A REVIEW ON THE APPLICATIONS OF DEEP LEARNING TECHNIQUES

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Abstract

DL is a branch or a subset of Machine Learning. In DL, each layer realizes how to change the given data to a progressively unique and combined portrayal. The word "deep" in DL signifies that the absolute quantity of levels in between the input is changed. There are diverse DL structures like DNN, RNN and CNN. It is utilized in numerous fields which incorporate face book, twitter, Instagram post refining, computer vision identification, NLP, sound acknowledgement etc., In every one of these cases they create results equivalent to, outperforming, human expertise execution. [1]

Keywords : Deep Learning, Machine Learning, Artificial Neural Networks, Machine Health Monitoring Systems (MHMS), Cerebrovascular Accident(CVA).

I INTRODUCTION

Rina Dechter and Igor Aizenberg and associates introduced the term 'Deep Learning' in ML and ANN respectively. In this paper we are trying to introduce different - architectures and applications of deep learning methods. [1]

The most broadly-utilized designs of Deep Learning are,

A. Convolutional Neural Networks (CNN)

CNN architecture is very efficient for visual recognition applications. If a particular section of an image is learned then CNN is able to recognize that segment present anywhere else in the image. The size and the quality of the training data are very important for CNN and is highly dependent on it. This architecture is highly susceptible to noise. [2]

B. Recurrent Neural Networks(RNN)

RNNs are used where ever the order or sequence in which the information presented is very important. It is used in domain spaces such as NLP, speech synthesis and machine translation. An RNN reduces the number of parameters because it shares the same parameters across all steps. One disadvantage of RNN is that it is hard to find long-term dependencies. This situation arises when there are many words between a naming word and its action word in a big paragraph or sentence. [2]

C. AutoEncoders

AutoEncoder is an unsupervised Artificial Neural Network. Backpropagation in an unsupervised environment is the principle used in Autoencoders. The main function of AutoEncoders is to identify, encode and compress the data and then remove the noise from them and represent back the encoded, compressed data to a representation or output signal that is very close to the input data. AutoEncoders use multiple hidden layers to represent data. [2]

D. Generative Adversarial Networks

Generative Adversarial Networks (GANs) comprises of two models - namely generator model and discriminator model. Both are separate deep learning systems (like CNN) and are trained simultaneously. The generator model generates new samples and feeds the discriminator along with the original sample from the domain. The discriminator model then classifies it as to whether it is original or generated by generator. The generated sample is so accurate that it is

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indistinguishable from the original one. Each time the discriminator classifies the data it becomes more and more accurate in distinguishing between original and fake.[2]

E. ResNets

ResNets are mainly used in Image Processing tasks. The main problem with deep networks is vanishing gradient problem. So, when we use a large number of layers the accuracy may degrade because of the vanishing gradient problem. Residual Network or ResNets consists of a skip function that skips one or more layers. This enables us to go deeper and deeper in the network, and when-ever needed, based on some identity function we can skip some layers as it seems unimportant for a particular case. Thus, the vanishing gradient problem can be reduced. [2]

In this review paper we are focusing on the applications of Deep Learning. Our review paper is organized thus: Section 1 introduces Deep Learning concept and its Architectures, Section II focuses on literature review and Section III gives the conclusion.

II LITERATURE REVIEW

[3] Justin Ker, Lipo Wang, Jai Rao, and Tchoyoson Lim, in their paper titled "Deep Learning Applications in Medical Image Analysis" in "IEEE Access" gave an overview of applications of different ML techniques in clinical picture examination. They discussed various Machnie Learning architectures but gave more importance to CNN. The authors emphasized the use of Computer Image Analysis in medical field because the medical records are now digitized. Digital Medical reports are semi-structured to some extent. They concluded their paper by pointing out some obstacles in this area and also mentioned some future directions.

