

A COMPARATIVE ANALYSIS ON APPLICATIONS, TOOLS AND TECHNIQUES OF DEEP LEARNING

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Received: 16 March 2020 Revised and Accepted: 17 June 2020

ABSTRACT: Nowadays, many frauds and issues are happening due to credit card and online payment transactions, which results, mistrust of people on government systems. Such issues could cause bad results in economy and developing behavior of the country. Sometimes, bank robbers tend to be real during the middle of the thievery, but they get detected due to recognition of their suspected behavior, wrong biometric and face recognition. Due to these features, Machine Learning(ML) is now being used in different fields worldwide to defend online scams. To deal with such challenges, Deep Learning(DL) can be used, which is a subpart of ML. There could be many approaches of DL to resolve various problems related to text recognition, handwriting identification, character detection, speech identification, weather prediction and many more. This article discusses- various algorithms of DL, applications, tools and techniques used to solve the given challenges. Furthermore, datasets are also specified, which are used to deal with the problems.

KEYWORDS: CNN, ANN, Machine Learning, Deep Learning, RNN

I. INTRODUCTION

ML has established a reputed role in solving many problems including credit card scams, text identification, Mathematical Programming Problems(MPPs), speech recognition along with handwriting recognition. As a result, ML is flourished in worldwide region. Due to spread of ML, a new concept called DL came in the field, which can perform number of tasks in the area of Artificial Intelligence(AI).

DL can further have many algorithms, where most of the time people use- Convolutional Neural Networks(CNN) and Recurrent Neural Networks(RNN) approaches [1]. CNN is very famous approach for solving the challenges in computer vision such as classification of images, face recognition [2] and voice identification, whereas, RNN deals with the sequence challenges [3]. A CNN extracts the characteristics from the videos and images, which could generate the result of compression and hence it can give birth to the solution for image classification issues. CNN is also identified as the potential clarification for image and video compression challenges [4]. The perfect identification of face can be done by using some key points which are- sex, age, uniqueness, posture and expressions [2]. Face recognition can be used in the area of biometrics, vigorous verification on devices, law implementations, self-driving automobiles, online transactions and many more. DL can be implemented to deal with voice identification challenges, it could improve the learning behavior of a machine, computer can understand what a human is saying and what type of tasks a human can perform [5]. MPPs contain the information about the challenges in the field of the structure of mathematical object function and number of limits in many arrangements so that, it can identify the solution for the challenges [6]. There can be many kinds of NNs- RNN, Feed Forward NN, Hybrid NN, Self-Organizing NN, Radial Basis Function NN and many more [7]. These NNs can be applied to solve the challenges in area of MPPs. Chebyshev Functional Link Artificial Neural Networks(CFLANN) Could be better for detection of credit card scams. ANN is the approach to detect online credit card payments frauds [8]. It is also famous for the prediction of stock market, which is a developing sector in every region of the country [9]. Number of people are involved in this sector through direct or indirect contact. Hence, it is a need for the people to know about the recent trends in the stock market field. RNN is used to forecast of contextual radiation levels depending upon prior available 40 weather and dimensional information [10].

Rest of the structure of article is described as- Section II contains the information about basic applications of DL. Section III consists of literature survey of the ML approaches. Further, Algorithms, datasets, tools and applications of ML approaches are described in the form of table in section IV. Section V includes the future scopes. Finally, conclusions are given in section VI.

II. BACKGROUND

Various applications of DL are given below in Fig 1. [2,4,7-9,11-17]-

A. Face recognition- It is the first step of any authentication procedure [2]. The result of the face recognition approach is always face positions. The tool which is used to recognize the face should always be vigorous towards expressions, postures, costumes, and make-over.

