STM JOURNALS

Journal of Artificial Intelligence Research & Advances
ISSN: 2395-6720
Volume 7, Issue 2
www.stmjournals.com

Study and Research Survey of Machine Learning on Different Field for Next Research Directions

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Abstract

Machine learning (ML) is a part of artificial intelligence (AI). ML is a brain of AI, which works to same to same as human creature. ML used to several learning algorithms is a part of related learning techniques as supervised, unsupervised, reinforcement, deep and deep-reinforcement learning techniques. ML used on various research fields as, cyber security, big data, IOT, big code naturalness, flood prediction, ultra sound computer-aided diagnostic system, medicine in healthcare, malware analysis, analyzing of large scale human mobile data, data fusion, natural language processing, performance of wireless networks, software development, hardware trozan attack, semantic web and different project development on industries, details explanations on research papers.

Keywords: *AI, ML, MLm, IOT, SDN, Cloud Computing.*

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INTRODUCTION

Artificial intelligence (AI) is a main part of computer science. Machine learning (ML) is a part of artificial intelligence or Implement on AI for better performance with results to re-train the existing models and develop to high performance computing [23]. ML techniques is divided into five categories such as supervised (SVM, Random forest, linear regression, decision tree etc), unsupervised (K-Means clustering, Hierarchical Clustering, Gaussian mixture model etc), reinforcement learning (Q-Learning, Monte Carlo method, Markov Decision Process etc), deep learning (ANN, DNN etc) and Deep-reinforcement learning (Deep Q-Learning etc) [27] [29] [33]. ML algorithm is used in different fields in AI (Figure 1).

LITERATURE SURVEY

Following Table 1 show some reviews, used on this research survey.

