

New Challenges and Future Trends: Big Data Analytics and Artificial Intelligence in IoT

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Abstract— Internet of Things (IoT), Big Data and AI are the monumental things today. They can extend not only information and communication technology, yet additionally a wide range of frameworks in our society, including business, finance, industry, manufacture, management, and environment. IoT connects the physical world to the Internet and produces a big amount of data. IoT, Big Data and AI are incredible advancements and when joined they become significantly increasingly integral assets that can be utilized for good or evil. The use of IoT, big data and AI on the Internet creates a number of challenges for internet governance. Big Data, IoT and AI will drive world's data to grow 5X by 2025.

Keywords— Predictive Analytics, Big Data, Artificial Intelligence, Data Analytics, IoT, augmented reality

1. INTRODUCTION

Big Data, artificial intelligence, and the Internet of Things, have rapidly turned into the foundations that characterize and maintain our interconnected, web-driven reality. How about we investigate them?

In this article we discuss about the chain that is framed between sensors, the Internet of Things (IoT), Big Data and Artificial Intelligence (AI). All these – from the outset – isolated technologies are connected within smart devices. In this article we summarize about the different components, yet for the most part go into the associations between them. At the point when all components are connected together, smart devices and smart solutions are made, with which we can extraordinarily improve and advance our daily life.

Internet of Things

According to the research, around 4.4 trillion GB of data will be produced by 2020 through the internet of things. There is ambiguity or it is difficult to comprehend efficiently. However, with an increasing amount of connected devices, it is not possible that more than 10 billion sensors and devices will be connected to the internet by 2020. In addition, all these devices will collect, evaluate, exchange and real-time transmission of data. Hence, without the data, IoT devices would not retain the features and capabilities which have made them achieve so much recognition globally.

The Internet of Things (IoT) is about to bring an enormous revolution in the way we communicate with “things”. All this will happen with the large amounts of data that will be produced by many smart devices and that will change the way Big Data is handled. By 2025, the annual report impact of IoT projects in cities is estimated to reach \$1.7 T. IoT is changing

the way cities manage services, systems and infrastructure from power and energy to lighting, smart buildings and water systems. As the IoT expands and businesses with IoT grow, they were confronted with many more challenges to solve.

Big Data and IoT are hot terms and it is difficult to speak about one without the other in the information technology arenas. Yet in reality, although they have a close connection, they are two distinct technology trends. Here we categorize how bigdata and IoT are different.

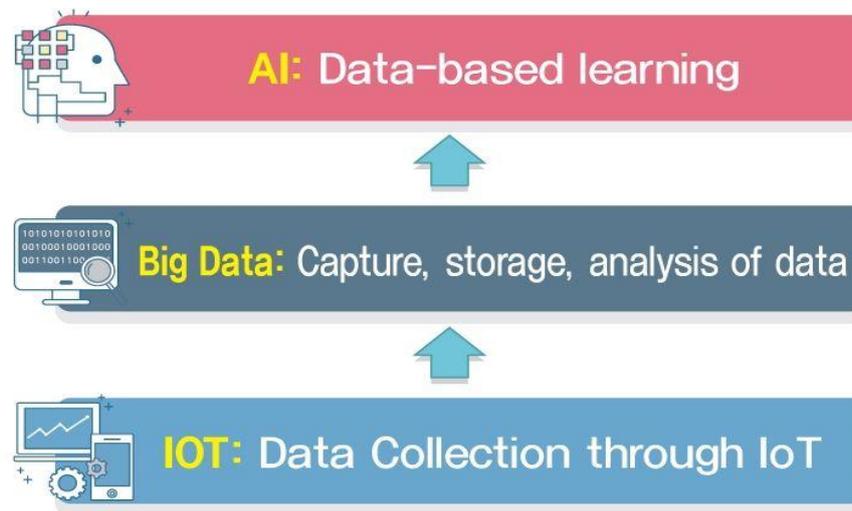


Fig. 1 The relationship between IoT + Big Data + AI

Big Data

Big Data, as its name implies, large amount of data are depicted. But, this isn't everything. Besides, quantity, IBM data scientists have also recognized Big Data, to demonstrate variety, velocity and veracity.

Big Data comes from a wide range of sources, including social media, transactions, enterprise content, sensors and mobile devices, among many others. Velocity refers to the speed at which Big Data is collected.

Every 60 seconds, 74 hours of footage uploaded in Youtube, 217000 Instagram posts and 206 million emails are sent. In contexts of veracity, the data collected should be of good quality and constantly updated in real time. Big data analysis can provide the businesses and individuals who use it equal weight. Big Data analytics to become \$16 bn industry by 2025.

Artificial Intelligence

Artificial intelligence technologies (AI) are commonly used for controlling, predicting, suggesting, detecting and statistical applications in computer applications. They are being implemented in a range of technologies, including driverless vehicles, robot-controlled confinement, financial forecasting and safety compliance systems, and are increasingly being implemented in cloud/ fog/ edge computation, highly sensitive analytics, robotics, Internet of Things, mobile computing, smart cities, smart buildings, smart health care etc.

