Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 8, July 2021: 315-322

Artificial Intelligence: An Integrated Technology for Future Applications

Dr. Ashok Kumar K[#1], Mr. Vanga Karunakar Reddy[1], Dr. Sunil Babu Melingi[2]
[1]Assistant Professor, Matrusri Engineering College, Saidabad, Hyderabad, Telangana-59
2Professor, Department of Electronics and Computers Engineering, K. L. Deemed to be university Vaddeswaram, Guntur, Andra Pradesh
[#]kashok483@gmail.com

Abstract: An Artificial Intelligence (AI) one of the popular technologies at recent years because of demand for automated systems without human involvement. AI is as similar as computational intelligence of machine and applying different algorithms to machine act as human. This paper discussed AI based system from definition to applications. Initially, this paper presents basic elements of AI such as Internet of Technology (IoT) and its different forms and then given background work of AI. The different algorithms are discussed for AI such as Machine Learning (ML) and Deep Learning (DL) and presented differences between these algorithms. Finally, this paper provides AI challenges and opportunities at future.

Keywords: Artificial Intelligence (AI); Internet of Things (IoT); Machine Learning (ML); Deep Learning (DL); Deep Neural Networks (DNN)

1. INTRODUCTION

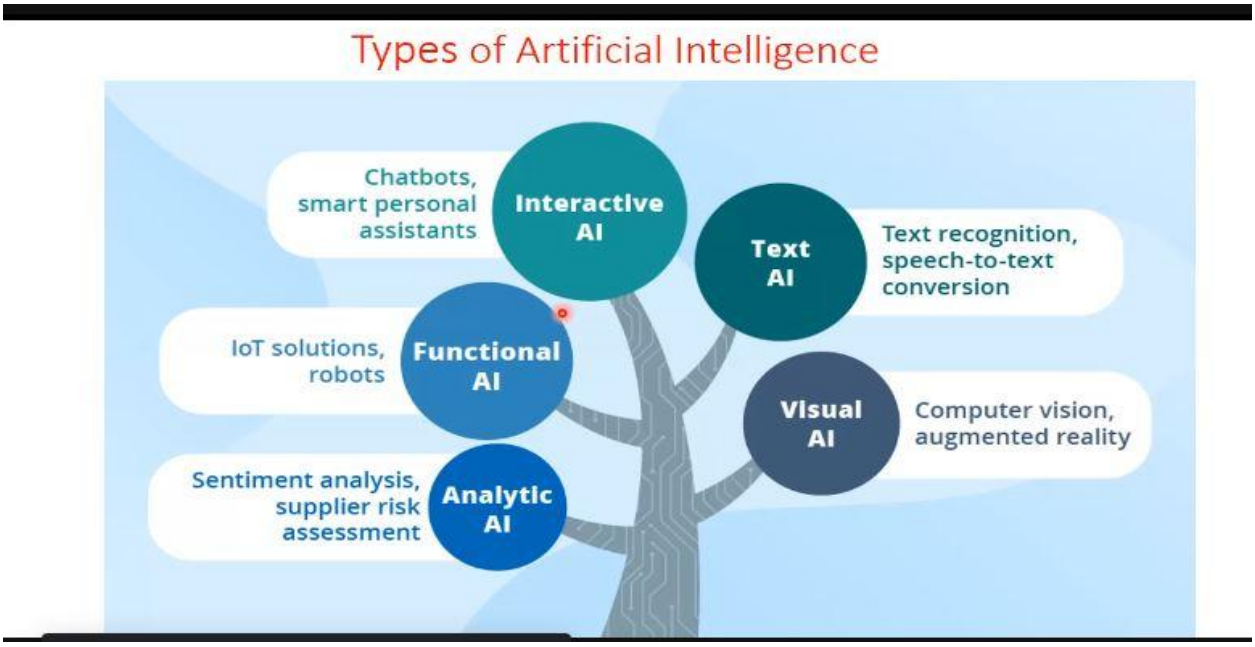
Internet of Things (IoT) is the leading technology at present days to transfer data through internet networks. IoT is composed huge number of sensors, microcontroller and communication devices to interconnect between source and destination. The sending and receiving of data relies on communications devices such as Bluetooth, mobile phone etc, and microcontroller monitors the devices to efficient communication. In IoT, sensors are plays a crucial role to covert information into suitable data format and sent to processor and server to further action. In particular situation, sensors are analogue in nature. To process data from analogue signals from sensors, analogue to digital converters are required thereby integrating both analogue to digital (A/D) and digital to analogue (D/A) converters with microcontrollers such as raspberry pi and arduino. The IoT system must be self adaptive and self optimizing hence it is compatible to process huge data automatically in terms of transmission and reception. The system must be composed with efficient router and router table to obtain high speed data transfer between source and destination nodes. IoT plays vital role into different domains such as medical, agriculture, military, industrial and metropolitan cities. The IoT turns IoV for smart vehicles, IIoT for industrial purpose and IoE for everything. IoT has huge number applications and Artificial Intelligence (AI) is one among them [1]. The research on IoT is applied towards AI in terms of transport and home appliances. Data mining is the technique majorly used in AI as data managed efficiently thereby reducing the required storage space. When the data is present more on network, it requires large time to extract data