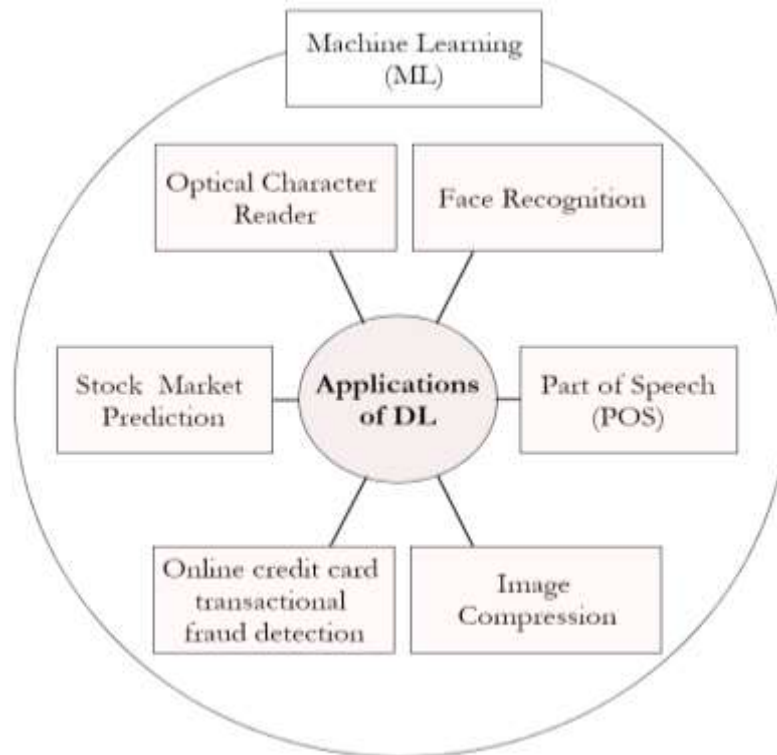


Fig1. Applications of DL

B. Optical Character Reader(OCR)- It is a technology, which is utilized to read the scanned and modified text, which is in the form of a print [11]. It can have non-cursive or cursive style. It consists of the process of scanning and decrypting the manmade text optically [12]. In this technique, number of pc softwares are used to detect the characters in the field of IoT [13].

C. Stock market prediction- Stock market is the platform to which most of the people are connected through direct or indirect contact [9]. It is a developing field in many countries, it consists of demand and supply of share efforts. This technique can be utilized in the field of finance [14]. But, it can face number of issues.

D. Part of Speech(POS)- POS is a technique, which is initially used for analysis of language text in the field of machine conversion, voice recognition and many more [15]. It is a method, which categorizes the words into small parts [16]. These parts could be verb, preposition and noun.

E. Online credit card transactional fraud detection- Nowadays, the main matter of concerns, are online payments and using the cards for making payments of goods [8]. Usually, the scams come up due to online transactions [7]. These issues can be solved by using Naïve Bayes, Decision Tree (DT) and Neural Networks (NN).

F. Image compression- It is a technique, which provides a possibility of keeping high quality videos and images within a limited storage [4]. This process can be directly applied to compressive sensing camera [17].

III. LITERATURE REVIEW

An experiment has been made on two datasets i.e. Chinese and English datasets [1], by consolidating CNN with RNN, an algorithm called Convolutional RNN(CRNN) has been applied to identify text. And resulted, CRNN as more accurate for classification of Chinese and English text.

An innovative face identifier tool called Deep Pyramid Single Shot Face Detector (DPSSD)based on Deep Convolutional Neural Networks(DCNN) has been proposed by [2]. This tool recommended a reckless property and had a capability to detect the face, which was having huge disparities along with small faces. Another

concept i.e. crystal loss function, was also created, which enabled face detection and authentications. It limited the feature descriptor to lie on a hypersphere, which has a definite radius, by increasing and decreasing the space of angles among negative subject sets and positive subject sets respectively. An experimental conclusion of facial recognition and verification was also generated based on IJB-A, IJB-B, IJB-C and CS5 datasets.

A residual dilated CNN with conditional random field(RD-CNNCRF) has been proposed to identify Chinese clinical named entities job [3]. A task called dictionary characteristic was used to identify hidden entities and a Character sequence labeling was directed to prevent the presence of noise in Chinese. Resulted RD-CNNCRF as better algorithm for identification of Chinese as compared to RNN algorithms.

With the increase and growth in NNs, different compression algorithms have been discussed and development of NNs algorithms are applied to images along with videos [4]. Many methods including HEVC structure and cutting – edge video coding are discussed and resulted the algorithm as best and worst suited for JPEG2000 and HEVC frameworks respectively.

An analysis has been made based on voice recognition by using DL algorithms [5]. Surveyed articles from 2006 to the present and concluded that there is a need to apply DRNN on speech identification field.

Many NN algorithms are experimented to solve different MPPs [6], also a grouping of MPIs has been made. Concluded NNs as non-satisfactory algorithm to deal with complex and difficult problems.

A comparison among K-Nearest Neighbor (KNN), DT, Naïve bayes, NNs and Logistic regression algorithms has been done [7] to identify the frauds in credit cards and concluded KNN as the best suited algorithm for the issues with an accuracy of 0.9913%.

