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Cutting Edge Tools: Comparative Study of Artificial Intelligence, Internet of Things and Machine Learning

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Abstract

The internet plays an important role in the fields of think, work, shop and the way we solve the problems across the world. Artificial Intelligence (AI) is the play of human knowledge forms by machines, particularly information systems and some technical devices. The scientific study of algorithms and statistical models is called machine learning (ML). An Internet of Things IoT or smart home is a variety of tools that support common ecosystems, more synonymous with concept products and different appliances. AI and ML represent the artificial world, whereas the IoT represents the senses and actors for better output. This article argues that the near future of fluent work will be enormously impacted and perhaps forever changed as a result of Artificial Intelligence (AI), Machine Learning (ML) and Internet of Things (IoT) becoming common place. This article is also highlights the importance, use, features and functions of three popular cutting edge tools like AI, ML and IoT.

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Artificial Intelligence, Internet of Things, Machine Learning, Cutting Edge Technologies

Introduction

Due to the achievement of the cutting edge technologies, over the last few years, the programmatic syntax has become more accessible and a lot easier and world wide access. Who really care for the internet, different apps and IoT, they can get more result to achieve in their respective goals in future. The IoT is the ability to provide interconnected computing devices, mechanical and digital machines, and unique identifiers of objects, animals or people and transmit data over the network without the need for human-to-human or human-to-computer interaction. Artificial Intelligence is ability of the machine to process thinking like human, it is

intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans. Machine Learning on the other hand is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. On both AI and ML are the two faces of the same coin and it's these revolutionary ideas that have given birth to the digital age. It is forever changing the library, knowledge and information society around the world.

According to Wikipedia (2019) "Artificial Intelligence (AI), sometimes called Machine Intelligence, is

intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans.” These procedures incorporate learning, thinking and self-correction. These are computer systems used to perform a specific task without using explicit instructions, instead relying on models and doubts.

Artificial Intelligence

AI or machine intelligence is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans. An AI can be classified into three different types of systems like a) Analytical, b) Human-inspired and c) Humanized artificial intelligence. The goal of AI is to create technology that allows computers and machines to function in an intelligent manner. Knowledge representation and knowledge engineering are central to classical AI. AI is heavily used in dynamic robotics. Classifiers and Controllers are the two types of AI applications. AI, works like electricity or the steam engine and it's a general-purpose technology and relevant to any intellectual task. Modern artificial intelligence techniques are pervasive and are too numerous to list here. AI paired with facial recognition systems used for mass surveillance (Wikipedia, 2019).

There are three philosophical questions posed related to AI are:

- Artificial general intelligence possible,
- Intelligent Machine solve and
- Intelligent machines dangerous.

Some of the activities of computers with artificial intelligence are speech recognition, learning, planning and problem solving. Techopedia (2019) identify the core problems of artificial intelligence include programming computers for certain traits such as:

- Knowledge
- Reasoning
- Problem solving
- Perception
- Learning
- Planning
- Ability to manipulate and move objects

The major components or frameworks that contribute towards the implementation of various intelligent systems, the main components of AI are;

Feature Engineering,

Artificial Neural Networks,
Deep Learning.

According to Schouw (2016). “The next generation IoT platforms will probably be called Artificial Intelligence of Things (AIOT), it's the IoT but enhanced by AI.”

Most frequently used applications of AI are ethical gene editing, intelligent disaster response system and the recommendation systems. With minimal human intervention and faster and accurate are the main advantages of AI. In the same way the challenges, need for massive data corpus, multimodal interactions and beyond human control are the disadvantages of AI (Educba, 2019).

Internet of Things

In recent years the major significant trend of IoT is the explosive growth of devices connected and controlled by the Internet. The three levels of IoT intelligence are i) IoT devices, ii) Edge/Fog nodes, and iii) Cloud computing. The three tiers architecture systems of IoT are; i) Tier 1: Devices, ii) Tier 2: The Edge Gateway, and iii) Tier 3: The Cloud

Enabling technologies for IoT

Based on RFID-tags and distinct identification through the Electronic Product Code (also called as Machine ID) the addressability is possible.