from storage space. To reduce time for extract data, the data mining techniques are used. The major steps involved to dig out the wanted data such as Data integration, Data selection, Data cleaning, Data Transformation, and Data mining and Pattern evaluation. Data selection is a technique to identify wanted data from entire storage device. The selection of desired data may be small and big thereby performing data through system. Data cleaning is method used for data cleaning or deleting repeated data or junk data from storage device. Thereafter, data transformed into a package. The packed data checked for standard and sent over the network. AI is composed with number of principles and methods of IoT network. Fuzzy logic and neural network are major techniques used in AI to present the system more reliable.

The AI is utilized experienced and super systems based on supporting and training data in the avoiding of high intelligent employees. AI presents efficient Machine-Machine (M-M) communication through trained systems. AI technology make machines intelligent by trained data algorithms and software hence machine can take decisions itself.AI technology includes various algorithms such as natural processing language and reasoning concepts utilized to make system intelligent. AI is part of science which adopting technology by machines to present best solution for critical real-time problems as similar as human beings. The process of presented intelligence deals with characteristics of human such as thinking, intelligence and also applying intelligence them at particular situation to get intelligent machine. AI technology is linked not only different concepts of computer science but also psychology, philosophy, etc. Fig.1 depicts types of AI technology with different application. An interactive AI is used in majorly in websites of different domains, example Chatbots, smart personal assistants. The interactive AI technology assists the user when user raised request such as enquiry of data of company/organization.

The functional AI presents role majorly in IoT solutions and robots. The robots/IoT application provides best solution based on functional AI. Analytic AI technology uses methodologies of sentiment analysis, supplier risk assessment. The analytic AI provides emotions to machine such as different emotions for different situation. The text AI utilized text recognition and speech-to-text conversion techniques to present efficient AI [2]. The reliable text AI used particularly at converted speech-to-text such as voice recognized robot. Visual AI uses computer vision and augmented reality to present virtual reality/augmented reality. The visual AI technology is used particularly at applications based on visualizations. The AI shows impact on different domains and then presents reliable system without involvement of human beings.

Figure.1 Types of Artificial Intelligence



In this paper, AI is discussed with its background, challenges, methodology and how future depends on this technology. This paper briefly explains required algorithms to train and then make machine intelligent. In addition to this, the pros and cons of these algorithms are discussed in terms of accuracy, and performance. This paper also extends discussion on applications at different domains and how is an application turned into smart application.

2. BACKGROUND

AI is dominant research domain at present because plays vital role in different fields to make automated and smart. Most of the dominant AI machines are prepared and automated with managed learning. The preparation of learning needs highlighted information which filtered from raw data to learn machines thereby smart and intelligent machines. AI presents automated computer which adapted self management, self healing, self-diagnosis and self-configuration. If information security is major concern in future, AI provides promising solution with improving cyber security through measuring of different attacks. AI enables natural solution for the problems of different network attacks with development of effective measures. **Trifonov, R et al. [2008]** analyzed and proposed major approach based on AI for cyber attack. According to Intelligence and National Security Alliance (INSA), Cyber Attack is a threat through set of suspicious activity from networks, systems and information. Counteraction of Cyber Attack is mainly composed with two approaches that are using AI methods and adopting the philosophy of military intelligence thereby analysis of new challenges referred by the expert community. The results are obtained by adopting intelligent methods thereby increasing the security level of computer networks. The feasibility of AI methods are analyzed and therefore summarized that even Cyber intelligent methods are not able to resolve. Recurrent neural networks are serviced the requirements of operational cyber intelligence for handling tactical cyber threats while selection and experimentation of Multi-Agent system. Tactical cyber threats are experimented using multi-agent system and selected