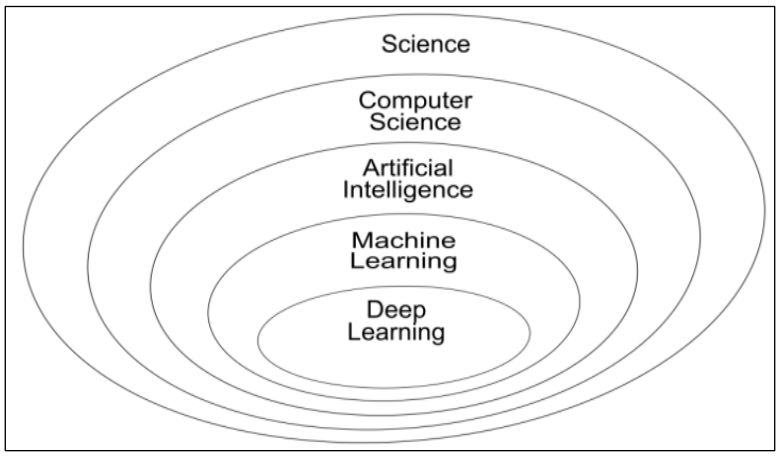

Fig. 1: *Introduction of Machine Learning on Research Survey.*

Table 1: *Literature Review.*

Author	Paper Title & Journal Name	Summary & Problem Statement
Anna L. Buczak , Erhan Guven (2015)	A survey of data mining and machine learning methods for cyber security intrusion detection, *IEEE Communications surveys & tutorials*	This review indicates the methods of machine learning and data mining used to cyber security for stop the misuse on cyber in cyber attack. Many problems in cyber not handle by Machine Learning and Data Mining methods. Next work is investigating the method of fast incremental learning for daily updates of models for misuse and anomaly detection [2].
Vinay Bhatt, Dr. Sanjay Kumar, Dr. Adesh Kumar (2018)	Study and Literature or Research Survey of Mobile Computing, Mobile Communication and Mobile Ad Hoc Network in Wireless Network. *Journal of Mobile Computing, Communications & Mobile Networks*	In this review explain the activities of mobile computing, mobile communication and mobile ad hoc network on wireless network. Problem is area and security of wireless network. Next work is check the performance to various protocol and provide secure data communication under various routing attack in wireless network [3].
Vinay Bhatt, Dr. Sanjay Kumar (2018)	Study and Literature or Research Survey of Routing Protocols and Routing Attacks in MANET with Different Security Technique in Cryptography for Network Security. *International Journal on Future Revolution in Computer Science & Communication Engineering*	In this survey, discuss different type of routing protocol, routing attack, and routing security under mobile ad hoc network. Major problem is security in large network. Next work is comparison between two routing protocol under routing attack for check performance on attack [4].
Vinay Bhatt, Dr. Sanjay Kumar (2018)	Performance Analysis between OLSR and FSR Protocols under Black Hole Attack Using FPGA, *International Journal on Future Revolution in Computer Science & Communication Engineering*	In this research work, analysis of performance between two MANET protocol (OLSR and FSR) under black hole attack using Field Programmable gate array (FPGA), performance of FSR is better than OLSR. Problem is how providing security to FSR protocol and how increase to performance of OLSR protocol. Next work is provide security to OLSR protocol because performance of OLSR is not better then FSR protocol under black hole attack [5].
Vinay Bhatt, Adesh Kumar (2018)	Security of OLSR Protocol by DES (Data Encryption Standard) Algorithm for Security under Black Hole Attack using FPGA (Xilinx), *International Journal of Wireless Network Security, Journal Pub*	In this research work provide security to optimized link state routing (OLSR) protocol by Data Encryption Standard (DES) 64 bit security algorithm. Problem is when size of data and number of node is increase then security is tuff then other network because size of key is small means size of DES is 64 bit. Next work is large key size security algorithm AES used in large number of nodes in complex structure protocol FSR for security under black hole attack using Xilinx [6].
Vinay Bhatt, Dr. Sanjay Kumar (2018)	AES Security Algorithm Implement on FSR Protocol under Black Hole Attack using FPGA (XILINX), *International Journal of Wireless Network Security, Journal Pub*	This investigation point to FSR protocol without black hole, FSR under black hole and FSR using AES-128 bit security under black hole attack. Performance of Secure FSR protocol is best then other operation on FSR protocol. Problem is how to apply this security on cyber attack. After work is study to cyber law for knowledge gain to break the cyber attack as Malware under cyber security [7].
Vinay Bhatt (2018)	Research Survey of Cybercrime or Cyber Attack, Cyber Law and Cyber Security on Cyber Space under Cyber Forensic Investigation. *International Journal of Information Security and Software Engineering, Journal Pub.*	In this study, learning to different types of cyber attack or crime, methods of cyber security in cyberspace and cyber law with various sections under IT act 2000 in India. Problem is how to use various cyber laws on different cyber crime under cyber space and how to provide security to cyber space. Next work is many security technique used in cyberspace on various cyber crime under forensic investigation for cyber security [8].
Amir Mosavi, Pinar Ozturk, Kwok-wing Chau (2018)	Flood Prediction Using Machine Learning Models: Literature Review, *Water.*	In this study, machine learning used in flood prediction for early stage of Prediction. Multidisciplinary nature (ML and hydrology is mixed) in this research work is