Bluetooth mesh networking; Light-Fidelity (Li-Fi); Near Field Communication (NFC); Radio Frequency Identification (RFID); Wi-Fi – technology for LAN; ZigBee – PAN; and Z-Wave are the Short-range wireless tools support for IoT

LTE-Advanced – High speed communication specification for mobile networks of Medium-range wireless

Low Power wide Area Networking (LPWAN) and VSAT are the Long-range wireless tools, and

Ethernet – General purpose networking standard using twisted pair and fibre optic links in conjunction with hubs or switches and Power-line communication (PLC) are the wired connections of IoT

Features of IoT

IoT comes with the combination of computation hardware, software and algorithms that makes it smart.

(Chandrashekhar, 2016) Some of the general and key characteristics of IoT are i. Intelligence, ii. Connectivity, iii. Dynamic Nature, iv. Enormous scale, v. Sensing, vi. Heterogeneity, vii. Security.

IoT is a global infrastructure for information, that enabling advanced services by interconnecting physical and virtual things based on existing and evolving information and communication technologies (Chandrashekhar, 2016). The IoT has five phases of lifecycle are; a) Create phase, b) Communicate, c) Aggregate, d) Analyse, and e) Act

Machine Learning

ML is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. Machine learning and statistics are closely related fields in terms of methods.

In the age of AI, principles are more relevant than ever. As machine learning proliferates, what steps can take to ensure that the values of librarianship are incorporated into AI. The access, information literacy, personal privacy, intellectual freedom, work and play should be directed not at maintaining traditional librarianship. The past research has focused on:

1. A Survey of Machine and Deep Learning Methods for Internet of Things (IoT) Security (Al-Garadi, Mohamed, Al-Ali, & Guizani, 2018)
2. How to Differentiate Between IOT, AI and ML? (CIS, 2017).
3. Difference between Machine learning and Artificial Intelligence (GeeksforGeeks, 2019).
4. A Comparative Roundup: Artificial Intelligence vs. Machine Learning vs. Deep Learning (Ghosh, 2016).
5. Artificial Intelligence (AI) for Development Series: Report on AI and IoT in Security Aspects (ITU, 2018).
6. Comparative study of Machine learning and Artificial Intelligence (Jaiswal, Shriwas, Bhargava, & Yadav, 2019)
7. FEATURE Libraries in the Age of Artificial Intelligence (Johnson, 2019).
8. A Survey on Various Techniques in Internet of Things (IoT) Implementation: A Comparative Study (Khoda, 2017).
9. A Comparative Study of KNN and SVM Algorithms in IoT (Kumar, Dsouza, & Praveen, 2017).
10. Deep Learning for IoT Big Data and Streaming Analytics: A Survey (Mohammadi, 2018).

11. Comparative Study of Web 1.0, Web 2.0 and Web 3.0 (Naik, & Shivalingaiah, 2008).
12. Machine Learning Approach for Agricultural IoT (Ponraj, & Vigneswaran, 2019).
13. A Novel IOT Based Solution for Agriculture Field Monitoring and Crop Prediction Using Machine Learning (Prasanna, & Rani, 2019).
14. A Survey of Machine Learning Methods for IoT and their Future Applications (Rana, Salau, Gupta, & Arora, 2018).
15. Beginners Guide to Machine Learning, Artificial Intelligence, Internet of Things (IoT), NLP, Deep Learning, Big Data Analytics and Blockchain (Ray, 2017).
16. IoT and AI: Introduction to the Internet of Intelligent Things (IoIT) (Shrivastava, 2019).
17. The Role of Artificial Intelligence (AI), Machine Learning (ML), and Internet of Things (IoT) in Digital Transformation in 2019 (Singh, 2019).
18. Artificial Intelligence (AI) (Techopedia. 2019).
19. The next generation Internet of Things – Hyper connectivity and Embedded Intelligence at the Edge (Vermesan, Guillemin, Valino, & Aagaard, 2017).
20. Machine Learning (Wikipedia, 2018).
21. Artificial Intelligence (Wikipedia, 2019).

The objectives of the study are to highlights the importance and features of three important cutting-edge tools are;

- To find out the importance of the three tools like AI, ML and IoT
- To identify their scope, importance, functions and features etc.
- To know the availability and use of these tools in the present era.
- To suggest and recommend application and other prerequisites for use of these tools in the changing technology era.

