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Machine Learning Techniques in IoT

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ABSTRACT

Internet of Things (IoT) is expanding expeditiously in different fields but has a tremendous implementation in the branch of savants and commence. Machine learning can also help machines; indulge them collectively to acknowledge them what people want from the data made by Homo sapiens. In addition, machine learning has an important role in IoT facet to hold the large extent of data generated by the machines. Machine learning gives internet of things and those machines a mind to think, which is called "encapsulated intelligence" by some researchers. This paper will mainly focus on machine learning intelligent algorithms like artificial immune system algorithm Bayesian theorem, Genetic algorithm (GA), Swarm algorithm (SA), algorithm, Bayesian theorem, Reinforcement algorithm, Ant colony algorithm, k-means algorithm and supportive vector machine algorithm and their role in internet of things.

Keywords: Encapsulated Intelligence, IoT, Machine Learning

I. INTRODUCTION

Internet of Things (IoT) is a combination of integral computing devices, digital era, or anything which used a network for data transfer. The term thing, in the Internet of Things, can be anything like car with the sensors, home gadgets anything that can be assigned a unique IP address .IoT is all about connecting the device through internet.. Internet of things all works on some kind of intelligence and this intelligence is machine learning. Though, there are stills lots of obstacles and challenges to overcome. But this all obstacle can be overcome by machine learning

II. LITERATURE SURVEY

Machine learning has given us everything from self-driving cars to Web search machine learning has made our understanding towards human genome easy. Machine learning made the human being progressive in every aspect. Today machine learning is used in each and every field that we can use it several times without actually knowing it. In this paper, analysis of various intelligent techniques applied to IoT.

A. Artificial Immune System

The Artificial Immune System is [1] a meta-heuristic algorithm based on foundation of the immune system. Artificial immune system is taken from the algorithm of biology which studies the immune system and immunology. In simple words immune system protect the body from the various disease. From this algorithm the idea of creating artificial immune system come to an existence. Artificial immune system also applicable on the internet of things; it is very excellent idea to create a

protective layer known as artificial immune system to protect and find to find invader in a smart device where the artificial system is behaving similar to the natural system. . The most sought after properties of an artificial immune system are robust, lightweight, error tolerant, distributed. Robustness is to pass the infected data to the artificial immune system for processing the data might be incomplete or contain the noise. Lightweight property of artificial immune system helps the smart device to not consume a large amount of power to perform its operation. Heterogeneous property helps in protecting the device from transmission of incomplete and malfunction data. Thus the artificial immune system has a vital role in internet of things

B. Genetic Algorithm

Genetic Algorithm [1] [8] is a searching technique which works randomly based on Darwin theory. It uses current and historical data to analyse the future and this technique is used in VM scheduling. GA is based on the biological concept of increasing the population.. The Genetic Algorithm-Placement of IoT Device (GA-PID) decides the placement point where the IoT device should be allocated to carry out the task. In this selecting individuals from the parental generation and interchanging their genes, new individuals (descendants) are obtained. Genetic algorithm is used to find the multi object optimization problem. The genetic algorithm is used to minimize path length which is used to give maximum network life. This observation is especially important for the IoT device problem.

C. Swarm Algorithm

Swarm algorithm is a highly advanced heuristic intelligent optimization algorithm that follows the behaviour of animal swarm. It is searching algorithm that gives global best information through collaboration between individuals. Swarm [1] [5][12] optimization is used efficiently to enhance physiological multi-sensor data fusion measurement precision in the Internet of Things. Swarm optimization (IPSO) is used to solve the convergence accuracy speed and local optimization of IoT devices.

D. Bayesian Theorem

Bayesian theorem [3] is a statistics theorem which explains that information about the true state is shown in terms of degrees of belief which is also called as Bayesian probabilities. Such kind of interpretation is type of a number of interpretations of probability. It has great implementations in the IoT. The algorithm applies on the IoT devices to find the occupancy of the room using a PIR Sensor. This algorithm also estimates the battery running occupying estimation in IoT.

E. Reinforcement Learning

Reinforcement learning is a method of learning [4] [11] in machine learning to allow machine behave according to the environment or by interacting the environment .it works on the trial and error method. Reinforcement learning works in a cycle of sense-action-goals. Because reinforcement learning learns from immediate interaction with the environment. Reinforcement learning learns from the immediate interaction with environment. Reinforcement learning is used in IoT. There are sensors, induction refrigerator, a.c , electric glass the mind or the science behind this is reinforcement learning because they adapt the environment and make changes according to it.

F. Ant Colony Algorithm

Ant colony algorithm [1] [9] is an approach which is being extracted from the behaviour of the ant's, like the ants which secretes chemical material known as pheromones. By which they implicitly communicate with other ants. When an ant explores and finds some object such as food, it secretes a pheromone along the route back to the colony. This algorithm is also used in IoT in finding the route and communication among these nodes. According to the features of the IoT such as the irregular Network topology, many nodes, the more variable network structure, this algorithm is used to search path, and

used to broadcast the signal, which is featured with the random sending. Ant colony algorithm can reduce the broadcast method efficiently. With the number of nodes in the search in routing was increased, the time of route setup was significantly shortened.