		major problem statement. Future work is performing a review on spatial flood prediction by machine learning models is highly encouraged [11].
Qinghua Huang, Fan Zhang, Xuelong Li (2018)	Machine learning in ultrasound computer-aided diagnostic systems: a survey. *BioMed research international*	In this review, ultra sound CAD (Computer Aided Diagnosis) system using by machine learning. It is tough to comparatively calculate the performance of different schemes using different datasets. Important task for future study is the structure of standard dataset on behalf of different ultrasound CAD applications [13].
Mohammed Ali Al-Garadi, Amr Mohamed, Abdulla Al-Ali, Xiaojiang Du, Mohsen Guizani (2018)	A survey of machine and deep learning methods for internet of things (iot) security, . *arXiv preprint arXiv*	This review indicates a variety of IOT security threats with IOT attack. In this complete system used DL and ML method for security to IOT. Challenges in this study, DL and ML for IOT security in the independent, interactive and interconnected environments for IOT systems, synergic integration of ML and DL through blockchain for IoT security and diverse security tradeoffs in IoT applications. Upcoming work is end to end advanced security for IOT based system [14].
Effy Vayena, Alessandro Blasimme, I. Glenn Cohen (2018)	Machine learning in medicine: addressing ethical challenges, *PLoS medicine*	In this survey discussed, ML is used in medicine as well as machine learning in medicine (MLm) on behalf of clinical location for health care delivery. Problem is progress of MLm, checking for different medicine to different patient, probable is critical for avoiding unnecessary risks [15].
Daniele Uccia,, Leonardo Aniellob, Roberto Baldonia, (2019)	Survey of machine learning techniques for malware analysis, *Computers & Security*	This literature survey specifies an analysis of malware by machine learning algorithm. Priority of essential proper benchmarks for malware analysis is a problem in this review. Upcoming work on designing of malware analysis economics environment where proper tuning strategies can be provided to balance competing metrics as well as accuracy and cost [17].
Eran Toch, Boaz Lerner, Eyal Ben-Zion, Irad Ben-Gal (2019)	Analyzing large-scale human mobility data: a survey of machine learning methods and applications, *Knowledge and Information Systems*	In this review, focus on challenges of mining in large scale and high dimensional mobile data using machine learning methods with divide three modeling category such as user, place and trajectory modeling. Problem is security issues and future work on security related parameters using machine learning methods [18].
Nasrin Sultana, Naveen Chilamkurti, Wei Peng, Rabei Alhadad (2019)	Survey on SDN based network intrusion detection system using machine Learning approaches, *Peer-to-Peer Networking and Applications*	In this Literature, works on Software Defined Networking Technology (SDN) for detection and protection to security related problems. Machine Learning techniques used in this complete system and implemented on SDN-based Network Intrusion Detection Systems (NIDS) for protection to network under the security related problems. Challenges under ML in this survey are computational realism, high volume data, handling packet processing flow, protect to various attacks [19].
Pradeep Pokhriyal, Vinay Bhatt, Akhilesh Bijalwan (2019)	Analysis of DTMF Frequency on IC MT8870D, *Recent Trends in Parallel Computing*	In this work, analysis to Dual Tone Multiple Frequency (DTMF) through IC MT8870D for frequency distribution. Upcoming work on IOT, cloud computing based research [20].
Vinay Bhatt, Pradeep Pokhriyal (2019)	Research Survey of Mobile Cloud Computing with Services of Cloud Computing, *International Journal of Distributed Computing and Technology, Journal Pub*	In this research review, focus on mobile cloud computing (MCC). Its features combines of mobile computing and cloud computing. Upcoming review and analysis on different parameters on MCC and ML [21].
Tong Meng, Xuyang Jing, Zheng Yan, Witold Pedrycz (2020)	A survey on machine learning for data fusion, *Information Fusion*	In this review, consider on data fusion by machine learning methods with the deal of imperfect raw data for capturing reliable, valuable and accurate information and comparison with probabilistic machine learning techniques. Problem is needs of serious security on fusion model. Proposed work on data fusion by more complex and large scale learning techniques [22].

Merima Kulina, Tarik Kazaz, Ingrid Moerman, Eli de Poorter (2020)	A survey on Machine Learning-based Performance Improvement of Wireless Networks: PHY, MAC and network layer, *arXiv preprint*	This survey explain the machine learning for ability to collect, store and process massive amounts of data with maintain advance hardware and computing power with adding wireless network. Problem is complexity of ML models and future work is implementation of distributed ML models [27].
Claudia d'Amato (2020)	Machine Learning for the Semantic Web: Lessons Learnt and Next Research Directions, *Semantic Web*	This survey paper explains the readable web machine by machine learning on semantic web. Symbol based and numerical based solution is a main problem in this review and upcoming work on this problem [32].
Jingjing Wang, Haijun Zhang and Kwang-Cheng Chen (2020)	Thirty years of machine learning: The road to pareto-optimal wireless networks, *IEEE Communications Surveys & Tutorials*.	This review give the details of thirty years of machine learning under wireless networks with including its types as supervised, unsupervised, reinforcement and deep learning techniques. Security is main problem and upcoming work on security [33].

