COMMENTARY UPON ROLE OF NEURAL NETWORKS IN SUPERVISED MACHINE LEARNING

Palak Bansal, Harkiran Kaur

Department of Computer Science and Engineering
Thapar Institute of engineering and technology(Deemed to be University), Patiala, India
palakbansal72@gmail.com,harkiran.kaur@thapar.edu

ABSTRACT

Supervised Machine Learning is an extensive field which is used by immeasurable masses in their respective domains. These are basically used in various domains in which there are different approaches or techniques which are used to implement the method of supervised machine learning by using different algorithms. This paper elaborates various approaches of neural networks. Further, a comparative analysis of these approaches has been presented based on different factors, which are classifying these approaches into various attributes. The result of this comparative analysis is supervised machine learning approaches contrasted between the existing approach and the ones which are used previously or will be used in future in order to crack the struggle that comes up in computer revelation.

Keywords: **Supervised Machine Learning, Neural Networks, Rule-Based Technique, Spiking Neural Networks.**

I.   INTRODUCTION

Machine learning is the art of making the computer learn and act without being unequivocally programmed. Supervised machine learning that proposes building a model that prognoses based upon the evidences in the presence of uncertainty. Supervised learning algorithms are adaptive algorithms as they identify the patterns in data. In this, the process of learning is performed using the observations. More the observations, better the prediction done by the machine. The basic working of Supervised machine learning includes the known data and known responses which results into a model. Further, the model and new data are added which results into predicted responses. In the frame of reference of machine learning Supervised learning in the context of machine learning, is a craft in which both the aided data and the yielded data that is the desired outcome is equipped in the system. Input and output data are labeled for classification which serves as a learning basis for the future or new data processing.

Supervised Machine Learning are used in wide locale ranging from Autonomous learning machines, Invariant Image Recognition, Engine performance optimization, Metric learning, user recognition. In Sovereign learning machines, neural networks are superintended by rule-based systems which rope the progression of the structure throughout the process of learning.In Invariant Image Recognition, the supervised Machine Learning is used to identify image independent of its dimension and orientation. In Metric Learning, the incremental training is performed and vector quantized abilities are used for the edifice.

II.   LITERATURE REVIEW

The author, David A. Handelman in [3], compares the present scenario of the learning progression and how is it improved by using rule based systems .Neural Networks are very competent at learning through knowledge. The training of the neural network is done through rule-based systems. The course of learning process of the system is administered and curbed by the rule based advent .The fabrication of the two- link manipulator is rendered primarily and then the utility of neural network for the task accomplishment by perceiving and inducing the rule-based task execution. Rule based system ensures proper task learning and the neural networks used for the autonomous learning machines for the Knowledge Based Systems amplify re-learning. The utility and fusion of neural networks and interspersed expert systems   repercuss into the impulsive and discursive forms of information processing. The consequences exhibit the consolidation amid distinctive stages of learning.

The author S.T Kim et.al, in his paper proposes the re-programmable data-flow neural classifiers as an substitute to customary execution of the artificial neural network classifiers which are based on functional language, neural data-flow multiprocessors, neural data-flow transformations and so on. The utile descriptors concerning the elevated inclination of the data of the administered matriculation process is malformed into automated refined data flow classifiers architecture. Recital of neural classifiers plays a crucial rule to implement the acquisition process. Here, the performance results show the usefulness of data-flow neural classifiers.

Alessandro Spreduti in [10] presents the basic concepts under snip the neural networks computational and competitive. This paper illustrates the handing out of the structures through the neural networks. The inquest sphere of emblematic and sub-emblematic is a promise for the growth of perspicacious systems. The demonstration of configuration and their processing amid the emblematic systems and ANN enormously accelerates the quiescent in the compound systems. The neural network frames the connection amidst the peculiar approaches of depicting the notions.

The author K. Sookhanaphibarn et.al, in aims to broach a system which is utilized to ascertain the illustration. A structure is acquainted which intent to fetch petite peck period. Also, the structure's objective is to acquire subordinate stretch. The prevailing procedures were not practical to be applied to the colored photographs of the intimated proportion. The implementations for the verdict of the codification process are multiple stratums. The paper also widens the vertiginous and escalading proportion of the ascetic calibrating. The projected system was tested against many different shaded images with a soaring proportion of equitable codification enforced. The conformity is contrived by linking diversified categorization approaches wormed that resolves the complications of the distinguishing the regularities in the data.

