GFJMR
January-June 2018
Vol. 16, Issue-1 (pp. 40-44)

IoT and AI: Future Opportunity Prediction Paradigm

Vanzara Rakesh
Ganpat University, Mehsana
rakesh.vanzara@ganpatuniversity.ac.in

Mankodia Anand
Ganpat University, Mehsana
anand.mankodia@ganpatuniversity.ac.in

Patel Amrut
Ganpat University, Mehsana
amrut.patel@ganpatuniversity.ac.in

Abstract

Internet of Things (IoT) is a paradigm to connect everything to Internet. It has been predicted that every entities in the houses, hospitals, industries, transport systems, and in general at every place get connected in a cluster through IoT paradigm. Although, IoT facilitates intelligent communication with "every connected things" via smart devices, still, self-learning, diagnosis from the collected data, and decision-making are key challenges. It is utmost important to take the decision based on the data collected through IoT paradigm. Artificial Intelligence (AI) is a key component to effectively utilize the IoT beyond the imagination and for the betterment of the every living elements' life on the earth. AI along with IoT results in the cases where we can predict the futuristic opportunities, threat and action required to keep the all working systems in stabilized state. In this paper, we present the detailed analysis to highlight the need of strong binding between machine learning, and IoT. Further, we also analyze the industrial and health care domain future with the strong integration of IoT and AI.

Key words:

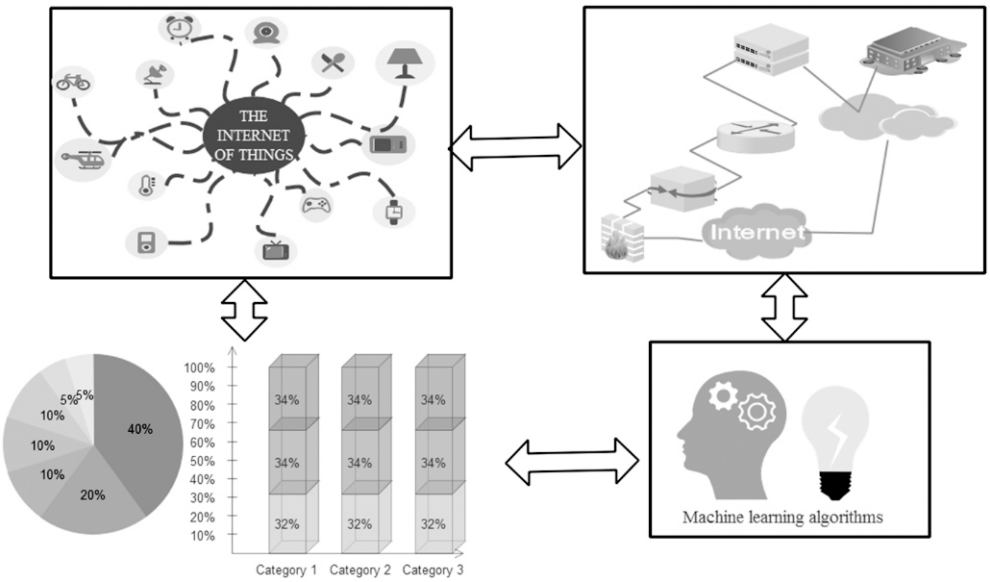
IoT, Machine Learning, Artificial Intelligence, self-learning

Introduction:

The development of Internet of Things is swiftly affecting most of the domains of businesses and the living standard of an individual. Internet of Things (IoT) is a paradigm in which sensors are embedded into all types of devices which provides continuous stream of data to a central location or cloud storage. Thus, in any domain with IoT based applications or services, it is assumed to have following 5 steps: i) Sense the environment or data, ii) Transmit the data, iii) Store it, iv) Analyze it, v) Act upon the analyzed data. Figure 1 shows the five step approach which can be applicable to any domain and applications. The growth of IoT

resulted in generation of big data and challenges to analyze the same. Numerous opportunities are presented by IoT applications like smart cities, smart transport system, energy meters, and health care monitoring systems. The biggest challenge is to analyze the big data generated by heterogeneous sensors through different applications and scenarios.