ARTIFICIAL INTELLIGENCE (AI)

According to John McCarthy (Father of AI), AI (Artificial Intelligence) is a method or engineering in computer science for making intelligence machine similarly the manner of human intelligence think [27]. In Present time, AI mostly used in various fields on IT industries for research and development likes robotics, IOT and making various intelligent machines. AI is based on reasoning, learning, problem solving and perception. Following Figure 1 show Different field for research and development in AI domain as (Figure 2):

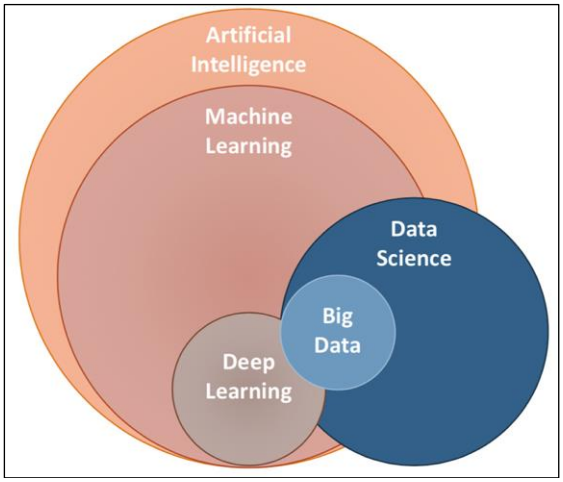

Fig. 2: *Van Diagram for Component of Machine Learning under Artificial Intelligence.*

MACHINE LEARNING (ML)

Machine Learning is a method that can find out from pattern as of beginning to end, self-improvement as well as without being clearly coded through programmer [25] [28]. The advance approaches through the idea that a machine can singularly find outs from the data to generate to correct results [2]. Machine learning merged with data and statistical tools for predict an output [1] [23]. This output is then applied through corporate to builds actionable insights. Machine learning is interrelated to Bayesian predictive modelling and also data mining [1] [2]. The machine accepts data as input apply an algorithm to formulate answers [1] [2]. Machine learning is moreover applied to designed for a variety of task similar to fraud detection, predictive maintenance, portfolio optimization, automatism task and presently [2] [23]. Figure 3 shows steps of machine learning works.

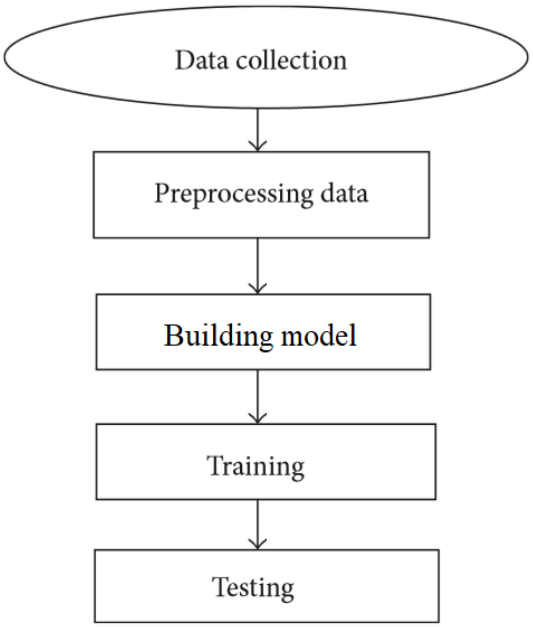

Fig. 3: *Working Flow of Machine learning.*

How Machine Learning Works

Machine learning is a brain for every task in artificial intelligence. ML works same as

