Automated Sentiment Analysis using Deep Learning Artificial Neural Network for Scholars Digital Database Protection

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Abstract - **Article and journal publications are the important criteria for the researchers from different domains. The digital publications are basic proof for the scholars and for them to do research and development through academics and industrial applications. These scientific publication database should be copyrighted to the concern person those published the journals. The international journal publishers should provide the confidential of digital data citation in the form of text, diagram, literatures and coding using different languages to stop the forgeries by extracting and using others digital data without any authentication from the ownership. Much application software is available to prevent from the forgeries to stop digital malpractice. But still it is challenging to prevent entirely from forgeries, particularly on sentiment analysis from web-mining. An artificial intelligence (AI) is emerging technology in software industry and becoming very popular for different applications like web-mining. The Artificial Neural Network (ANN) can be proposed for sentiment analysis in web-mining content and meaning based retrieval on web database to prevent inconsistencies forgeries. The ANN is the most accurate tool to examine the content of the literature is original and its uniqueness. Also, proposing the concept of ANN to monitor the journal publishers for them while issuing the priority on indexing to the scholars and researchers by comparing the citation. The ANN is used to monitor the journals publications and indexing in the procedure of first come first out (FIFO) model.**

Keywords - Artificial Intelligence (AI), Artificial Neural Networks (ANN), Indexing, web-mining, citation content

I. INTRODUCTION

Generally, so as to assist readers perceive a journal paper well in consent for making idea. The author must cite relevant and necessary previous work as references for the paper. Relevant papers were found by researchers in the print age through library digital media. Later on, literature search engines were developed specially (such as Google Scholar) or integrated into varied websites of on-line digital libraries (such as ACM Portal, IEEE Xplore, Elsevier, etc.) to retrieve relevant papers in various analysis areas. Keyword-based question is one normally used technique for data retrieval. However whether or not search results meet researcher's requirements depends on keywords utilized by them to an excellent extent. Moreover, the search results measure equivalent search keywords whereas researchers would like to measure completely different. To the present finish, citation recommendation aims to recommend relevant papers as references for satisfying researchers personalized citation necessities. Citation recommendation systems are used to recommend citations for particular content like literature of every place where a citation should be available in the journal.

Because of the large quantity information of knowledge data with quick update speed, Sentiment Analysis (SA) technology has emerged because the times need, attracting an outsized range of scholar's reception and citation analysis. The sentiment analysis ways will be divided into 3 kinds: machine learning methodology, dictionary based method and hybrid method. The dictionary based method includes dictionary-based methodology and corpus-based methodology that are performed by estimating the weight of the relevant words in the dictionary.
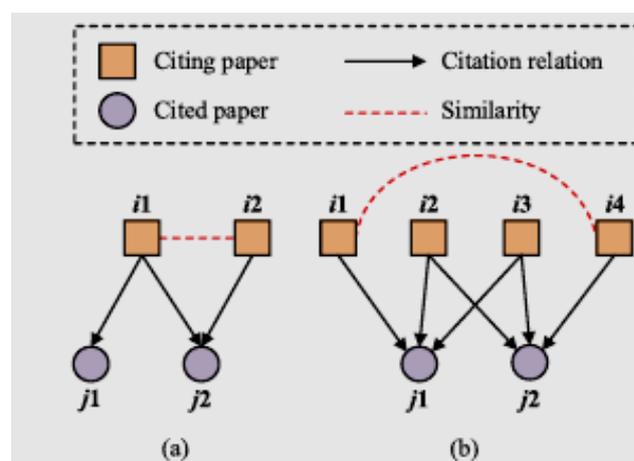
Figure 1: (a) Common cited papers, (b) Co-Occurred citing papers

As a crucial deep learning technique, the ANN has recently been well studied and wide utilized for citation content retrieval, sentiment analysis, sentence modeling, sentence matching, question/answering matching and document modeling. Because of its capability of deep

illustration learning and sentence-level data awareness, it's additionally been adopted for sentimental analysis (SA).

The ANN model will use filters completely different of various lengths to come up with different feature maps. With reference to language process tasks, the filters of varied lengths may be thought-about as totally different varieties of N-gram scanners that otherwise interpret and take apart sentence phrases. Options from N-grams of variable lengths may play totally different roles within the final call of sentiment classification. Considering a sentence "this loose assortment of for the most part impermanent numbers would most likely have worked higher as a one-hour TV documentary", whereas 3-grams would most likely find "have worked better" as a significant contributor to positive feelings, 5-grams would span their vision and see "would most likely have worked better" as a negative indicator. As such it's argued that once words square measure scanned in an exceedingly correct combination, they may engender higher options and thereby up the polarity detection.