Despite this spectacular growth the quality assurance of AI application implementation systems remains far from adequate and the requirement for demonstrable assurance in all AI applications is in increasing. The software testing has proven its economic efficiency to ensure the reliability of many complex software systems as a fundamental, efficient and well known method of quality assertion.

Artificial Intelligence (AI) algorithms are improve the ability to provide value for each sector for bid data analysis and IoT platforms. In this research we are considers three major IoT data types:

- (1) Raw (untouched and unstructured) Data,
- (2) Meta (data), and
- (3) Transformed (valued data).

In order to identify, categorize, and make decisions, artificial Intelligence (AI) will support the processing of each data type.

AI pays dividend for companies

- The artificial intelligence market was estimated to grow to 21.5 billion USD in 2018 and is expected to grow to 190.6 billion USD by 2025.
- The leading AI market share businesses include Google, Microsoft, Intel, Facebook, Nvidia, IBM, Samsung and Amazon web-services.
- The main factors on the AI market are increasing Big Data, increasing the use of cloud based applications and services and the increased demand for intelligent virtual assistants.
- The major restraint for the market is the limited number of AI technology experts.
- Critical challenges facing the AI market include concerns regarding data privacy and the unreliability (and bias) of AI algorithms.

2. ROLE OF BIG DATA IN IOT

When organizations collect the data for evaluation, IoT plays as a significant role of this data and the role of Big Data in IoT is manifested in the picture. Big Data analysis has emerged as abasis for evaluating IoT data obtained from “connected devices” to take initiative to improve decision-making. Big Data in IoT is responsible for the storage and processing of a large amount of data in real time using innumerable 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 Hadoop Map Reduce or Spark.
4. Generating the reports of analyzed data.

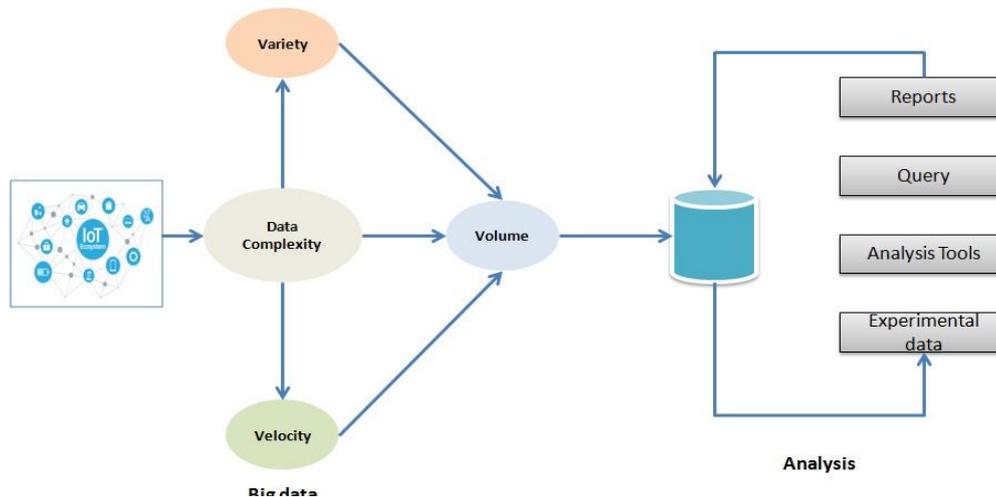


Fig. 2 Role of Big Data In IoT

3. BENEFITS OF USING IOT AND AI TOGETHER

IoT applications realize their maximum potential through internet of intelligent things. Artificial Intelligence and machine learning bring more detailed data insights to the table at a faster pace. Enterprises expect use IoIT to benefit from the following:

3.1. IMPROVING ACCURACY RATE

If you have ever tried to analyze data from multiple sheets on your computer, you must have realized that it is a tedious job. Human brains are limited to perform certain tasks at a certain rate, and when the minds are exhausted, we are even more prone to making errors.

The Internet of Intelligent Things has the ability to break down large quantities of data coming and going through devices. The best part about this is that since the whole process is machine and software-driven, it can be performed without any human intervention, which makes it error-free and improves accuracy rates.

For example, ATM withdrawals, online payments, and e-commerce transactions are prone to high risks of fraudulent activities. With the combined power of human understanding and IoT machine learning and RPA techniques of artificial intelligence, potential frauds can be taken into account in advance, thus preventing any loss of money.

3.2. PREDICTIVE ANALYSIS AND MAINTENANCE

Predictive analytics refers to a branch of analysis that looks at existing data, and based on the outcomes, it predicts possible future events. It would not be an exaggeration to say that IoT and AI are the foundation of predictive maintenance. Currently, IoT devices are being used by enterprises to report any mishaps or concerns, like equipment failure, etc., in an automated manner without human intervention.

However, this method allows machines to perform predictive analysis by adding artificial intelligence. Meaning that enterprises will be able to detect possible mishaps and failures in advance and work on their maintenance. Due to this, the chances of losses are decreased highly as conditions are being detected even before failure. This will add up huge benefits in saving costs of big corporations and helping them to avoid setbacks in their business.