A NN based system, which focused on information handling, cost metric assessment and imbalanceness has been applied on real life dataset to identify banking scams [8]. And concluded that the system performed better in case of cost.

A comparison has been done between three NN based algorithms i.e. Levenberg-Marquardt, Scaled Conjugate Gradient and Bayesian Regularization in order to predict stock market [9], it was applied on 15-minute and tick by tick datasets. Which resulted, SCG and Bayesian regulation as best algorithm among three in case of 15 minute and tick by tick dataset respectively. But when both datasets results were compared, it was concluded that the correctness of tick by tick dataset was better as compared to 15-minute dataset.

In order to predict radiation information and historical weather data, RNN has been applied on two datasets, each dataset was consisting of different levels of noise [10]. Resulted that RNN performed better for both high noise dataset as well as low noise dataset.

A RNN based bidirectional long short-term memory (BLSTM) algorithm was used to identify handwritten text from a UrduNasta'liq dataset [11]. This algorithm utilized a RNN based BLSTM network, bidirectional RNN and LSTM construction, where, BLSTM was well known for structure knowledge. Concluded that with the increase in duration there is an increase in units of hidden memory.

An approach based on Fully CNN was applied to identify the characters, this approach didn't have any dictionary limits and it can predict indefinitely [12]. This algorithm was resulted, very good at identifying the character, words along with unlimited symbol tabs i.e. contact number, last names as well as abbreviations.

A DL supported OCR algorithm has been applied for refining the accuracy problems in the field of IoT [13]. An experiment has been done on a Chinese upper case datasets and a comparison among four algorithms i.e. Visual Geometry Group(VGG), Capsule Network(CapsNet), Residual Network(ResNet) and CNN was made. It resulted CapsNet and ResNet as most accurate algorithms for the dataset with an accuracy of 99.38% and 99.17%, respectively.

In context with finding out the stock worth, an Artificial NN was consolidated with Autoregressive Integrated Moving Average (ARIMA) [14]. CNN and Generative Adversarial Network(GAN) was also used as a predicting model for stock prices. And concluded GAN as better approach for prediction of stock price as compared to other ML approaches.

In order to identify Urdu POS, ML and DL models have been used [15]. A performance evaluation was also constructed based on Support Vector Machine (SVM), Conditional Random Field (CRF), DRNN and Hidden Markov Model(HMM). Concluded, CRF as the best approach for the implementation of Urdu POS using CLE dataset whereas, DRNN outperformed in case of BJ dataset.

A tagger has been proposed [16] to assess biomedical POS by utilizing DNN architecture. It uses three DNNs, which were LSTM, GRU and RNN. Concluded that Bidirectional LSTM, bidirectional GRU and

Bidirectional RNN outperforms rather than simple LSTM, GRU and RNN. The developed model attained 94.80% correctness.

A DCNN has been applied to solve the issue of reconstruction/inverse in Compressive Sensing(CS) [17]. Resulted, the improvement in the performance in case of hard expression of analytics and reduction in reconstruction computational duration.

An algorithm called 1-Dimensional CNN(1-DCNN), has been implemented to identify Online Handwritten Chinese Character Recognition(OLHCCR) rather than 2-DCNN and RNN [18] and resulted 98.11% and 97.14% accuracy on IAHC-UCAS2016 and ICDAR 2013 datasets, respectively. Which applies, 1-DCNN as better algorithm for OLHCCR.

A Deterministic Annealing NN(DANN) has been applied to deal with graph partitioning, which was a traditional natural processing combinatorial issue [19]. A function called entropy class barrier was constructed at start and resulted that DANN performed better by taking a route of issue's lowest points including all parameters in a reducing form from highest positive point to 0. A comparison has been also made among different algorithms i.e. MM, KLM, RSP, RGSP and DANN and concluded that DANN performed 16.30% better than others to solve graph partitioning issue.

An evaluation has been comprehended for text identification based on many script classifiers i.e. naïve bays, KNN, SVM, NN and DT [20]. A survey was also performed for wrapper, embedded, filter and hybrid feature selection techniques.

A framework has been proposed based on graph capsule recurrent CNN, which was highly efficient for identification of large scale multi label text [21]. At first, the framework, converted the document into a representation in the form of a matrix, which avoided large space and native chronological semantics. This matrix was implemented as the input to proposed system and resulted the algorithm as the better solution for identification of large-scale multi-label text.