Tackled the sentiment analysis system by proposing an ANN design where consisting of various filters. In contrast to the same work, that concatenates options of various sorts together and inputs them into one classifier, our planned model injects totally different options into different classifiers with different convolution layers followed severally by their own pooling and softmax layers.

II. RELATED WORKS

The existing methods such as SVM or NB can have higher range of accuracy and are used previously. Pang et al. implemented the use of three machine learning rules (NB, SVM, ME) to divide sentiments into two different categories like positive and negative. They have used the bag of words characteristics frame to carry on the experiment and reached the NB method to have the poor effect, the SVM method is the best relatively.

Hang Cui et al. reached that the high order N gram as a feature classifier using SVM has better accuracy than the previous existing systems with high range of database. However, when the training data is less, the NB classifier works better than other existing systems. Boiy and Moens used various feature representations to combine NB, SVM and ME methods in a multilingual array. They have received 750 positive sentences and 750 negative sentences for each language. It is concluded Hang Cui [5] et al. found that the high order N-gram as a feature classifier (e.g. SVM) has better performance than the previous methods in the experiments of sentiment classification with large-scale data sets. However, when the training data is small, the NB classifier performs better. Boiy and Moens [6] used different feature representations to combine NB, ME, SVM methods in a multilingual field. They collected 750 positive sentences and 750 negative sentences for each language. It is concluded that NB is the most suitable method. [5].

Sentiment analysis involves machine learning, linguistics orientation, negation handling and feature-based sentiment classification. The linguistics orientation approach to sentiment analysis is an unsupervised learning technique because it doesn't need any previous coaching so as to mine the information. It measures the chance of a facet word of being positive or negative. When put next to the linguistics orientation approach with the N-gram model-based technique for flick review, it's ascertained that the machine learning approaches are a lot of correct, though they need a major quantity of your time to coach the model [2]. The linguistics orientation approach is a smaller amount correct however is a lot of economical to use in period of time applications. The performance of linguistics orientation conjointly depends on the performance of the underlying tagger. Negation may be a quite common descriptive linguistics construct that affects polarity and thus, ought to be adequately prohibited in sentiment analysis.

III. EXISTING SYSTEMS

Sentiment analysis is treated as a classification task because it classifies the orientation of a text into either positive or negative. The experimental results that applied Support Vector Machine (SVM) on benchmark datasets to coach a sentiment classifier. N-grams and totally different coefficient theme were wont to extract the foremost classical options. It conjointly explores Chi-Square weight options to pick informative options for the classification.

A. Disadvantages of an Existing System

The artificial intelligence is not applied in the existing system. The meaning of the literature is not understood by the SVM tool. It is used to check only the bag of words.
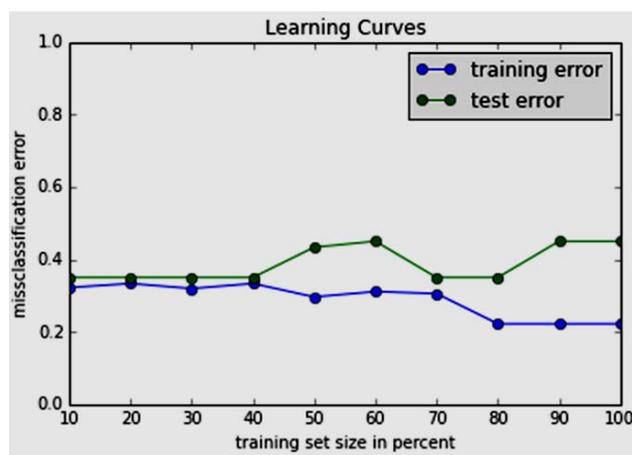
Figure 2: Sentiment analysis error estimation using Support Vector Machine (SVM)

Although SVMs have smart generalization performance, they will be rottenly slow in check section, a drag self-addressed. From a sensible purpose of read maybe the foremost significant issue with SVMs is that the high algorithmic complexness and intensive memory necessities of the desired quadratic programming in large-scale tasks.