human being, in AI. The major objective of ML is learning and inference [27]. Initially machine learns using the discovery patterns, the discovery made by the data [27]. The job of data scientist in machine learning is selected the correct data and carefully load the data to machine [27]. This problem is solved by subset of data or list of attributes called feature factor [28]. The machine applies a number of fancy algorithms to simplify the actuality and transform this discovery into a model [28]. Once the model is built, it is probable to test how powerful it is scheduled never seen previous to data [27] [28]. The latest data are transformed into a features vector, leave through the model and provide a prediction [29]. This is each and every one the attractive part of machine learning [28]. There is no required to update the rules or train another time the model [28] [29]. Figure 4 shows working by methods of machine learning system.

MACHINE LEARNING ALGORITHM

Machine learning algorithm is a method, used in ML system for develop an intelligent model. Figure 5 shows application of ML algorithm with performance.

Categories of Machine Learning Algorithms

There are five main categories of machine learning algorithms as show in Tables 2:

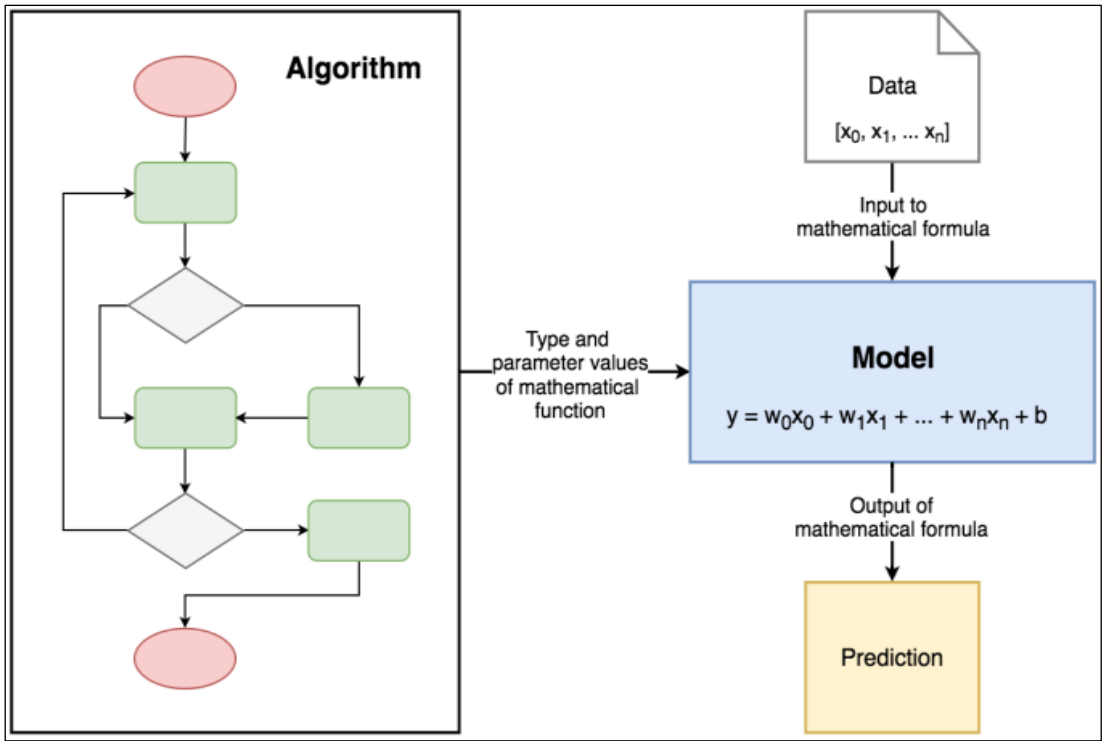

Fig. 4: *Working Process of Machine Learning.*

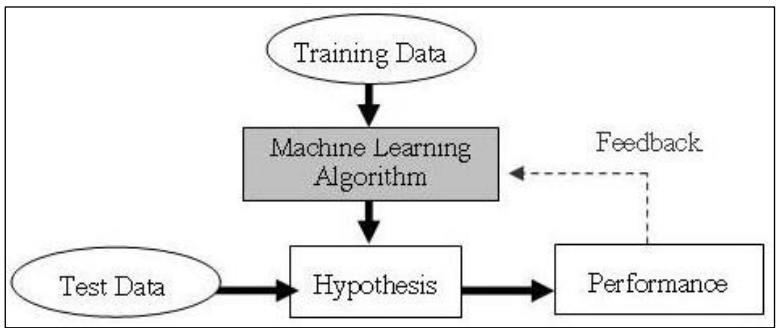

Fig. 5: *Processing by Machine Learning Algorithm.*

Table2: *Types of Machine Learning Algorithms.*

S. No	ML Algorithms	Description	Examples
1	Supervised Learning	An algorithm make use of training data and feedback by humans to learn the relationship of Provided inputs to a provided output [16] [27] [28].	Linear regression, Logistic regression, Decision Tree, Naive Bayes, Support Vector Machine, Random Forest, K-Nearest Neighbours etc [16] [27][28].
2	Unsupervised Learning	In unsupervised learning, an algorithm discovers input data with no being provided to an clear output variable [26] [28] [29] [33].	K- Means clustering, Hierarchical Clustering, Gaussian mixture model, Density- Based Spatial Clustering etc [28] [29] [33].
3	Reinforcement Learning	In Reinforcement learning, algorithm is discovers for decision making by the data in the basis of error and trial [28] [29] [33].	Q- Learning, Monte Carlo Method, Markov Decision Process, Multi-Arm Bandit etc [33].
4	Deep Learning	Deep learning is pass on a multi-layer network, impressed through the biological nervous system that is to say neural networks and capable of handling the highly growth of training data volume helped through the rapid development of computing hardware [12] [27] [33].	Artificial Neural Networks (ANN), Deep Neural Networks (DNN), Convolution Neural Networks (CNN) Recurrent Neural Networks (RNN) etc [16][33].