G. Cuckoo Search Algorithm

Cuckoo [1] search algorithm is a meta-heuristic algorithm that models natural behaviour of cuckoo species. Cuckoos are the beautiful birds but their aggressive reproduction strategy is more interesting to us. The cuckoos [7] reproduce in such a way that only one egg is laid at a time and laid it in a nest randomly and in next step the nest which has the better quality eggs will be carried further for the next generation. This algorithm has a vital role in the Internet of Things (IoT). Error correction is of great significance to achieve Iot precision. Currently, accurately predicting the future dynamic measurement of error is an effective way to improve IoT precision. Aiming to solve the problem of low model accuracy in traditional dynamic measurement error prediction. This study employs to predict the dynamic measurement error of sensors. However, the execution of the SVM depends on setting the appropriate parameters. Hence, the cuckoo search (CS) algorithm is adopted to optimize the key parameters to avoid the local minimum value which can occurs when using the traditional method of parameter optimization.

H. Neural Network Algorithm

Neural network [1] [4] [6] algorithm is a method used in machine learning to calculate the error contribution of each neuron after a batch of data. The neural network is categorized in two networks: hierarchical network and interconnected, which is categorized according, to the neuron functionality in the different layers. These layers are input, hidden and output layer, which are connected in a sequence. Neural network is widely used in internet of things to accurately classify the input data. The data of sensors has been distinguished on the basis neural network .by neural network .By neural network; the response time of overall network can be reduced. Moreover, can increase the performance of the sensors.

I. K-means Algorithm

K-means is a [2] unsupervised learning which is famous for giving the solution of the cluster analysis. This method has some easy rules .This method distinguish a given data into different number of clusters (assume it k- cluster).The main motive is to find k-centroids for every cluster .The centroids are placed in such order that they are not near to each other, they should be far from other one. The next step is to choose each point from a given data set and relate it to the nearest centroid. When there is no point remains, the starting step is ended. On reaching this step re-calculate new k-centroid as barycentre's then step is second is done again but with new k-centroids. As a result of previous step a loop is generated which signifies that k- centroids move from its place step by step till there are not any further changes. The algorithm main aim is to minimizing the objective function. K-mean algorithm is also used to find the best area in the smart city, which is suitable for living, and where the air pollution is less and fumes gas from the traffic system is negligible among the whole polluted smart city. K-means clustering algorithm that can use both of the trajectory variables and the associated chemical value to classify source regions of definite chemical category.

J. Supportive Vector Machine Algorithm

In this approach [3] of algorithm explains to learn to distinguish data points using labelled practice samples. Basically, the problem is to distinguish those points in two different fragments. These [4] fragments are placed by as far as possible ends and new reading will be distinguish on basis of which side of the ends it is. Supportive vector machine algorithm, which contains optimizing a quadratic function with linear constraints .This type of approach, is highly used in IoT and basically for the

automatic traffic accident detection which includes to the interrelation of computing devices and sensors using radio frequency identification. An intelligent transportation framework based on IoT is the finest application of the supportive vector machine algorithm.

Bayesian Statics	Resource Utilization Execution Time	• It obeys the likelihood principle • It provides interpretable answers • It does not tell you how to select a prior • It can produce posterior distributions that are heavily influenced by the prior
Genetics Algorithm	Resource Utilization Make Span	• There are multiple local optima • The number of parameters is very much in count • No guarantee of finding global maxima • Incomprehensible solutions
Swarm Algorithm	Convergence Cost Make Plan Randomization	• Minimize make span • Fair distribution • Quick Coverage local optima • Lack of reliability
Artificial Immune System	Make Span	• Optimal life span
Reinforcement Learning	Convergence Cost Make Plan	• Uses “deeper” knowledge about domain • No model required • Shallow knowledge • Must have model of environment
Ant Colony Algorithm	Randomization	• Minimize make span • Fair distribution • Quick Coverage local optima • Lacking reliability
Cuckoo Search Algorithm	Randomization Convergence Cost Make Span	• Global convergence due to Switching • Probability factor
Neural Network Algorithm	Step-size Scaling Probability Randomization	• Relatively simple implementations • Standard method and general works well • Slow and inefficient
K- Mean Algorithm	Convergence Cost Make Plan Randomization	• Simple and easy to implement • Computation cost is less • Sensitive to outliers
Supportive Vector Machine Algorithm	Cost Make Plan Randomization	• SVMs cannot accommodate such structures • More robust sensitive to outliers

Table 1. Advantages and Disadvantages of Various Techniques

III. CONCLUSION

IoT is modifying our existence. Machine Learning changes the scenario of dealing of human with machine and retrieving the data from them. Today machine learning not only connecting the machines but also making the human interaction with machines easy. Some of the application of machine learning comes to existence and more to come in future which is somehow uncertain and magical.

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