Materials and Methods

The investigator selected only the three powerful cutting-edge tools have been included in this study. The features, services and functions of these three tools detailed data, were retrieved from the internet. The methodology is to content analysis of the tools like *AI*, *ML*, and *IoT*.

Data Analysis and Findings

The new technologies like ML, AI, IoT, NLP, Deep Learning, Cloud, Big Data and Predictive analytics

are having a massive impact in India (Ray, 2017). The Figure 1 shows that these tools will provide

better work or services without much more effort from human being.

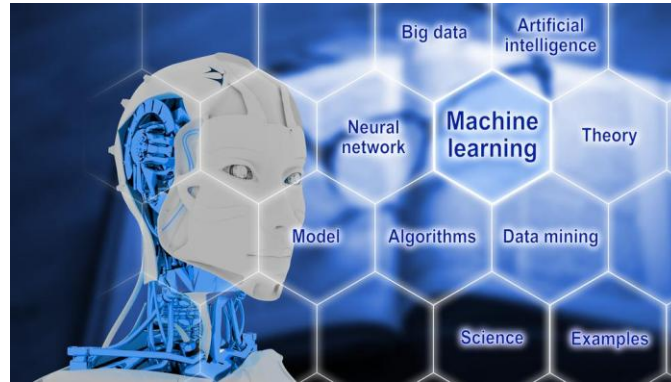


Figure-1 Cutting edge tools

Table.1 Comparative feature, services and functions of AI, ML and IoT cutting edge tools

Sl. No.	Description	AI	ML	IoT
1	About	AI is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans.	ML is closely related to computational statistics, which focuses on making predictions using computers.	The IoT has evolved the convergence of real-time analytics, multiple technologies, commodity sensors, machine learning, and embedded systems over network
2	Scalability	Less Scalable	Right Framework and Language	Scalable being cloud based.
3	System	AI is all about system behaviour	Automatically learn and improve	IoT is inbuilt in a system.
4	Data	Needs lot of data, like patterns and understanding the behaviours.	ML have access to the users' information.	IoT is all about sensors.
5	Objects	AI does not specifically require objects; it is the system itself.	Object Detection and Object Localization	IoT is mostly concerned about the objects which are embedded with the technology that can capture sensory movements as well as other patterns.
6	Goals	To create expert systems and implement human intelligence in machines	To develop general purpose algorithms of practical value.	The main goal of IoT is to form an Ecosystem of connecting a Thing to Thing.
7	Online /Offline	AI is mostly related to online features and	Locally on device (offline) and In the cloud (online)	IoT is designed in a way, even to work without

Sl. No.	Description	AI	ML	IoT
		responses		Internet.
8	Behaviour	AI is all about instinctive reactions with respect to the input received.	Only one input, situation, and only one output, action	Triggered using the devices and are predefined using specific codes based on algorithms.
9	Cost	Price is mostly calculated based on each requirement.	Building digital products based on machine learning	Price is calculated based on the number of sensors and the vastness of the network
10	Cloud Computing	Highly Strong – As it facilitates the machine to think, enact and learn from the human instances created.	Cognitive computing; Personal assistance and chatbots; Increased demand for cloud; Business intelligence.	Both are complimentary in efficiency while Cloud gives a pathway to manage data.
11	Data Analysis	Yes	Yes	Yes
12	Stated Year	1956	1959	1999
13	Founder(s)	Allen Newell & others	Arthur Samuel	Kevin Ashton
14	Scalability	Powered scalability	Scalable algorithms	Techniques for scalability
15	Knowledge Intelligence	Acquisition of knowledge intelligence is defined as an ability to acquire and apply knowledge.	Acquisition of knowledge or skill	Acquisition of knowledge growth and development
16	Procuring through the data obtained.	AI is all about data, it learns and rectifies its performance from errors encountered and evolve in a genuine way. It supports decision making.	Machine learning makes it possible to discover patterns in supply chain data by relying on algorithms.	In IoT it is mostly captured moments from sensors that bring in data and are stored inside and whenever required the data is pulled in.
17	Areas that contribute	Artificial Intelligence is a combination of science and technology based on computer science, maths, Biology, Psychology	Machine Learning Algorithms, Computer Vision, Supervised Machine Learning, Unsupervised Machine Learning, Deep Learning, Neural Networks, Reinforcement Learning, Predictive Learning, Bayesian Network, Data Mining	Embedded Systems, Big Data, Security, Smart City, Service Oriented Architecture, Smart Energy.
18	Applications	Artificial Intelligence is used in various fields such as Gaming, Natural language processing, Expert systems, Vision systems, Speech recognition, Handwriting recognition, Intelligent Robots.	IoT application on all channels, Wearables, Smart City, Smart Grids, Industrial Internet, Connected Car, Connected Health (Digital Health/Telehealth /Telemedicine), Smart Retail, Smart Supply Chain, Smart Farming.	Dynamic Pricing, Email Spam and Malware Filtering, Fraud Detection, Google Translate, Online Customer Support, Online Fraud Detection, Online Video Streaming, Predictions while Commuting, Product Recommendations, Search Engine, Result Refining, Self Driving Cars, Social