B. Sentiment Analysis Classification

The sentiment analysis plays an important role in web-mining of content citation. It is typically used once user got to create a choice concerning a product together with its name that comes from the opinion of others. Sentiment analysis will reveal what others have faith in a product. In line with the knowledge of the gang sentiment analysis provides indication and recommendation for the selection of product. One international rating may modification perspective concerning that product.

The most common use of Sentiment Analysis is that this of classifying a text to a category. Counting on the dataset and therefore the reason, Sentiment Classification may be binary (positive or negative) or multi-class (3 or additional classes) downside. Among researchers, could be able to notice either similar or fully completely different opinions regarding the relation sentiment analysis, counting on their perspective. However, regardless the result or approach, all of them adopt constant techniques. The most common use of Sentiment Analysis is that this of classifying a text to a category. Counting on the dataset and therefore the reason, Sentiment Classification may be binary (positive or negative) or multi-class (3 or additional classes) downside.

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The figure 3 shows that the 3 different sentiment analysis are shown. Detecting author's opinion thinks about with distinguishing fake opinion from reviews. Sentiment analyses classify the polarity of a given text by expressing the author opinion as positive or negative.

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binary (positive or negative) or multi-class (3 or additional classes) downside. Among researchers, work could be able to notice either similar or fully completely different opinions regarding the relation sentiment analysis, counting on their perspective. However, regardless the result or approach, all of them adopt constant techniques. The sentiment classification method is administered at following 3 levels.
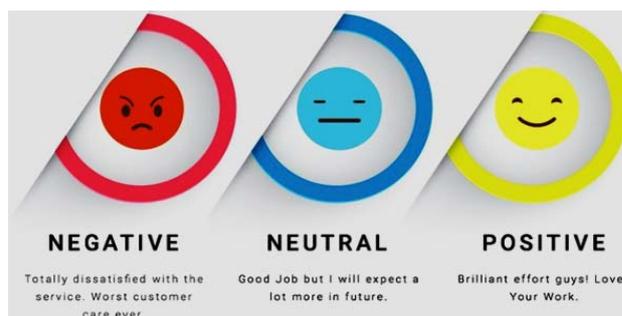
Figure 3: Different classes of sentiment analysis

Document Level: during this level the complete document is contemplate and is then classify text as positive or negative. However within the case of article or journals, comparative sentences might seem. The challenge within the document level classification is that the complete sentence AN exceedingly document might not be relevant in expressing the opinion regarding an entity. Thus subjectivity and objectivity classification is extremely necessary during this form of classification wherever unrelated sentences should be eliminated from the document.

Sentence Level: during this level sentences are classified as positive, negative or neutral. Just in case of straightforward sentences, one sentence indicates one opinion concerning an entity. However in presence of complicated sentences within the narrow-minded text, sentence level sentiment classification is not applicable. The advantage of sentence level analysis lies within the subjectivity/ and objectivity sound judgment classification.

Word or Phrase Level: Analysis of options of product for sentiment classification is typically known as word or phrase or feature primarily based sentiment analysis. It is having fine-grained analysis model among all different models. Prominently approaches sentiment analyses are clustered into machine learning-based approaches like artificial neural network.

IV. PROPOSED SYSTEM
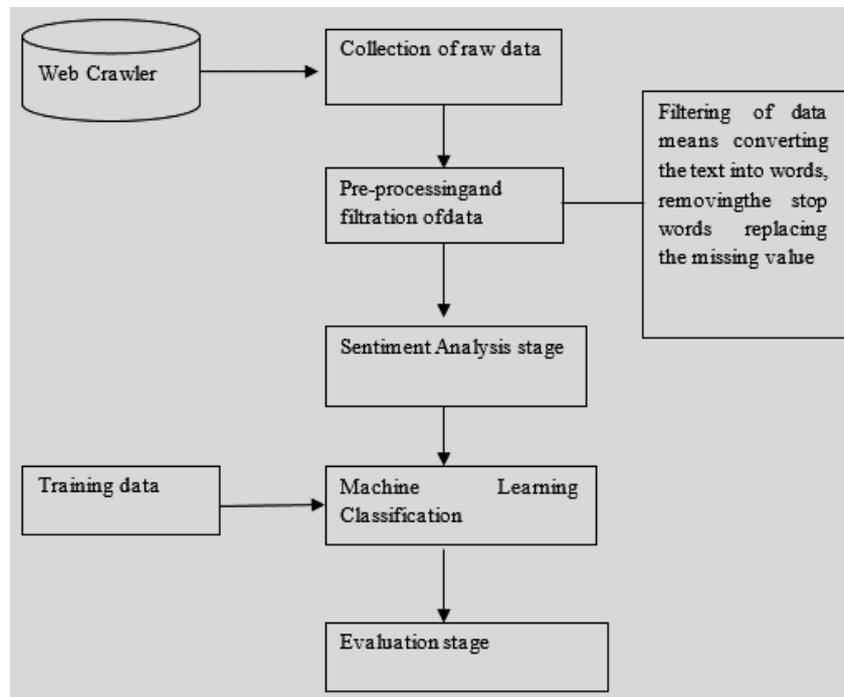
Figure 4: Proposed architecture diagram for ANN based sentiment analysis