Figure 1: IoT and AI: Five step approach



Big data generated through different IoT applications are analyzed to reveal important information, unseen correlations, and hidden patterns. Such an analyzed data will help all stakeholders to take the most appropriate decisions in the benefits of an organization or an individual. The rest of the paper is structured as follows. Section II presents the related work and highlights the challenges of each approach presented in literature. Usage of AI along with IoT and use cases are presented in Section III. Finally, paper is concluded with important future directions.

Related Work

IoT is the new paradigm which poses the many challenges in terms of volume of data generated, heterogeneity of the data collected through numerous devices, and processing of the collected data to activate the specific event and to get insight into the collected data. Bin at el. presented four approaches for analyzing the data collected through IoT applications (Bin andXiaoyi, 2010). These four approaches are summarized as follows:i) multi-layer model consists of data aggregation layer, data management layer, event processing model, and data mining service layer. ii) Distributed data mining model. iii) grid based data mining model for large scale and applications with requirements of high performance. iv) data mining model from multi technology integration perspective. Chen at el. presented systematic approach for reviewing data mining techniques for most common applications(Chen et al., 2015) and they reviewed functions like classifications, clustering, association analysis, time series analysis. It has been concluded that the data generated by the data mining applications like e-commerce, industry, and health care are similar to IoT data. They have also mapped most appropriate data mining functionalities to the specific

applications' data.

Tsai at el. presented a survey to address the challenges in analyzing the IoT data through selection of appropriate data mining techniques. They have presented the challenges in preparing the model for mining and selection of mining algorithms for IoT(Tsai at el., 2014). They have emphasized the usage of data characteristics to select the algorithm based on matching between data characteristics and algorithm's taxonomy.

An objective of IoT is to develop a smarter environment,by saving time, energy, and money. Throughthis paradigm, the expenses in industries can be reduced. IoT is a set of connected devices that can transfer dataamong one another in order to optimize their performance; these actions occurautomatically and without human awareness or input. IoT includes four maincomponents: 1) sensors, 2)processing networks, 3) analyzing data, and 4) monitoringthe system. The most recent advances made in IoT began when lowcost sensors became more available, weband mobile technology developed, and communicationprotocols changed (Qin at el., 2016). So communicationprotocols are constituents the technology that should be enhanced (Ma at el., 2015). In IoT, communication protocols can be divided into three major components:

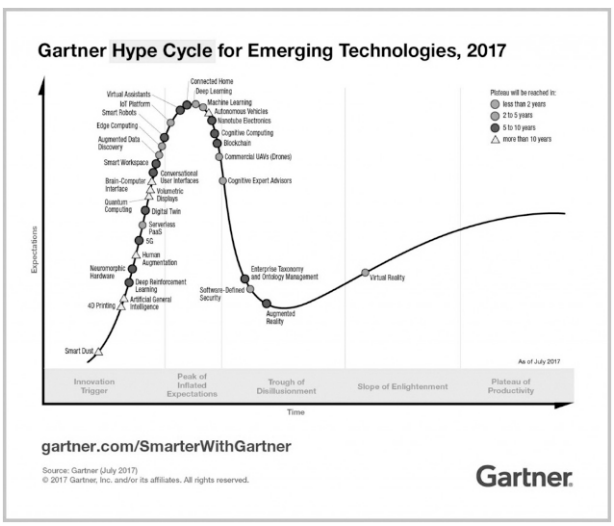
(1) Device to Device (D2D): It enables communicationbetween nearby mobile phones.

(2) Device to Server (D2S): in this type of communication devices, all the data is sent to the servers, which can be close or far from the devices. This typeof communication mostly is applied in cloud processing.

(3) Server to Server (S2S): in this type of communication, servers transmit data between each other.