The author Zheng Zan and Jun Wang demonstrates an ideology using the arrangement of neurons to present a model for the dynamic conjecturing control which is utilized for introverted distinct time disconnected systems. This kinetics of the system is stimulated by delimited qualms. The accurate non-linear facsimile of the development is not acknowledged specifically. Instead of this, a prejudice representation is used, in which, the non- linear model is decay to an affine term with an unidentified phrase that is elevated in environment. In this, the minimal and maximal escalation predicament is rephrased as an arched derogation quandary. This complication which is occurred is resolved with the assistance of a double coat recurrent ANN. This Neuro-dynamic loom is projected, in order to develop the nonlinear VPC influence the computational efficiency in a superior mode and

discard a illumination for existent accomplishment knack of the cited mechanization. The results of pretension are endowed to authenticate the efficacy and description of the intended procedure. The practice that had been implemented is with the assistance of unmodeled dynamism.

The document written by the author Praneet Dutta et.al rationale the algorithm of Supervised Machine Learning in the concept of the Engine amendment. In this, the instigator is providing with the compartment of the sphere in which we are functioning. The Supervised Machine Learning Algorithms involves ingesting the data, scrutinize the data and train from it. By feeding the data onto the system, we are instructing or building the system skilled regarding the consideration or the parameters that are key inside in the data which are inter related to one another. The Effectualness of the diverse regression models had been utilized in this method and the running was prepared by the means of neural networks. The Neural Networks by the side of with the regression models have been worn to analyze the data and prophecy for the assessment of the Engine Torque for the unlike power train systems are worn. The utility of neural networks endow us with the towering co-relation.

The authors Zhiyang Xiang et.al in [13] portrays and proposes a framework that are used for the metric learning process and entrenching with topology wise neural network. The benefit of incremental training and vector quantization abilities of ANN's eruditing the manifold topologies is used to build a depiction of the data, in order to hassle the exertion of stumpy effectiveness in both time and space in hesitant entrenching scheme such as Multi-Dimensional Scaling and Isomap. In a research the projected metric learning is used in coalescence of Support Vector Machine to decipher a semi-supervised learning (SSL) predicament. The outcome demonstrates that our projected method amplified classification meticulousness in the SSL testing. In this, a outline for metric knowledge and entrenching with topology erudition neural networks is projected. It is a cumulative exercise substitute to conservative embedding process such as MDS and Isomap. Besides, the anticipated method boost the time efficiency to coach the entrenching since the pair wise distance matrix is assemble on the vector quantization's which is noticeably fewer in number evaluate to the inventive collection.

SriramRavindranet.al in [8] expressed the idea concerning the gigantic investigation into patron attestation and slighter investigation in budging a patron. Together both the looms involve the essentials in the engagement. The predicament of the substitution of the mechanisms exerted for affirmation is with the countersign solely The preparation had been done by the means of neural network based approach is an expeditious standalone concealed coating ANN with virtuous abstract recital .This investigation endeavors to eject the fluctuations in the precision of the practiced means.

The Paper by the author Dhanalakshmi et.al surveys the outlooks opinion mining by the means of acquired computation to ascertain the polarization of assessment of the disciple based on pre-determined description of training and erudition. The learning accomplished engrosses the appliance of a amalgamation of automated erudition and information extraction techniques resting on the cited congregate. In accumulation on condition that a footstep by footstep vindication of the progression of execution of estimation mining from student annotations by means of the release source data analytics tool Rapid Miner, the document also presents a relative recital revise of the break through like SVM, Naïve Bayes, K Nearest Neighbor and Neural Network classifier. The results are evaluated to locate the enhanced presentation by way to a variety of assessment criterion for the diverse algorithms.

The Author, Nikola K. Kasabov et.al commences an innovative slant for vibrant learning, revelation and in many more proficiencies. The scheme is founded on embryonic coordinate facts of sprouting spearing neural networks elucidated by the fabrication. The projected NeuCube based course proffers also a finer classification accurateness when evaluated with customary AI and arithmetical methods. The created paradigms are unswervingly and expeditiously implementable on sky-scraping execution and low down the power expenditure and neuromorphic podium for real-time submission.

