Solving Security Challenge in IoT with AI

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Abstract: Objects or physical things in the world are getting interconnected to share information through the technology called Internet of things (IoT). As the number of interconnected devices are growing, the volume of data transfer is growing exponentially. This has posed various challenges in the technology. Among the greatest challenges of IoT are Security and Data analytics.

Artificial intelligence has been doing great in solving problems in various sectors across all industries. Meanwhile, this article will focus on utilizing the power of AI to solve the Security and Data analytics challenges of the IoT.

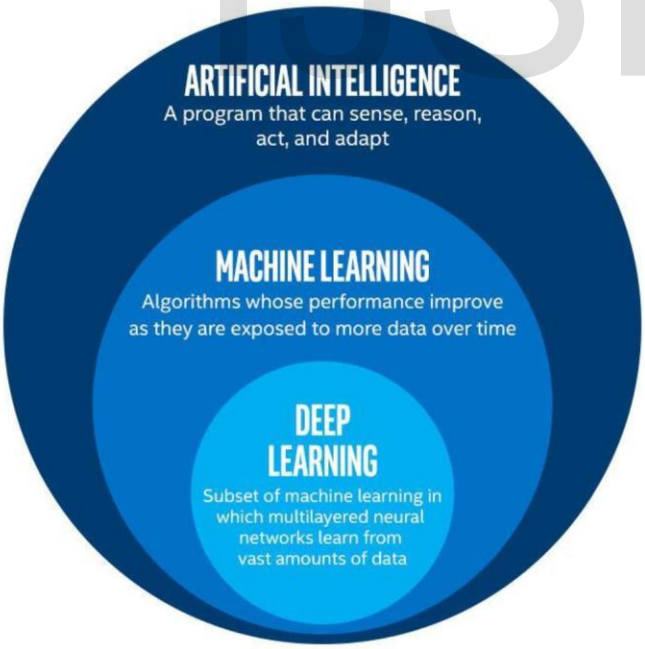
Introduction

Internet of Things (IoT) can be described as the use of connected devices to collate data from embedded sensors and actuators that are present in a system or physical objects. The embedded sensors are connected to the internet wirelessly or through the wired connection. For local or intra-connectivity among the sensors in a system or systems that are located within the same area, internet connection may not be required as data is being shared locally among the devices responsible for the data collection and the sensors generating the data. According to *Ndubuaku and Okerafor(2015),* IoT is referring to objects or systems that can be read, recognized, located, addressed and controlled via the internet regardless of the path through which it gets connected to the internet.

The path or connectivity among IoT devices can any or multiple of these technologies; RFID, WiFi, Bluetooth, GSM, GPRS, 3G, LTE, etc.

Artificial Intelligence (AI) can be described as the ability of a program to sense, reason, act and adapt (*Intel, 2018*). AI is a system that has the capability to mimic human behaviour without human interaction. In order to achieve human-like character in an AI, things are needed and these are Machine Learning and Data Analysis modules.

Machine learning (and its subsidiary Deep Learning) brings about the adaptable learning process in the machine while the Data analysis module is responsible for evaluating the data gathered overtime in order to create room for improvement in the system.



Source: Artificial Intelligence 50, Intel AI Academy

According to Gosh et al. (2018), embedded systems and sensors that are responsible for Internet of Things are now being upgraded to allow the incorporation of Machine Learning and the data analysis module. This would produce smart objects that are interconnected over the internet.

Literature Review

Majority of the Artificial Intelligence systems available in the industry today are capable of doing only one specific task or aspect of the activity of human life. For example, considering Artificial Intelligence as a lawyer, there is a high probability that AI will outperform human lawyers in this field (*HBS, 2018)*. The same Artificial Intelligence system may not be able to identify the gender, age or body languages of its opponent lawyer when encountering a human opponent.

Gosh et al (2018) proposed that combination of Artificial Intelligence and Internet of Things will bring about a smart or autonomous world where the smart objects (i.e. Artificial Intelligence plus the Embedded device or sensors) are interconnected to perform multiple tasks.

The combination of Artificial Intelligence with the Internet of Things is proposed to bring solutions to some of the challenges that are identified to be critical to the sustainable development of the Internet of Things. According to *Dupont et al (2018)*, for the development of Internet of Things to be sustainable in Africa continent, it must be economically viable, environmentally friendly

and socially integrated. Also, *Onyalo, Kandie & Njuki (2015)* identified that wide adoption of Internet of Things would bring opportunities like poverty alleviation, improvement in the quality of life and preserving the environment. All these opportunities are possible and realistic but they are also accompanied with challenges and one of the main challenges is the infrastructure.