cyber intelligence for analyzing feasibility in terms of security. The results are presented by implementing project with different conditions at Technical University of Sofia. Recurrent neural networks presented the essential requirements of intelligence of cyber threats and selected as multi-agent system for the tactical cyber threats.

Chen et al. [2020] presented AI impact on education which is assessing learning, instruction, and administration with preliminary analysis. The study in the field of AI such as innovation and development in machines, computers presented and other artifacts with analyzing characteristics such as adaptability, cognitive abilities, decision-making capabilities and learning. AI is intensively applied in the domain of education particularly different levels of institution institutions. Initially, AI transforms computer thereafter transitioning computer technologies into intelligent online systems for education hence using ultimately in embedded different systems such as computer and non-computer. Chatbot or humanoid robot is able to perform assigned functions and works independently without involving instructor. As computer based systems leverage adaptability and machine learning, the curriculum is personalized and customized in line with primary needs of students hence, improving quality of learning of learner through experience. **Wang and Yang [2020]** discussed characteristics and status of AI in the domain of education and proposed a practical path to advertise of AI development in education in terms of four levels such as layout, establishment, academic community and cultivating deplane. To build AI academic community of education, graduates and undergraduates are the key for cultivating teaching ambient and class room environment. To eliminate papers for evaluation, AI applied intelligent techniques at assessment, peer evaluation thereby strength academic community. The unpredictability of AI development is eliminates different inabilities among human-machine thereby distinguishing differences human and machine. Hence, cultivate AI is highly important for education in terms of influential and inclusive. Hence, Artificial Intelligence (AI) has huge scope at different domains if data is highly trained and algorithm has 100% accuracy. From above literature, it is clear that AI is contributing various domains to make automatic. AI is contributing more on real time systems to make automatic and smart when data trained and processed accurately.

3. CONTRIBUTIONS AND KEY CHALLENGES

AI is not technology; it is prototype of advanced IoT system. The research of AI is concentrated on applying intelligence to IoT based systems. From the last decade, different experiments are conducting on AI with reference of IoT. To make automated IoT system, number of novel ideas is proposed and trailed. One of the excellent ideas from research is to communicate machines/devices itself without involvement of human being [6]. To this end, a person can be controlled home appliance such as lights, fans and other electronic devices from any remote point using smart phone. AI is one of the strategic technologies which are leading next generation thereby affecting the global landscape. The development in AI critically requires for the education of AI. Different levels of AI education are determined by position of country in terms of revolution of scientific and technology hence shown most significance in various domains. The significance of education examines in terms of theoretical and practical values through AI from perspective disciplines. To advertise

development of AI in education in terms of status and characteristics four levels such as cultivating discipline, building academic, perfecting discipline and planning discipline.