The paper described by the instigator Son. N. Tran construes the exercise of the layer wise machine learning which includes both supervised and unsupervised Machine learning for the bright amendment. This paper explores the alluded extensibility that can be constructive to the inclusion of backdrop acquaintance into deep neural networks, whether the use of the neural network can improve erudition presentation when it is accessible, and to the withdrawal of understanding from qualified deep association and whether it can proffer a better indulgence of the depiction erudite by such an arrangement. Towards the end, the exercise of effortless representative link which is represented as a deposit of reasonable regulations that we call confidence convention. This is suitable for the representation of deep networks for irrefutable reckoning. The Exercise of this mode, a deep neural–symbolic system is proposed and evaluated, with the experimental results indicating that modularity all the way through the exploitation of confidence conventions and acquaintance inclusion can be beneficial to association recital.

The author, Yohannes Tsehaya et.al in this research paper the process of expansion of a weakly supervised computer-aided detection(CAD)system that utilizes biopsy points to become skilled to categorize PC a on mp MRI. Our CAD system, which is pedestal on a deep convolution neural network construction, yielded an area under the curve (AUC) of 0.903±0.009 on a receiver operation characteristic (ROC) curve computed on 10 different models in a 10-fold cross-validation. Nine of the ten ROCs were arithmetic noteworthy. The CAD system proved to be more full-bodied in detecting high-grade transition zone lesions.

The Paper by the author, Yingyezhe Jin and Peng Li, consolidates the exaltation of Organic b calcium intonated approach for supervised loom for the domestication and sanctity of the conjunction, where supervise activist erudition is transformed by the after conjunctive enkindling aligned pigeonholed by the calcium congregation after the synapses . The projected loom thwarts conjunctive density scattering, breakthrough culture recital as well as sanctifies the congruence intervening the basin and coat which is apprehended. The paper concludes the proposal of a novel calcium-modulated governs STDP loom together for the apportionment and sanctification, intended resourcefulness recite instruction in the milieu of the liquid state machine.

Amel Hebboul in [4], proposed the identity instruction tactic in a halfway superintended erudition which coalesces crowding, and categorization. The paramount reward of utilizing this mesh of neurons is the association amid cartography perpetuation and curriculum of the input portrayal by using the bunch posterior contingencies of frame which is worked upon. It is a productive exemplary with externally antecedent circumstances such as a convenient amount of neuronal influence. The projected loom had been introduced on imitation and tangible modems. Procured outcomes are very capable.

TABLE I. COMPARITIVE ANALYSIS OF NEURAL NETWORK APPROACHES

ATTRIBUTES	AREA OF CONCERN	USING NEURAL NETWORKS(EXISTING/LATEST)
Performance	Rule-based Learning Structuring Spiking Neural Networks GPNN(Growing Probabilistic Neural Network)	Proper Task is accomplished including rule based execution. The handling of structured information is done very logically and efficiently. Neural Classifiers plays a crucial rule for the learning process. Affiliation amidst the representation of dossier preservation and classes' depiction augment performance.
Implementation	Neural Classifiers	The Neural Classifiers plays a crucial rule for the learning process.
Time and Space	Novel recognition system	The supervised learning using novel recognition system requires smaller amount of time and space.
Improvement/ Optimization	Neuro dynamic Approach	The contemplated procedure enhances the kinetics of neural energy and computational competence along with shedding leads to towering.
Quality of the product	Regression Models	Large amount of time and money are used, though the quality is same as the prior one.
Accuracy	Embedding Methods Neural networks based approach Natural language Processing Spike Timing dependant plasticity	The Classification Accuracy is increased using embedding methods since the time and efficiency required to train the embedding algorithms is fewer. A stable accuracy 87% for using ECM-ELM. Naive Bayes algorithms is outperformed The proposed approach outperforms a baseline up to 25%.
Precision	Natural Language processing	KNN (K Nearest Neighbor) algorithms which are used are best in terms of precision.
Scalability	Spiking neural networks	The statistics of MRI is unswervingly as well as resourcefully feasible on elevated recital.
Modularity	Layer wise Combination of both Supervised and unsupervised.	A Deep Learning network with the layer wise can be sighted as an aggrandized commutable scheme. Modularity through the use of confidence rules and knowledge insertion is beneficial to hardware performance.
Robust	Convolution Neural Networking	The System proved to be more robust in detecting high grade transactions.