As proposed by *Gosh et al (2018)*, if the embedded devices and the IoT sensors are improved to be capable of running Machine Learning (and Deep Learning), the number of physical devices to solve multiple tasks would be reduced. This contributes greatly to the solution for the challenges of infrastructure in the development of the Internet of Things.

Problem Statement

How can Artificial Intelligence solve the problems of Security and large data processing in the Internet of Things?

Internet Society (2015) noted that challenges of Internet of Things include Security, privacy considerations, interoperability / standardization issues, legal issues and the global adoption.

The aim of this paper is to analyse the functionality of Artificial Intelligence in bringing solutions to the security challenges and data privacy issues in the deployment of Internet of Things.

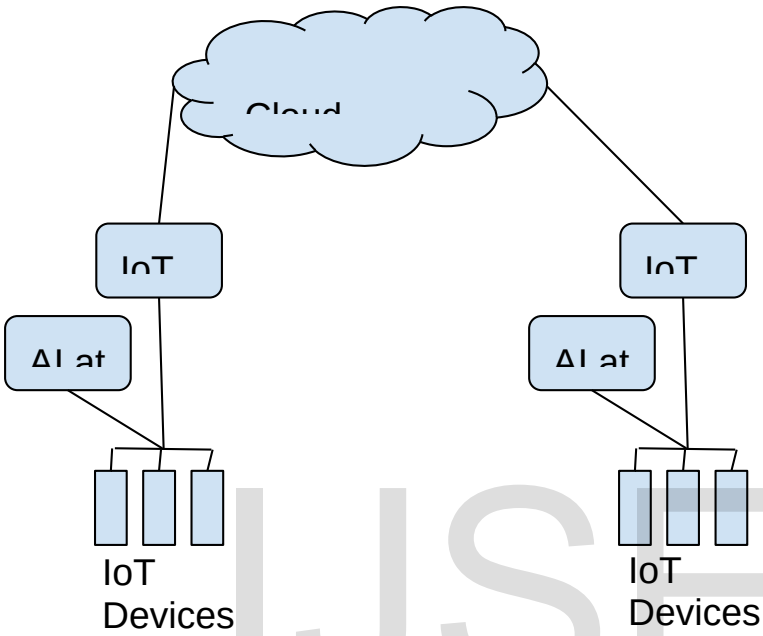
Methodology

Gosh at el (2015) proposed that smart objects would have the capability of implementing Machine Learning algorithms as this would make such devices to have the ability to reason based on the immediate occurrence and take decisive action. Possibly, such a solution would address the security issue in the deployment of Internet of Things as the smart objects would have been equipped with the capability to treat security issues like filtering the sources of the input signal (or data), dropping of suspicious data, pause on strange incidents etc.

In reality, the ability of a smart object to implement a Machine Learning algorithm would psoe another challenge in the IoT system. The new challenge of the smart object is the possibility of increased latency or delay in the response of the device as the same device is responsible for the data processing of machine learning input and its resulting output.

In order to avoid the new challenge of changing the existing embedded devices and sensors used in the deployment of the existing Internet of Things, the method adopted in this paper is to utilize the concept of edge computing to implement the Artificial Intelligence functionalities in the deployment of Internet of Things.

Chen & Ran (2019) identified edge computing as a solution to the problem of latency and data privacy in the implementation of Artificial intelligence.



From the diagram above, the concept of this proposed solution is to introduce a server running the Machine Learning algorithm at the closest data center (edge) to the cluster of IoT devices. The existing IoT devices or sensors will interface with the edge AI server for the intelligent learning, decision taking and adaptation based on the data received. This setup will have an effect on the existing flow of IoT data (i.e. from sensors to IoT gateway and to the cloud) since the edge AI server is introduced to work in parallel with the existing flow of data.

Conclusion

In solving a challenge in an existing system, care must be taken to avoid introducing a new bottleneck through the new sub-system being introduced. Artificial intelligence is a system with capabilities for processing large amounts of data for accurate decision making and action taking while the Internet of Things on the other hand generates high volumes of data at a very minimal latency or delay.

Latency is a critical factor in the deployment of Internet of Things but in Artificial intelligence, accuracy is the main concern. Hence, in order to merge the two systems to work together, the Artificial Intelligence system must be strategically introduced to the existing IoT system through edge computing.

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