AI provides an absolute solution for any challenge based on five pillars of *R*s that are resilience, rationality, responsibility, realm and reproducibility [8]. The latest research on AI presents that advanced models such Deep Neural Networks (DNN) used because of altering trained data as per real time conditions. This reason motivated research community to advance and add resilient feature to DNN. Though DNN has resilient feature, it lacks of causality and transparency. Hence, the modern AI based systems need to be more rational that is AI system should be verify and understand fully before applied. Responsibility of AI considered as "ethics" that is research community of AI should realize ethics as it is primary parameter while designing intelligent automated AI based system. AI provides human interactions with automated systems such as Amazon Alexa and Google Home devices to perform complex decision-making and also improvement of student education via virtual classes. Final, R represented as reproducibility which is creates software standards with minimum conditions. AI is mainly composed with two strong machine learning algorithms such as reinforcement algorithm and deep learning algorithm. These two algorithms are widely at domain of signal/image processing. Deep learning algorithm is implemented with DNN which has strong ideas to solve complex problems. DNN has consists of three major layers that are output, hidden and input layer. The input layer is responsible for state information of input ports whereas hidden layer filters required features from input data. The output layer performs decision based on linear regression or classification of extracted data from hidden layer. A neuron is the basic element of DNN which process information and then passes to neighbor neurons. An activation function is calculated once data is accumulated and processed from entire neurons in the network. The reinforcement learning works with an idea of how brain learns and performs new task and also executes task through trial and error method. The decision making in reinforcement learning by observing and interacting of environment state and perform action on environment thereby monitoring the condition of new environment [10]. Here, important note is that the state of environment is affected itself or action taken by reinforcement learning and quick response also provided by both learning agent and environment state. Based on immediate responses, respective decision is taken to specific environment state.

Figure. 2 Difference between algorithms of Machine Learning and Deep Learning

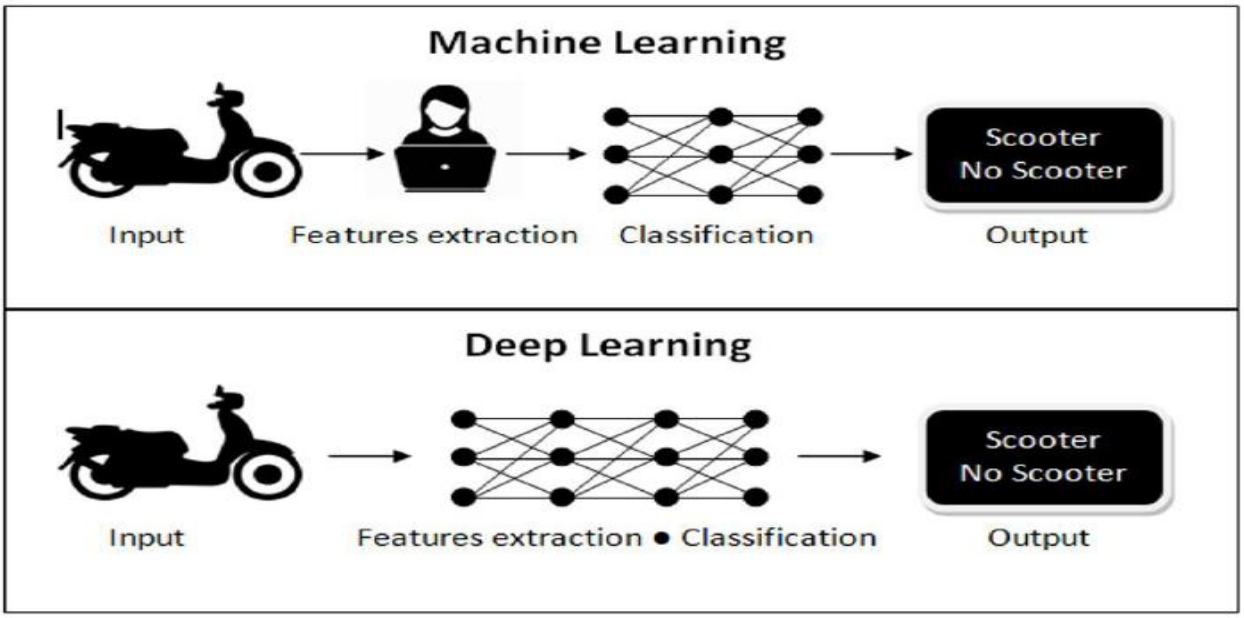


Fig.2 shows differences between Machine Learning (ML) and Deep Learning (DL) with an example. These algorithms are measured and evaluated with different parameters such as accuracy, precision and sensitivity [7]. Most of the experiments are given that DL is providing better performance than ML. From fig.2, it is clear that DL is providing better accuracy and precision than ML and it is also provides better speed because of less number of cycles required to complete task.