An image-text double NN has been applied for arrangement of small modelled images [22]. This model was divided into two sub models, each one was for image and text classification respectively. An approach is also proposed to recover the performance and concluded, the efficacy of the proposed model by looking at nominal and quantitative results of the ideal.

An operative consolidation of tree kernel components based on NN was constructed for solving the issue of binary classification [23]. This method permitted improved capture of semantic connection among two small parts of texts such as number of queries and solutions etc. Along with it, another model was also developed for selection and collection of meaningful texts in order to decrease the rate of calculation cost and noise. For this model, LSTM network was utilized for the detection of finest subtrees among syntactic parsing of queries, further these evaluations were used for tree kernel oriented ranker.

Explored many ML approaches, and a model was created using SVM, Logistic Regression and different algorithms of NN [24]. An evaluation has been done and resulted RNN as the best approach for solving the challenge of recognition of paraphrase tasks. In context with this, plagiarism identification was taken as the most useful section, where, paraphrase recognition can be applied successfully.

A system was presented for distinctly applying deep belief network and autoencoder NN on a DUC 2007 dataset, [25]. This system was assessed by utilizing norms of ROUGE-1 and ROUGE-2. In order to find out the better performance, the results were evaluated and autoencoder NN was concluded as better approach over deep belief network.

Constructed a spell checker, which uses trie dictionary for the storage of Punjabi words [26], it used a n-gram and a tree oriented approach to recognize the words, which were spelled incorrectly. Rule based algorithm was also consolidated with LSTMCNN to make misspelled words as correct words. Many rules were also used to do the correction among different Punjabi words.

Different spell checkers were used to find out the accuracy of words [27], concluded that different languages utilize different spell checkers. Damerau-Levenshtein was evaluated as the supreme spell checker among all. For checking the spelling of Arabic words a RNN has been used.

In context with finding out the accurate answer of the MCQ questions, a transformer oriented NN has been constructed, it enabled the extraction of chronological features and total information from the sentences of question and answers [28]. WikiQA dataset was used to identify the conclusions, which resulted transformer based NN performed better in conditions of assessment metrics.

IV. SUMMARY OF STATE OF ART

This section summarizes existing literature work on algorithms, datasets, tools and applications of ML approaches as shown in Table 1

Table 1. Summary of algorithms, dataset used, tools/techniques and applications of DL

Article	Year	Algorithm	Data Set	Tools/ Techniques	Applications
[1]	2019	CRNN	English & Chinese dataset	Jieba	Text detection
[2]	2018	CNN	IJB-A, IJB-B, IJB-C, CS5	DPSSD	Face recognition
[3]	2019	RD-CNNCR, RNN	CCKS-2017	-	Chinese clinical named entity recognition
[4]	2018	CNN	-	H.264/ AVC	Video & Image compression
[5]	2019	DRNN	-	-	Speech recognition
[6]	2019	FFNN, RNN, ANN, RBFNN	-	Fuzzy Logic Method	Solution for MPPs
Article	Year	Algorithm	Data Set	Tools/ Techniques	Applications
[7]	2018	KNN, DT, Naïve Bayes, NN, Logistic regression	European cardholder transaction dataset	-	Credit card scam detection
[8]	2017	ANN	A dataset given by BBVA	Batch Normalization	Online card payment fraud detection
[9]	2019	SCG	15minute, tick by tick dataset	Gauss Newton	Stock market
[10]	2018	RNN	-	-	Weather forecast
[11]	2017	BLSTM, RNN	Urdu Nasta'Liq	-	Handwriting recognition
[12]	2018	Fully CNN	NIST block	-	Character identification

			based		
[13]	2019	VGG, CapsNet, ResNet, CNN	Chinese uppercase	DP OCR technique	OCR
[14]	2019	ANN, ARIMA, GAN, Support Vector Regression	-	-	Stock market price prediction
[15]	2019	CRF, SVM, DRNN, HMM	CLE, BJ	-	Urdu POS recognition
[16]	2019	RNN, LSTM, GRV	Dataset from GENIA	-	POS identification in biomedical field
Article	Year	Algorithm	Data Set	Tools/ Techniques	Applications
[17]	2019	DCNN	Berkeley segmentation	-	Image compression
[18]	2018	1-DCNN	IAHCC-UCAS 2016, ICDAR 2013	-	OLHCCR
[19]	2019	DANN	-	Metis method	-
[20]	2018	Naïve Bayes, KNN, SVM, NN, DT	-	Feature selection	Text recognition
[21]	2019	Capsule RCNN	Benchmark dataset	-	Large scale multi-label text recognition
[22]	2018	Image Text dual NN	UIUC Sports	-	Image classification
[25]	2019	Deep belief network, Deep autoencode	DUC 2007	ROUGE	Text identification