[4] In the paper titled "Deep learning and its applications to machine health monitoring" in the publication, "Mechanical Systems and Signal Processing", Rui Zhao, Ruqiang Yan, et al. summarizes the performances of DL-based MHMS. They came to a conclusion, based on a comparison between four categories of Machine Learning frameworks such as: CNN, Auto encoder, RNN and Restricted Boltzmann Machine models. When contrasted with traditional ML models, DL models can accomplish better performance in machine health monitoring. The performance of Auto Encoder architecture in MHMS can be enhanced by pre-training and denoising techniques. They instituted that Convolutional Neural Networks variations, and, Long Short-Term Memory could effectively deal with automatic fitness examination. They found out the capacities of these Deep Learning techniques, especially illustrative learning for complex hardware data and target estimate for various machine wellbeing checking assignments. They found that DL based MHMS did not need much human labour and expert knowledge. This meant that the end-to-end structure could outline fresh unprocessed machine input to output. So, the use of DL models were not confined to a particular sort of devices, but tended to be utilized as a common answer to address the MHM issues.

[5] Kehl K. L., Elmarakeby H., and et al. in their paper "Assessment of Deep Natural Language Processing in Ascertaining Oncologic Outcomes from Radiology Reports", attempted to recommend their discoveries from an accomplice investigation of 2406 patients with lung malignant growth. As indicated by them, DL models like DNLP could gauge human identification of the discoverability of malignant growth, malignant growth aggravation, and malignancy advancement/reaction in medical reviews with great distinction. This was an effective and fast method to review medical records, and create proof with regard to viability of treatment approaches and provide decision making support. Real world cancer outcomes from unstructured Electronic Health Reports gave the impression of being practical. This procedure has the ability to expand limit to study from the huge populace of sufferers have malignant growth whom get treatment beyond the health centre preliminary setting.

[6] Adrian Carrio, Carlos Sampedro, et al. in their paper "A Review of Deep Learning Methods and Applications for Unmanned Aerial Vehicles" in "Hindawi Journal of Sensors", assessed Deep Learning applications in Unmanned Ariel Vehicles. The authors tried to give a broad idea about Aerostack architecture, which was an ariel robotics architecture. For feature extraction from the data obtained from various image sensors, acoustic sensors, radars etc., they found CNN to be is the most commonly used architecture. For Planning and situational awareness and motion control they proposed CNN and its variants. In addition to these recommendations, they coined some challenges currently faced in Deep Learning Techniques based on UAV Technology. Systems like feature extraction systems needed big computational resources. It was difficult to integrate the computational resources to on board UAVs, and it required high capability communication services and off-board processing.

[7] The paper by Daniele Ravi, Charence Wong, et al. titled "A Deep Learning Approach to on-Node Sensor Data Analytics for Mobile or Wearable Devices", in IEEE Journal of Biomedical and Health Informatics, discussed a DL approach in wearable devices, where on board data analytics was performed. On node computation in wearable devices suffered some problems due to resource constraints. They introduced a strategy that combined hand-crafted features and extracted features from a deep learning approach for time-ordered data-characterization. The outcomes demonstrated that when utilizing the above-said features alone showed less precision than when they were utilized jointly. This strategy solved many problems that regularly come in a DL system when on-the-board calculation is needed. They also performed pre treating of frequency-based data prior to passing the data to DL framework that optimized the result. The classification precision of their model was assessed against different base strategies utilizing lab and real-world data sets together. According to them, the calculation times for this strategy were reliable with the requirements of live on board calculations on advanced smart cell phones and wearable sensor platforms.

[8] In the paper titled "Mobile Big Data Analytics Using Deep Learning and Apache Spark", published in IEEE Network Mohammad Abu Alsheikh, Dusit Niyato, and et al. studied the importance of DL in MBDA using Apache Spark model. Some of the advantages of DL in MBD included, (1) Deep Learning provided high accurate results. (2) DL could generate inherent features automatically and (3) DL could learn from unlabeled data, which was simple and modest to gather. A few difficulties in utilizing DL in MBD analysis proposed by the authors were as per the following. (1) When performing Data Analytics, use of full available Big data increases the computational burdens. (2) Optimizing the parameters using Gradient based learning was computationally very costly. (3) Mobile Big Data was very volatile; so, different Deep Learning Models were needed to tackle the situation. To handle this, they proposed an Apache Spark framework model. In paper they admitted that this framework did not tackle the veracity side of Mobile Big Data.