5	Deep-Reinforcement Learning	This learning is combination of deep learning and reinforcement learning algorithm [33].	Deep-Q Learning [33].

MACHINE LEARNING ON VARIOUS FIELDS FOR RESEARCH DIRECTIONS

There are many applications of machine learning in different research field in the basis of various review papers as.

Machine Learning on Cyber Security

ML used in cyber security for data sets related observations, performance of intrusion detection system (IDS) under related factors, comparison criteria like accuracy, time for training a model, misuse detection, training for model in cyber using classifier, approval for anomaly detection [2] [8].

Machine Learning on Internet of Things (IOT)

ML is implementing on IOT for availability of securing data sets, learning to secure IOT for low quality data, improve the performance of IOT data with security [6] [7], permanent Learning on behalf of learning IoT threats, security of IOT in independent, interactive and interconnected environment, cryptographic implementation [4] [7] for break the misuse by attackers [2] [8] [9] [14] [20].

Machine Learning on Big Codes and Naturalness

ML provides probabilistic model for source code with new tool that can be support to all area of program for analysis in software engineering [10].

Machine Learning on Flood Prediction

ML provides to solution of complex mathematical expressions in flood prediction for better performance, data decomposition, model optimization hybridization and cost effective solutions with effectiveness and accuracy [11].

Machine Learning on Ultrasound CAD system

Machine learning is implementing on Ultrasound Computer Aided Diagnostic (CAD) Systems for detection means using technology for find the injury region of the image and diagnosis means using the technology for discover the potential diseases using deep learning method [13].

Machine Learning for Medicine

MLm (Machine Learning in Medicine) algorithm provides privacy protection for regulatory restrictions in all steps of data processing with requirement of large amounts data with different variety. Medical software based company develop the ML based device for data sourcing, product development and clinical deployment. This device run on cloud based platform for prediction and healthcare delivery for healthcare professionals [15].

Machine Learning for Malware Analysis
ML is used on malware analysis for measures an accuracy and executing time with balance competing matrices like cost and accuracy using different algorithms of machine learning such as rule based classifier, decision tree, SVM, Random forests and neural networks [17].