		r NN			
[26]	2015	LSTM	Trie dictionary	Spell checker	Punjabi Spelling check and correction
[27]	2019	RNN	Social media dataset	3-gram method	Spelling check
[28]	2019	Transformation oriented NN	WikiQA	Linguistic tool	Answer selection in MCQs

Various tools and techniques used for implementing applications of DL are given in Fig2.

1. **Jieba**- This tool is used by [1], to do separation of Chinese text among data [1].
2. **DPSSD**- This tool is used as a face detector by [2].
3. **H.264/AVC**- It is a tool, which is used by [4], to get the video compression results.
4. **Fuzzy Logic Method**- This method is used by [6], to get the solutions of MPPs.

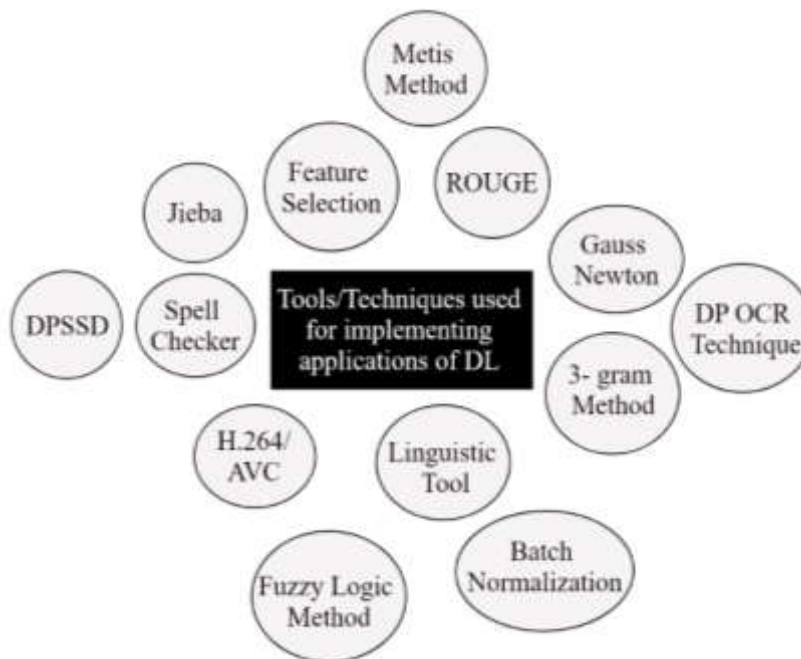


Fig 2. Various tools and techniques used for implementing applications of DL

5. **Batch Normalization**- This technique is applied on ANN by [8] to identify online credit card fraud.
6. **Gauss Newton**- This technique is used by [9], to predict stock market.
7. **DP OCR technique**- This technique is used by [13], in OCR.
8. **Metis Method**- This method is used by [19], for reading capital Chinese character.
9. **Feature Selection**- This method is used by [20], to text identification.
10. **ROUGH**- This tool is used by [25], for identifying text.
11. **Spell Checker**- This tool is used by [26], for spelling check and correct in Punjabi.
12. **Gram Method**- This method is used by [27], to check spelling.

13. Linguistic Tool- This tool is used by [28], to do correct answer selection in MCQs.

V. FUTURE SCOPES

There are some challenges in face identification which need to be solved and it is important to develop some hypothetical knowledge about DCNN oriented systems [2]. Number of features and approaches could be applied to solve word and text identification by using language modeling and dictionary in future [11]. There is another option to develop a socialite DL oriented POS scheme [15].

VI. CONCLUSIONS

The idea of using DL approaches, in the field of finance and stock market is to avoid frauds. There could be many approaches of DL to resolve various problems related to text recognition, handwriting identification, character detection, speech identification, weather prediction and many more. Consolidation of DL algorithms could be an option for prevention and detection of online payment scams. Furthermore, the article could be useful for students as well as researchers in concept of knowing algorithms, tools/techniques and datasets used for solving AI challenges.

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