CONCLUSION

This paper discusses the importance of supervised machine learning and its usage in various grounds. Further, the paper describes the diverse techniques or approaches that are used to distinguish the supervised machine learning algorithms with the use of neural networks among various attributes. The use of rule-based techniques leads to proper task accomplishment. The use of Spiking neural networks enhances the accuracy of supervised machine learning and thus, improving the efficiency. It has also been observed that the utility of convolution neural networking makes the system massed robust. Different parameters distinguish different approaches for supervised machine learning. The use of neural networks is going to be in every enclosure of various domains ranging from Deep Learning algorithms, Medicine, Embedding systems and many more. In addition, it has been identified, that by the comparative analysis done for the different approaches of supervised machine learning using neural network provides us with enhanced repercussion than the preceding one.

REFERENCES

[1] Dhanalakshmi, V., Bino, D., & Saravanan, A. M. (2016). Opinion mining from student feedback data using supervised learning algorithms. *Big Data and Smart City (ICBDSC), 2016 3rd MEC International Conference on.* Muscat, Oman: IEEE.

[2] Dutta, P., Sharma, S., & Rathnam, P. A. (2015). Engine performance optimization using machine learning techniques. *SAI Intelligent Systems Conference (IntelliSys), 2015.* London, UK: IEEE.

[3] Handelman, Lane, & Gelfand. (1989). Integration of knowledge-based system and neural network techniques for autonomous learning machines. *Neural Networks, 1989. IJCNN., International Joint Conference on.* Washington, DC, USA, USA: IEEE.

[4] Hebboul, A., Hachouf, F., & Boulemnadjel, A. (2015). Using a Growing Probabilistic Neural Network to reinforce a Semi Supervised Support Vector Machine. *Programming and Systems (ISPS), 2015 12th International Symposium on.* Algiers, Algeria: IEEE.

[5] Jin, Y., & Li, P. (2017). Calcium-Modulated Supervised Spike-Timing-Dependent Plasticity for Readout Training and Sparsification of the Liquid State Machine. *Neural Networks (IJCNN), 2017 International Joint Conference on.* Anchorage, AK, USA: IEEE.

[6] Kasabov, N. K., Doborjeh, M. G., & Doborjeh, Z. G. (2016). Mapping, Learning, Visualization, Classification, and Understanding of fMRI Data in the NeuCube Evolving Spatiotemporal Data Machine of Spiking Neural Networks. *IEEE Transactions on Neural Networks and Learning Systems* , 887 - 899.

[7] Kim, S., Suwunboriruksa, K., Herath, S., Jayasumana, A., & Herath, J. (1992). Algorithmic transformations for neural computing and performance of supervised learning on a dataflow machine. *IEEE Transactions on Software Engineering* , 613 - 623.

[8] Ravindran, S., Gautam, C., & Tiwari, A. (2015). Keystroke User Recognition through Extreme Learning Machine and Evolving Cluster Method. *Computational Intelligence and Computing Research (ICCIC), 2015 IEEE International Conference on.* Madurai, India: IEEE.

[9] Sookhanaphibarn, K., Raicharoen, T., & Lursinsap, C. (6-9 Dec. 2004). A supervised neural network approach to invariant image recognition. *Control, Automation, Robotics and Vision Conference, 2004. ICARCV 2004 8th.* Kunming, China, China: IEEE.

[10]   Sperduti, A. (1997). An overview on supervised neural networks for structures. *Neural Networks,1997., International Conference on.* Houston, TX, USA, USA: IEEE.

[11]   Tran, S. N., & Garcez, A. S. (2016). Deep Logic Networks: Inserting and Extracting Knowledge From Deep Belief Networks. *IEEE Transactions on Neural Networks and Learning Systems* , 1-13.

[12]   Tsehay, Y., Lay, N., Wang, X., Kwak, J. T., Turkbey, B., Choyke, P., et al. (2017). BIOPSY-GUIDED LEARNING WITH DEEP CONVOLUTIONAL NEURAL NETWORKS FOR PROSTATE CANCER DETECTIONON MULTI PARAMETRIC MRI. *Biomedical Imaging (ISBI 2017), 2017 IEEE 14th International Symposium on.* Melbourne, VIC, Australia: IEEE.

[13]   Xiang, Z., Xiao, Z., & Wang, D. (2016). A Framework for Metric Learning and Embedding with Topology Learning Neural Networks . *Natural Computation (ICNC), 2015 11th International Conference on.* Zhangjiajie, China: IEEE.

[14]   Yan, Z., & Wang, J. (2013, August 20). Robust Model Predictive Control of Nonlinear Systems With Unmodeled Dynamics and Bounded Uncertainties Based on Neural Networks. *IEEE Transactions on Neural Networks and Learning Systems* , 457 - 469.