Sl. No.	Description	AI	ML	IoT
				Media, Social Media Services, Traffic Alerts, Transportation and Commuting, Videos Surveillance, Virtual Personal Assistant.
19	Research areas	Expert systems; Neural networks; Natural language processing; Fuzzy logic; Robotics.	Machine Learning Algorithms; Computer Vision; Supervised Machine Learning; Unsupervised Machine Learning; Deep Learning; Neural Networks; Reinforcement Learning; Predictive Learning.	IoT Security; IoT Semantics; IoT Protocols; IoT Architecture; Communication in IoT; IoT Energy Management; IoT and Machine Learning; IoT Business Model.
20	Issues	Threat to Privacy; Threat to Human dignity; Threat to safety.	Focusing Too Much on Algorithms and Theories; Mastering ALL of ML; Using Changing or Premade Tools; Having Algorithms Become Obsolete as Soon as Data Grows; Getting Bad Predictions to Come Together With Biases; Making the Wrong Assumptions; Receiving Bad Recommendations; Having Bad Data Convert to Bad Results.	Security; Privacy; Internet Walls; Cloud attacks; Understanding IoT; Lack of Confidence.
21	Algorithm	AI is based on deep learning algorithms which are obtained from various sources to design the behaviour of the system.	Naïve Bayes Classifier Algorithm; K Means Clustering Algorithm; Support Vector Machine Algorithm; Apriori Algorithm; Linear Regression; Logistic Regression; Artificial Neural Networks; Random Forests; Decision Trees; Nearest Neighbours.	IoT is all about sensory data that is used to creating an algorithm to formulate the system behaviour.
22	Human Interventions	AI is all about human intrusion, it is either human-human or human-computer	Minimal human intervention	Transferring data without or with human intervention. It is nothing about human-to-human or computer interaction as it has UIDs
23	Features	Knowledge.	Perform data visualization	Connectivity
		Reasoning.	Automation at its best	Analyzing
		Problem solving.	Customer engagement like never before	Integrating
		Perception	Change the mortgage market	Artificial Intelligence Sensing
		Learning	Accurate data analysis	Active Engagement
		Planning	Business intelligence at its best	Endpoint Management
		Ability to manipulate and Move objects	Perform automated data visualization	

Table 1 reveals that the impertinent, features, functions, use and other issues related to the three cutting edge tools are enumerated comparatively. Scholars and experts they have given their feedback and ideas to use and improve the functions and facilities for their day to day life (Gang board, 2019).

In conclusion, the rapid growths of Internet of Things (IoT) are made tremendous changes in each field. AI radically changing the way we think about technology and it is limited to science fiction. AI leads to intelligence or wisdom and it will go for finding the optimal solution. ML leads to knowledge and it will go

for only solution for that whether it is optimal or not. AI is decision making but ML allows system to learn new things from data. Machine Learning refers to systems that can learn from experience. It works as a computer program that does smart work with a simple concept machine takes data and learn from data. The main aim of this article is to create awareness and better use of these types of cutting edge tools for their routine work in their respective subject area for get better and instant results.

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