Machine Learning for Analyzing of Large Scale Mobility Data
ML used on mobile computing [3] [4] for analyzing to high dimensional or large scale and bulky of human mobility data with protection using mobility patterns on mobility based models and maintain data labeling, end user application, standardization mobility models for statistical data and privacy to threats [18] [21].

Machine Learning on SDN
Software Defined Network Technology (SDN) gives a view to detection and check network security problems to programmable features. ML methods applies in SDN based Network Intrusion Detection System (NIDS) for security to computer network [6] [7] [19] [31]. Deep learning is a method of Machine learning, implement on SDN based system and develop to new tool SDN based NIDS in SDN environment [19] [31].

Machine Learning for Data fusion
Data fusion is a common way to deal with faulty raw data used for capturing reliable, valuable and accurate information. Machine learning method is learn automatically without clearly programming by offering the strong capability of computing and predicting with compare to classical probabilistic data fusion techniques [22].

Machine Learning on Natural Language Processing
Machine learning is used on natural language processing for improving to carefully selection of the features and find better results to classification of text. ML used different algorithms and techniques such as decision tree, Naïve bayes, support vector machine, part of speech tagging, sentiment analysis, clustering, latent semantic indexing, matrix factorization etc for text classifications [24].

Machine Learning on Wireless Networks
ML is implement on wireless network for improve the performance of wireless network under its various layers of the protocol stack as PHY, MAC and network layer using data driven approach [5] [27]. ML used for optimized to wireless communication parameters and improve to network quality of service (QOS) and quality of experience [27].

Machine Learning for Software Development
ML provides everywhere tool to software development for predicting and classifying data with including applications on more than problem domains [1] [27]. ML removes the problem of lack of comprehensive data sets in software development [27].

Machine Learning for Hardware Trozen Attack
ML is success of hardware trozen attack. Classification techniques in machine learning used for hardware trozen detection, design for security bus security and secure architecture under hardware trozen attack [28].

Machine Learning for Safety Assurance
ML provides automotive functional safety standard methods for supporting the safety argumentation of a ML based system. Various issues like powerful solvers, validation of data representatively as well as model diversity, inclusion of expert knowledge, and model introspections with verifiable guarantees solved by ML with including data collections [30].

Machine Learning for Semantic Web
ML used for develop a web machine called semantic web used for solve a problem with symbol based solution, numeric based approach with large web of data for solving problem like link with type prediction, ontology enrichment with completion [32].

Machine Learning in Industries
ML used on industries for manufacturing to many powerful dynamic systems such as cyber physical systems, cloud systems, Machine to

Machine Communication, smart factories, augmented reality and simulation, data mining, internet of things, Enterprise resource planning (ERP) and business intelligence, virtual manufacturing, intelligent robotics etc [21] [34]. In industries ML used for develop highly research projects such as Metamo FAB, ENTOC, ParsiFAI 4.0, ARIZ, SOPHIE, OPAK, ESIMA, AWSIoT, FUSION, E-Factory, INESA smart factory etc [34].

CONCLUSION AND FUTURE SCOPE

In this survey paper, study to machine learning with its techniques and its examples under artificial intelligence. The main focus on uses of machine learning in different research fields. This review paper, indicates five techniques of machine learning uses on different fields. The main techniques is deep learning and deep-reinforcement learning is used for future work and applied on internet of things (IOT), Medical health-care, ultrasound CAD system, cloud computing, cyber security etc, related to various research field and development for industries. Artificial neaural network (ANN), Q-learning and Deep Q- learning techniques is important in this review paper. For statistical measurements used linear regression, K-nearest neighbours, bayes classification etc techniques is important algorithms.

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Cite this Article
Vinay Bhatt, Sanjay Kumar. Study and Research Survey of Machine Learning on Different Field for Next Research Directions. *Journal of Artificial Intelligence Research & Advances.* 2020; 7(2): 46–55p.