It is a challenging task to prepare and process the data for communication mechanisms as discussed above. To respond to this challenge, different kinds of data processing, such asanalytics at the edge, stream analysis, and IoT analysis at the database, must beapplied. The decision to apply any one of the mentioned processes depends onthe particular application and its needs. Fog and cloud processing are two analytical methods adopted in processing and preparing data before transferringto the other things. The whole task of IoT is summarized as follows: sensors and IoT devices collect the information from the environment. Next,knowledge should be extracted from the raw data. Then, the data will be readyfor transfer to other objects, devices, or servers through the Internet.

Figure 2: Hype cycle for emerging technologies (Gartner, 2017)



Machine Learning and IoT are very popular expressions at the present time, and very close to the pinnacle of the hype cycle which is shown in Figure 2(Gartner, 2017).

Machine Learning and IoT Applications

Industrial Applications

Predictive paradigmis a great help in ain all types of industrial applications and in particular, mechanical settings. Information gathered from different sensors of machines, and machine learning calculations can understand what is commonplace for the machine and afterward identify when something unusual happens.Foreseeing when a machine needs service or replacement is unimaginably important, results into great savings.Most of the organizations are using machine learning to predict with over 85% accuracy when machines will need service, replacement which result in huge savings on cost.

Individual's Need

We are living with machine learning applications in our regular day to day existences. Companies like Google and Amazon utilize machine figuring out how to take in our inclinations and give a superior ordeal to the client. That could mean proposing items that you may like or giving pertinent proposals to films, and entertaining events.So also, in IoT machine learning can be to a great degree significant in forming our condition to our own inclinations.

Health Care Industries

It is predicted that by 2022, all health care industries and supportive systems are going to utilize IoT and machine learning to benefit all the stakeholders at very large scale. In this scenario, it is really nice to have the future patient in hospital before they really get the critical conditions. Thus, mortality can be reduced significantly and living standard of all the living entities on the planet can be enhanced significantly.

Conclusion

It has been elaborated in the paper that the IoT and AI is five steps approach and most critical part is taking the decision and future prediction without knowing the history of any events. It is utmost important to take the decision based on the data collected through IoT paradigm. Machine learning is a key component to effectively utilize the IoT beyond the imagination and for the betterment of every living elements' life on the earth. AI along with IoT results in the cases where we can predict the futuristic opportunities, threat and action required to keep the all working systems in stabilized state. In this paper we have focused on the usage of IoT and AI without deep dive into the algorithms and scenarios.

References

Bin, S., Yuan, L., &Xiaoyi, W. (2010, April). Research on data mining models for the internet of things. In *Image Analysis and Signal Processing (IASP), 2010 International Conference on IEEE.*,127-132.

Chen, F., Deng, P., Wan, J., Zhang, D., Vasilakos, A. V., &Rong, X. (2015). Data mining for the internet of things: literature review and challenges. *International Journal of Distributed Sensor Networks*, *11*(8), 431047.

Ma, M., Wang, P., & Chu, C. H. (2015, December). LTCEP: Efficient Long-Term Event Processing for Internet of Things Data Streams. In *Data Science and Data Intensive Systems (DSDIS), 2015 IEEE International Conference on* IEEE.,548-555.

Qin, Y., Sheng, Q. Z., Falkner, N. J., Dustdar, S., Wang, H., &Vasilakos, A. V. (2016). When things matter: A survey on data-centric internet of things. *Journal of Network and Computer Applications*, *64*, 137-153.

Sheng, Z., Yang, S., Yu, Y., Vasilakos, A., Mccann, J., & Leung, K. (2013). A survey on the ietf protocol suite for the internet of things: Standards, challenges, and opportunities. *IEEE Wireless Communications*, *20*(6), 91-98.

Tsai, C. W., Lai, C. F., Chiang, M. C., & Yang, L. T. (2014). Data mining for Internet of Things: A survey. *IEEE Communications Surveys and Tutorials*, *16*(1), 77-97.