoT sensors, and data analytics. The analytics are performed in real-time in order to be used in different parts of the smart building to manage the oxygen level, smoke/hazardous gases, and luminosity.

The framework is implemented in ClouderaHadoop distribution where the analytics is performed using PySpark. The results show that the framework can be utilized for IoT-enabled big data analytics. The proposed framework is specifically designed for smart buildings that should be extended to make it generalize so that it can deal with other IoT applications including smart cities and smart airplanes.

Lee et al. [3] propose an IoT-based cyber physical system that supports information analysis and knowledge acquisition methods to improve productivity in various industries. This system, which focuses on industrial big data analytics, integrates various data analytics components in the form of reconfigurable and interchangeable modules to meet different business needs. The authors also provide a new context intelligence framework that can help handle industrial informatics based on the sensors, locations, and unstructured data for big data mining. A case study is also performed to illustrate the design of the proposed cyber physical system.

Wang et al. [4] discuss the challenges and opportunities resulting from IoT and big data for the maritime cluster. They also develop a new framework for integrating industrial IoT with big data and analytics technologies. Implementing such framework can help increase output and productivity as well as allow whole clusters to continue acting as leaders in the global maritime industry.

Jara et al. [5] conduct a survey to highlight the existing solutions and challenges to big data that are posed by cyber-physical systems. Their study focuses on cloud security and the heterogeneous integration of data from

multiple sources. They highlight the need for developing sophisticated data discovery mechanisms and for performing real-time stream data processing.

Ding et al. [6] propose a general statistical database cluster mechanism for big data analysis in the IoT paradigm (IOT-StatisticDB). They input statistical functions on IOT-StatisticDB via statistical operators inside the database management systems (DBMS) kernel. The statistical analysis is performed in a distributed and parallel fashion using multiple servers.

III. THE RELATION BETWEEN BIG DATA AND IOT

As per the study, around 4.4 trillion GB of data will be generated by the year 2020 through the Internet of Things. This is no doubt difficult to comprehend easily. However, with the growing number of connected devices it is not surprising that by 2020, more than ten billions of sensors and devices will be connected to the internet. Furthermore, all of these devices will gather, analyze, share, and transmit data in real time. Hence, without the data, IoT devices would not hold the functionalities and capabilities which have made them achieve so much worldwide attention.

When organizations are grabbing hold of the data for analysis purpose, IoT is acting as a major source for that data, and this is the point where the role of big data in IoT comes into the picture. Big data analytics is emerging as a key to analyzing IoT generated data from “connected devices” which helps to take the initiative to improve decision making.

The role of big data in IoT is to process a large amount of data on a real-time basis and storing them using different storage technologies.

IoT big data processing follows four sequential steps

1. A large amount of unstructured data is generated by IoT devices which are collected in the big data system. This IoT generated big data largely depends on their 3V factors that are volume, velocity, and variety.
2. In the big data system which is basically a shared distributed database, the huge amount of data is stored in big data files.
3. Analyzing the stored IoT big data using analytic tools like HadoopMapReduce or Spark
4. Generating the reports of analyzed data.

