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Emerging Trends in Computer Engineering

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Abstract: The technological advancements to be depicted in the course called emerging trends was a challenging task and therefore it was decided to prepare a learning material with the involvement of industrial and academic experts for its uniformity in the aspect of delivery, implementation and evaluation.

Keywords: AI, Machine Learning, Deep Learning, IOT.

I. INTRODUCTION

Advancements and applications of Computer Engineering and Information Technology are ever changing. Emerging trends aims at creating awareness about major trends that will define technological disruption in the upcoming years in the field of Computer Engineering and Information Technology. IoT, Digital Forensics and Hacking are some emerging areas which are covered in this course and are expected to generate increasing demand as IT professionals and open avenues of entrepreneurship. Considering the necessity of Artificial intelligence (AI) which is an area of computer science that emphasizes the creation of intelligent machines that work and reacts like humans, it is important for Diploma to be aware of AI concept.

II. ARTIFICIAL INTELLIGENCE

A branch of Computer Science named Artificial Intelligence (AI) pursues creating the computers / machines as intelligent as human beings. John McCarthy the father of Artificial Intelligence described AI as, “The science and engineering of making intelligent machines, especially intelligent computer programs”. Artificial Intelligence (AI) is a branch of Science which deals with helping machines finds solutions to complex problems in a more human-like fashion.

Artificial is defined in different approaches by various researchers during its evolution, such as “Artificial Intelligence is the study of how to make computers do things which at the moment, people do better.”

Artificial Intelligence is one of the emerging technologies that try to simulate human reasoning in AI systems the art and science of bringing learning, adaptation and self- organization to the machine is the art of Artificial Intelligence. Artificial Intelligence is the ability of a computer program to learn and think. Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and reacts like humans. AI is built on these three important concepts.

The ultimate goal of artificial intelligence is to create computer programs that can solve problems and achieve goals like humans would. There is scope in developing machines in robotics, computer vision, language detection machine, game playing, expert systems, speech recognition machine and much more.

The following factors characterize a career in artificial intelligence:

- Automation
- Robotics
- The use of sophisticated computer software

Individuals considering pursuing a career in this field require specific education based on the foundations of math, technology, logic and engineering perspectives. Apart from these, good communication skills (written and verbal) are imperative to convey how AI services and tools will help when employed within industry settings.

AI Approach:

The difference between machine and human intelligence is that the human think / act rationally compare to machine. Historically, all four approaches to AI have been followed, each by different people with different methods.

Think Well:

Develop formal models of knowledge representation, reasoning, learning, memory, problem solving thatcan be rendered in algorithms. There is often an emphasis on a systems that are provably correct, and guarantee finding an optimal solution.

Act Well:

For a given set of inputs, generate an appropriate output that is not necessarily correct but gets the job done.

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- A heuristic (heuristic rule, heuristic method) is a rule of thumb, strategy, trick, simplification, or any other kind of device which drastically limits search for solutions in large problem spaces.
- Heuristics do not guarantee optimal solutions; in fact, they do not guarantee any solution at all:

all that can be said for a useful heuristic is that it offers solutions which are good enough most of the time

III. MACHINE LEARNING

When you command your smartphone to call someone, or when you chat with a customer service chatbot, you are interacting with software that runs on AI. But this type of software actually is limited to what it has been programmed to do. However, we expect to soon have systems that can learn new tasks without humans having to guide them. The idea is to give them a large amount of examples for any given chore, and they should be able to process each one and learn how to do it by the end of the activity.

- Machine learning is a branch of science that deals with programming the systems in such a way that they automatically learn and improve with experience. Here, learning means recognizing and understanding the input data and making wise decisions based on the supplied data.
- It is very difficult to cater to all the decisions based on all possible inputs. To tackle this problem, algorithms are developed. These algorithms build knowledge from specific data and past experience with the principles of statistics, probability theory, logic, combinatorial optimization, search, reinforcement learning, and control theory.

The developed algorithms form the basis of various applications such as:

- Vision processing
- Language processing
- Forecasting (e.g., stock market trends)
- Pattern recognition
- Games
- Data mining
- Expert systems

IV. DEEP LEARNING

The machine learning example I provided above is limited by the fact that humans still need to direct the AI's development. In deep learning, the goal is for the software to use what it has learned in one area to solve problems in other areas. For example, a program that has learned how to distinguish images in a photograph might be able to use this learning to seek out patterns in complex graphs.

Deep learning is a subfield of machine learning where concerned algorithms are inspired by the structure and function of the brain called artificial neural networks.

All the value today of deep learning is through supervised learning or learning from labelled data and algorithms.

Each algorithm in deep learning goes through the same process. It includes a hierarchy of nonlinear transformation of input that can be used to generate a statistical model as output. Consider the following steps that define the Machine Learning process.