[9] According to Carlos M.J.M. Dourado Jr, Suane Pires P. da Silva et al. in the paper titled "Deep learning IoT system for online stroke detection in skull computed tomography images" published in Computer Networks, claimed that it was conceivable to recognize and categorize CVA in cranium utilizing Computed Tomography pictures. Internet of Things was included to do this online. Joint utilization of CNN and BC, MLP, KNN, RF and SVM was utilized to distinguish the occurrence of a stroke. As per the conclusion by the authors, CNN was the best approach because it accomplished 100% result in all factors in the evaluation matrix.

[10] According to He Li, et al., in the paper titled "Learning IoT in Edge: Deep Learning for the Internet of Things with Edge Computing" published in Edge Computing for the Internet of Things, talked about the importance of DL ideas for Internet-of-Things into the edge-computing area. They designed an overloading strategy to overcome the limited processing capability of edge computing. In the examinations, they picked ten diverse Convolution Neural Network models as the DL system and gathered halfway information magnitude and calculation expenses from pragmatic DL implementations. The consequences of the authentic monitoring showed that their answers could expand the quantity of steps conveyed in edge-servers with ensured Quality of Service prerequisites.

[11] In the paper titled "Twitter Sentiment Analysis with Deep Convolutional Neural Networks", published in SIGIR, Aliaksei Severyn et al. suggested a new DL system for an emotion study of titter posts. The fundamental core interest of the new system suggested in this paper was to initialize weights to parameters, in a Convolutional Neural Network. Providing good inilialization parameters would give accurate results. So, they proposed a three-stage procedure to teach the attributes of the network. In the first step, they initialized the word-embeddings using an unsupervised neural model. In the second step, for refining a large embedding distant supervised corpus they used a CNN. And in the third step, they used the word-embeddings and other parameters obtained from the above steps to initialize the network; then they used it to train it on a supervised data. This model proposed a DL perspective for sentiment analysis to foretell the polarities of twitter tweets. The prediction was performed on both phrase level and message level. An examination between the consequences of this methodology and different frameworks on testing, proposed that this approach be positioned in the initial two places in phrase level and message level subtasks.

[12] According to Muhammed Ali Sit, et al., in the paper titled "Identifying disaster-related tweets and their semantic, spatial and temporal context using deep learning, natural language processing and spatial analysis: A case study of Hurricane Irma", published in International Journal of Digital Earth, it was possible to perform space-time study of big-data from social media during any disaster, so that we could extract necessary data about affected locations to support environment-monitoring during disaster management. Though this paper they introduced a new method that was a mix of deep learning, NLP and space time study to recognize the substance, topographical areas and time-data-calamity related social-media-based posts. After math they performed a binary-classification of calamity-based twitter posts using Long short-term memory. They used Latent Dirichlet Allocation to extract the minute facts of data about the situation of calamity. It additionally grouped each post with various names, for example, impacted person and alerts and guidance. They obtained information before the disaster, during the disaster and aftermath of the disaster. The methodology suggested by the authors in this article could be used during a disaster. This model gave live information of harm caused and caution information, and provided informed decisions by evaluating the circumstance in affected regions.

[13] In the paper titled "An Intelligent Traffic Load Prediction Based Adaptive Channel Assignment Algorithm in SDN-IoT: A Deep Learning Approach", published in, IEEE Internet of Things Journal, Fengxiao Tang et al. published in, IEEE Internet of Things Journal, suggested a new DL method for traffic-haul forecast technique to foresee the future traffic-jam and internet traffic overcrowding. For high speed transmission in IoT assigning suitable channels was mandatory. In this paper they proposed SDN-IoT for reliable transmission. This article proposed step-by-step process to achieve efficient traffic. First they used a deep learning technique called CNN to foresee the traffic-

congestion. Then, as the next step, they proposed an intelligent algorithm to distribute lines intelligently to each connection in Software Defined Network: Internet of Things, which they named as DPPOCA. Finally, they combined the above-mentioned traffic prediction and channel assignment together and proposed a new intelligent channel assignment model called TP-DLPOCA. This algorithm could smartly avoid traffic overcrowding and allocate appropriate lines to the radiotelephony connections of Software Defined Network – Internet of Things rapidly. The proposed method outperformed the conventional channel assignment problem upon extensive simulation.