Key Challenges

AI based systems are contributed potentially to various domains such robotics, automation, medical diagnostics and military. Though it is performing high speed operations, it addresses several issues such as quality of training, data characteristics, translations, Interoperability and security.

i. Quality of Training

The algorithms of AI based system are evaluated mainly based on quality of training models and thereafter performance measured. However, data scarcity is common problem to any AI based application because quality of training must high.

ii. Data characteristics

Extraction of data characteristics of AI based system is critical challenge because of high volume of information coming from sensors. Preserving of data characteristics with high quality is challenging task. Though number of techniques is presented to preserving data, cloud storage provides reasonable solution for AI based system.

iii. Translations

Most of the algorithms are non-standard and lack of documentation such as examples. AI based systems are initially detects or senses the data and then translates into required format

which is support by the computer. To adopt AI based system, data must be under different phases or transformations.

iv. Interoperability

Many of AI based systems are lack of standards and regulations as integrating possible number of AI algorithms such as supervised and un-supervised learning algorithms [9]. Hence, interoperability issues arise with compatible interfaces. International standard organizations must work together to overcome different technical issues.

v. Security

The data security in AI system is highly challenged because attackers are easily exploiting important data. The attackers easily mislead system while training the system wrong data set. Hence, re-examine before applying data set to AI based system.

Not limited above, there are many challenges for accurate AI system because of various reasons. Hence, researcher community should take at most care such as AI learning algorithms, training system while presenting any system based AI.

Opportunities

a. AI-Big Data

Though AI and Big Data are different domains, the integrated technology presents huge number advantages. Big Data provides dataset for training of either ML or DL of AI based system. In future, AI must be integrating with Big Data because it is not able work with slow processors and small amount of data.

b. AI-Cyber security

By integrating both AI and Cyber security, the security system gets an additional infrastructure from cyber attackers and vulnerable networks. Cyber threats and security incidents are analyzed with both cyber security and machine learning algorithm. The extra resource of AI with Cyber security is controlling network traffic and also presents strong firewall to the system.

4. CONCLUSION

Artificial Intelligence (AI) is providing intelligence to machine as like as human being such as learn, train and execute. This paper discussed components of AI based systems and types of AI system. The required training algorithms of AI are presented and differences are discussed with examples. Finally, this paper propounded key challenges and future opportunities of AI with other technologies.

REFERENCES

1. Lv, Z., Han, Y., Singh, A. K., Manogaran, G., & Lv, H. (2020). Trustworthiness in industrial IoT systems based on artificial intelligence. IEEE Transactions on Industrial Informatics, 17(2), 1496-1504.

2. Stepin, I., Alonso, J. M., Catala, A., & Pereira-Fariña, M. (2021). A survey of contrastive and counterfactual explanation generation methods for explainable artificial intelligence. IEEE Access, 9, 11974-12001.
3. Trifonov, R., Nakov, O., & Mladenov, V. (2018, December). Artificial Intelligence in Cyber Threats Intelligence. In 2018 International Conference on Intelligent and Innovative Computing Applications (ICONIC) (pp. 1-4). IEEE.
4. Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: a review. IEEE Access, 8, 75264-75278.
5. Wang, Y., & Yang, Y. (2020, June). Research on Education Development Based on Artificial Intelligence Technology. In 2020 International Conference on Artificial Intelligence and Electromechanical Automation (AIEA) (pp. 136-139). IEEE.
6. Karn, R. R., Kudva, P., Huang, H., Suneja, S., & Elfadel, I. M. (2020). Cryptomining Detection in Container Clouds Using System Calls and Explainable Machine Learning. IEEE Transactions on Parallel and Distributed Systems, 32(3), 674-691.
7. Kaur, S., Singla, J., Nkenyereye, L., Jha, S., Prashar, D., Joshi, G. P., & Islam, S. R. (2020). Medical Diagnostic Systems Using Artificial Intelligence (AI) Algorithms: Principles and Perspectives. IEEE Access.
8. Ong, Y. S., & Gupta, A. (2019). Air 5: Five pillars of artificial intelligence research. IEEE Transactions on Emerging Topics in Computational Intelligence, 3(5), 411-415.
9. Zhang, L., Liang, Y. C., & Niyato, D. (2019). 6G Visions: Mobile ultra-broadband, super internet-of-things, and artificial intelligence. China Communications, 16(8), 1-14.