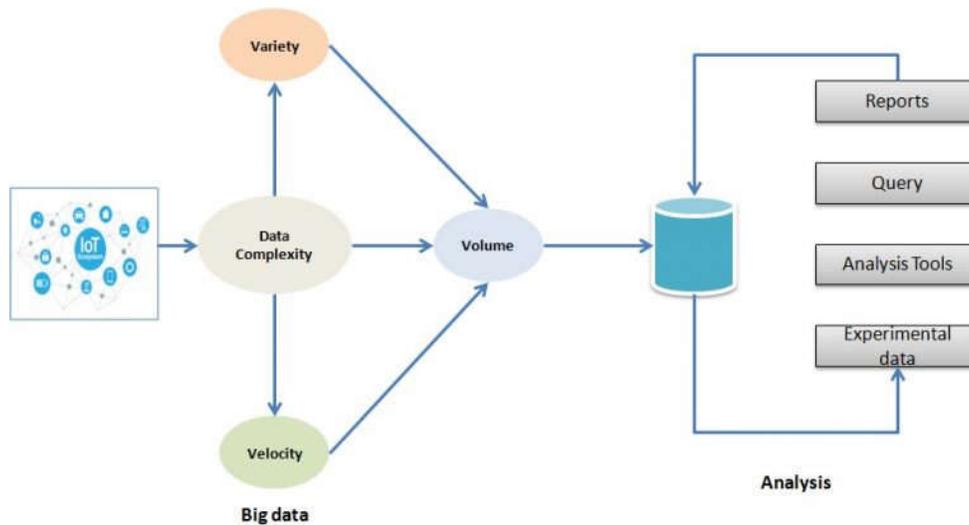


Fig 2. Process of IoT data with Big Data analysis

IV. HOW DO IOT AND BIG DATA IMPACT EACH OTHER?

It's not just that there is the only interdependent relation between big data and IoT. As they help each other, in addition to that they hugely impact each other. Fact is the more the IoT grows it will place more demand on businesses regarding big data capabilities. For example, as the IoT generated data is increasing at a huge rate, conventional data storage technology is already being pushed to its limits. As a result, it demands more advanced and innovative storage solutions to handle these growing workloads resulting in updating the infrastructure of an organization's big data storage. Similarly, the IoT big data combined applications accelerate the scope of research in both the fields. So, IoT and big data both the technologies carry inter-dependency and need further development.

V. BENEFITS OF IOT AND BIG DATA FOR COMPANIES IN DIFFERENT SECTORS

5.1 Helps to increase the ROI for the Businesses

IoT and big data analytics are transforming how businesses are adding value by extracting maximum information from data to get better business insights. With the increased demand for data storage companies prefer big data cloud storage which ultimately lowers the implementation cost for them.

5.2 It will reshape the future e-health system

The combined features of the IoT and big data can reshape the next generation of e-health care systems. Big data will lead to hypothesis-driven research to data-driven research transformation. On the other hand, IoT will help to control and analyze the different levels of connections between various sensor signals and existing big data. This will enable new ways of remote diagnosis with a better understanding of the disease which will lead to the development of innovative solutions in the healthcare field.

5.3 Advantages in manufacturing companies

If manufacturing companies install IoT sensors within its equipment, they can collect significant operational data on the machines. This helps them to have an in-depth look at how the business is performing and enable them to find out which equipments need repairing before much problems arise. This prevents them from more

significant expenses by skipping the downtime or replacement of the equipment. Hence, investment in IoT and big data causes saving businesses money.

5.4 Internet of things and big data will raise self-service analytics

With more inventions in the IoT field, most of the IT functions can be handled with data automation and integration. Additionally, big data tools will increasingly become self-sufficient and straightforward to perform basic functions. Hence, analytics as a service will become more of a self-service type.

5.5 Benefits in the transportation industry

In the transportation sector, IoT sensors have been installed in the vehicles as a way to track them the go and around the world. This doesn't only help companies to keep a closer eye on the vehicles, but it also provides the data regarding fuel efficiency, how drivers utilize their time and delivery routes. This information can be indispensable for optimizing fleets and for the improvement of organizational productivity.

5.6 More benefits in Industrial internet of things (IIoT)

IIoT is related with various connected devices which help following tasks to control the behavior of the industrial devices –

- Monitoring
- Collecting
- Exchanging
- Analyzing
- Instantly acting on information
- Hence, the convergence of IoT and big data in IIoT is an important component.

5.7 Edge-Computing will be in high demand

Working on real-time data is a high priority today and a necessity as well. As IoT and Big data both enable on-demand and real-time action, the importance of deployment of these technologies is high. In this view, the popularity of edge computing is also becoming very high. As the IoT and big data are closely linked, there are many examples out there of organizational benefits to put them to good use.

VI. CONCLUSION

IoT is one of the biggest sources of big data, which are rendered useless without analytics power. IoT interacts with big data when voluminous amounts of data are needed to be processed, transformed, and analyzed in high frequency. This work specifically focuses on how big data uses for analyses the data which is collected from millions of sensors through IoT. The paper focus to highlights the points which area the applications going to be beneficial

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