- Identifies relevant data sets and prepares them for analysis.
- Chooses the type of algorithm to use
- Builds an analytical model based on the algorithm used.
- Trains the model on test data sets, revising it as needed.
- Runs the model to generate test scores.

Deep learning has evolved hand-in-hand with the digital era, which has brought about an explosion of data in all forms and from every region of the world. This data, known simply as big data, is drawn from sources like social media, internet search engines, e-commerce platforms, and online cinemas, among others. This enormous amount of data is readily accessible and can be shared through fintech applications like cloud computing.

However, the data, which normally is unstructured, is so vast that it could take decades for humans to comprehend it and extract relevant information. Companies realize the incredible potential that can result from unravelling this wealth of information and are increasingly adapting to AI systems for automated support.

Applications of Machine Learning and Deep Learning

- Computer vision which is used for facial recognition and attendance mark through fingerprints or vehicle identification through number plate.
- Information Retrieval from search engines like text search for image search.
- Automated email marketing with specified target identification.
- Medical diagnosis of cancer tumours or anomaly identification of any chronic disease.

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- Natural language processing for applications like photo tagging. The best example to explain this scenario is used in Facebook.
- Online Advertising.

V. INTERNET OF THING(IOT)

The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices.

Internet of Things (IoT) refers to physical and virtual objects that have unique identities and are connected to the internet to facilitate intelligent applications that make energy, logistics, industrial control, retail, agriculture and many other domains "smarter".

Internet of things (IoT) is a new revolution in which endpoints connected to the internet and driven by the advancements in sensor networks, mobile devices, wireless communications, networking and cloud technologies.

A. Characteristics of IoT:

- Dynamic &Self-Adapting: IoT devices and systems may have the capability to dynamically adapt with the changing contexts and take actions based on their operating conditions, user's context, or sensed environment. For example, the surveillance cameras can adapt their modes (to normal or infra-red night modes) based on whether it is day or night.
- Self-Configuring: IoT devices may have self-configuring capability, allowing a large number of devices to work together to provide certain functionality (such as weather monitoring).
- Interoperable Communication Protocols: IoT devices may support a number of interoperable communication protocols and can communicate with other devices and also with the infrastructure.
- Unique Identity: Each IoT device has a unique identity and a unique identifier (such as an IP address or a URI). IoT device interfaces allow users to query the devices, monitor their status, and control them remotely, in association with the control, configuration and management infrastructure.
- Integrated into Information Network: IoT devices are usually integrated into the information network that allows them to communicate and exchange data with other devices and systems.
- Enormous scale: The number of devices that need to be managed and that communicate with each other will be at least an order of magnitude larger than the devices connected to the current Internet.

B. Features of IOT:

- Connectivity: Connectivity refers to establish a proper connection between all the things of IoT to IoT platform it may be server or cloud.
- Analyzing: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence.
- Integrating: IoT integrating the various models to improve the user experience as well.
- Artificial Intelligence: IoT makes things smart and enhances life through the use of data.
- Sensing: The sensor devices used in IoT technologies detect and measure any change in the environment and report on their status.
- Active Engagement: IoT makes the connected technology, product, or services to active engagement between each other.
- Endpoint Management: It is important to be the endpoint management of all the IoT system otherwise; it makes the complete failure of the system.

C. Advantages and Disadvantages of IOT:

Advantages of IoT

- Efficient resource utilization: If we know the functionality and the way that how each device work we definitely increase the efficient resource utilization as well as monitor natural resources.
- Minimize human effort: As the devices of IoT interact and communicate with each other and do lot of task for us, then they minimize the human effort.
- Save time: As it reduces the human effort then it definitely saves out time. Time is the primary factor which can save through IoT platform.
- Improve security: Now, if we have a system that all these things are interconnected then we can make the system more secure and efficient.
- Reduced Waste: IoT makes areas of improvement clear. Current analytics give us superficial insight, but IoT provides real-world information leading to more effective management of resources.

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• Enhanced Data Collection: Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyse our world. It allows an accurate picture of everything.

Disadvantages of IoT:

• Security: As the IoT systems are interconnected and communicate over networks. The system offers little control despite any security measures, and it can be lead the various kinds of network attacks.

• Privacy: Even without the active participation on the user, the IoT system provides substantial personal data in maximum detail.

• Complexity: The designing, developing, and maintaining and enabling the large technology to IoT system is quite complicated.

• Flexibility: Many are concerned about the flexibility of an IoT system to integrate easily with another. They worry about finding themselves with several conflicting or locked systems.

• Compliance: IoT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

VI. CONCLUSION

The technological advancements to be depicted in the course called emerging trends was a challenging task and therefore it was decided to prepare a learning material with the involvement of industrial and academic experts for its uniformity in the aspect of delivery, implementation and evaluation.

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