For example, shipping companies can use predictive analysis to check and analyze their data timely to avoid any sudden downtime of a ship and keep maintaining their ships through regular servicing from time to time.

3.3. IMPROVED CUSTOMER SATISFACTION

The core of every business is customer satisfaction. Currently, companies like Amazon have earned the badge of being the most customer centric company by keeping the priorities of their customers before everything else. However, certain times human customer experience is failing on account of many factors like language barriers, time constraints, etc.

Companies are recognizing the power of AI by enabling chat bots for interacting with customers. Huge amounts of customer data can be used to provide them with a more personalized experience as per their choices and solving their queries accordingly.

3.4. INCREASED OPERATIONAL EFFICIENCY

Predictions made with artificial intelligence are highly useful to increase business efficiency. Combined in-depth insights obtained through artificial intelligence can be used to improve the overall business processes from the scratch, which can result in increased operational efficiency and decreased costs.

You can get insights into time consuming and costly to maintain business tasks and automate such tasks to increase effectiveness with accurate predictions. Moreover, for companies working on a big scale with airplanes and ships, the insights obtained through artificial intelligence can help them to modify their processes, and it can improve equipment settings and update inventory controls on time to save on unnecessary expenses.

4. HOW IOT, BIG DATA AND AI WORK IN HARMONY

Not only is IoT assisting in new developments in technology, with the help of AI and Big Data it is also enabling us to access data in real time. This real-time data has helped to improve key process within business, moving towards a 'smart' and more efficient society.

In fact, the latest marketing report from Frost & Sullivan 'Technology Advancements Shaping Big Data Progress' suggests that a combination of IoT, Big Data and AI could help futuristic developments and applications to reach new heights.

The report explains the areas in which a convergence of these technologies will greatly benefit, helping to advance ideas and concepts, such as the self-driving car, further than previously thought.

For example, IoT is already one of the key sources for real-time data for AI applications, and enables the decision of AI to be carried out. AI technology is also at the core of predictive analytics and maintenance for IoT. By combining these technologies together costs are reduced and the adoption of new technologies, using the self-driving car as an example, will be done at a much quicker rate.

5. IOT, BIG DATA AND AI ARE INSEPARABLE

Essentially, IoT includes sensors which are integrated into all types of systems and deliver dissemination of information to one or more central (cloud) locations via internet connections. This information may be analyzed. These results are used to improve the life of the user. All IoT devices follow these five basic steps: measuring, sending, storing, analyzing, acting. What makes an IoT application worth buying (or making) is value in the last step of

that chain, acting. Acting can mean an infinite number of things, ranging from a physical action to providing information. Regardless of how acting looks, its value depends entirely on the analysis. And AI (or rather machine learning) plays a crucial role in this analysis. With machine learning, patterns can be detected in the data. When machine learning is applied to the “analyze” step, this can dramatically change what is (or is not) done in the subsequent “acting” step.

In order to make IoT meet its promise, we need to improve the speed and accuracy of Big Data analysis. If we cannot use it, all data in the world is completely useless. Machine learning is the only way of analyzing the data generated by IoT. Machine learning can identify patterns, correlations and anomalies, from which lessons can be learned in advance for example, eventually make better decisions. The potential of Big Data can only be realized when it is combined with AI.

6. THE CONVERGENCE OF IOT, BIG DATA AND AI FOR BUSINESSES

There has been a vast amount of news about these three buzzwords which shouldn't be ignored, as the combination of IoT, Big Data and AI could mean great things for businesses in the future.

These three processes provide business owners/managers with the data that they need to make key decisions, working towards increasing the efficiency of business processes. Increasing the efficiency of a business will decrease costs, saving businesses considerable amounts of money that can be utilised for other activities.

A good example of IoT, Big Data and AI working together is in the machinery/manufacturing industry. The Big Data collected from IoT sensors enables AI to make decisions based on potential issues or maintenance work that needs to be fixed on machinery and as a result the business owner is aware well in advance of any technical issues that may need to be addressed. Therefore, the relevant staff member can schedule in maintenance without affecting the efficiency of work flow, downtime is reduced and the business doesn't lose out on vital production time.

CONCLUSION

As indicated by the journal articles and the conference papers we have reviewed in this article, the complexity of Big Data is an urgent topic and the awareness of this is growing. Consequently, there is a lot of research carried out on this, and we will in all likelihood find more and more progress in this field during the next few years.

The use of data generated from the IoT and the analytical tools creates many opportunities for organizations. These tools use predictive modeling technologies, clustering, and classification to provide data mining solutions. IoT improves the decision-making habits of decision-makers. The emergence of IoT and related technologies, such as cloud computing, provides the ability to remove data sources in different domains.

This paper is a review about the IoT, Big Data and AI, the impacts of IoT on Big Data, and benefits of AI using IoT, the Big Data technologies and the challenges. The era of the IoT and AI will bring a change to existing processes for good. As automation and in-depth analysis work hand in hand, industries and businesses will reap the benefits of growth, while making huge profits. The need of the hour is to create better methods for utilizing IoT and artificial intelligence for a better future.

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