[14] In the paper titled "Data Mining Applications in Healthcare", published in Journal of Healthcare Information Management, Hian Chye Koh and Gerald Tan, , discussed uses of DM in healthcare. They also pointed out some limitations of applying Deep Learning techniques in Health Care. One significant limitation was the openness of data. The input data for DM were frequently present in different forms and frameworks, like management, health centers, labs and more. So the input data must be gathered and preprocessed before Data mining process. Data warehousing implementation was costly, Distributed network topology was one of the solutions mentioned. Secondly, the absence of a standard clinical jargon was another issue in information mining. The accuracy of the result obtained after mining relied on the quality of the information fed into the deep learning system.

[15] In the paper titled "Credit Card Fraud Detection using Deep Learning based on Auto-Encoder and Restricted BoltzmannMachine", published in International Journal of Advanced Computer Science and Applications, Apapan Pumsirirat and Liu Yan, aimed to focus on credit card fraud incidents in real time that was not possible to be identified upon past encounters or managed learning. They suggested a framework of deep AE and Restricted-Boltzmann-Machine which had the capability to recreate normal transactions so that we could discover irregularities from ordinary examples. The cited DL method was built upon AE. This was an unmanaged studying method. In this, back propagation method was used by setting the sources of info equivalent to the yields. The outcomes demonstrated that AutoEncoder and Restricted-Boltzmann-Machine in DL could precisely identify bank-card cheats.

[16] In the paper titled "Deep Learning Detecting Fraud in Credit Card Transactions", published in IEEE, Abhimanyu Roy et al analyzed four DL methods namely ANN, RNN, LSTM and GRU for detecting credit card fraud. They utilized a dataset which contained around 80 million master card exchanges that were pre-marked as false and real. The LSTM and GRU model altogether beat the standard ANN. The timestamp information of transactions gave necessary information to categorize genuine and non-genuine transactions. The results of testing showed that whenever the size of network was big, the performance also increased.

[17] Yair Rivenson et al. in their paper "Phase recovery and holographic image reconstruction using deep learning in neural networks" in Light: Science & Applications, demonstrated that a CNN, could do phase recovery and holographic image recreation after training. This design evacuated twin picture issue and self-obstruction-related relics by utilizing a single hologram intensity. When contrasted with the other existing holographic phase recuperations, this CNN model was quicker in processing and reproducing better holographic images of the items with a smaller number of estimations.

III CONCLUSION

This review paper presented a short summary of DL technique and its applications along with its architectures. We discussed various applications of DL in different domains in the paper, and found that Deep Learning was a

powerful area with a lot of architectures to handle supervised and non-supervised data from a variety of sources. Deep Learning methods were used in Medical Image Processing and Machine Health Monitoring Systems. Another medical area was to extract relevant cancer outcomes from radiologic reports. Deep learning methods had excellent abilities to study data representations from sensor data. Deep Learning methods had the ability to do on board sensor data processing for cell phones or wearable devices. The DL frameworks could be used to detect bank-card fraud successfully. The LSTM and GRU models were found to be the best in distinguishing between genuine and non-genuine credit card transactions. Auto-encoder and Restricted-Boltzmann-Machine in DL could also identify the genuineness of bank-card transactions. Deep learning architecture CNN was a perfect tool for making predictions from the data collected from sensors. Mobile big-data analytics could also be successfully performed by Deep Learning. LSTM methods were used to perform sentiment analysis of twitter tweets during disasters. CNN framework was excellent in recovering holographic images and reconstructing improved phase and amplitude pictures of the things with minimum number of measurements.

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