An Artificial Neural Network (ANN) is proposed for processing citation content based on sentiment analysis (SA), figure 4. Artificial Intelligence (AI) is emerging technology in software industry and becoming very popular for different applications like web-mining. The Artificial Neural Network (ANN) can be proposed for sentiment analysis in web-mining content and meaning based retrieval on web database to prevent inconsistencies forgeries. The ANN is the most accurate tool to examine the content of the literature is original and its uniqueness. Also proposes the ANN to monitor the journal publishers of them issuing the priority on indexing to the scholars and researchers by comparing the citation. The ANN is used to monitor the journals publications and indexing in the procedure of first come first out (FIFO) model.

A. Artificial Neural Network

An artificial neural network is portrayed by a simplified mathematical model of the processes in an exceedingly biological nerve cell. An artificial Neural Network, ANN, is outlined as a topology of interconnected artificial neurons, during which generally input neurons, internal neurons and output neurons is known. The manner the neurons are organized and connected depends on the neural network architecture. Neural networks implement algorithms that try and succeed a desired performance approaching natural neural systems through techniques comparable to learning expertise and by generalizing from similar things.

The above figure 5 shows that the artificial neural network architecture. The Artificial Neural Network contains three different layers are input layer, hidden layers and output layer. The hidden layer may have more than one layer for decision making purpose. The input database of citation is given to the input layer as $\{x1, x2…,xn\}$. The input database is convolved with the weight vector during the sigmoid function between input layer and hidden layer. The decision making of citation regarding titles of articles, keywords, publication year, and variety of references is preceded in the hidden layer.
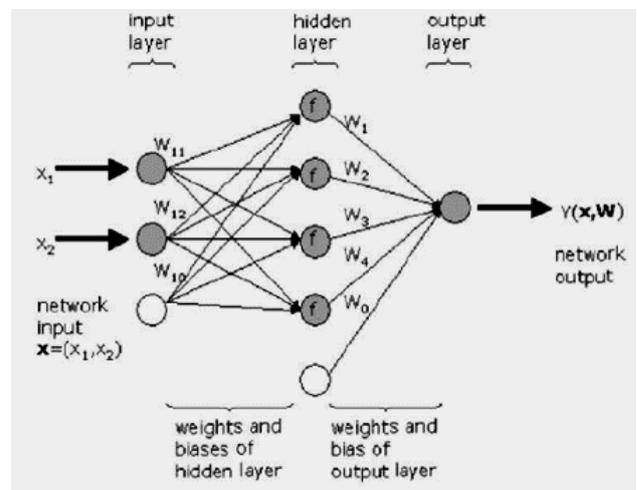
Figure 5: Artificial Neural Network Architecture

The output layer is used to fetch the information about citation content and provide further information about sentiment analysis. Because of the good performance of ANN, we have got reason to believe that ANN can be applied to the sentiment analysis. Another advantage of utilization ANN is that we tend to simply ought to label the whole sentences by artificial means that avoids the massive work in RNN. The key factors behind this success is however to adjust ANN to cope with the non-image information well. Another vital factor is that simply employing a single deep learning methodology typically does not bring the simplest results, which indicates a mixture of deep learning and different pre-training methods ought to result in the next accuracy rate. The ensuing word vector file is often used as options within the ANN. So we use the word vector file created by word2vec tool because the input data for the ANN rather than initializing all word vectors by randomly sampling every worth from a homogenous distribution. When two words which means is analogous, the vectors worth of them is closed too. Then if the word's sentiment is analogous, we will gain the similar vector input for the CNN. This will improve the likelihood of obtaining identical label once 2 sentences have similar words.
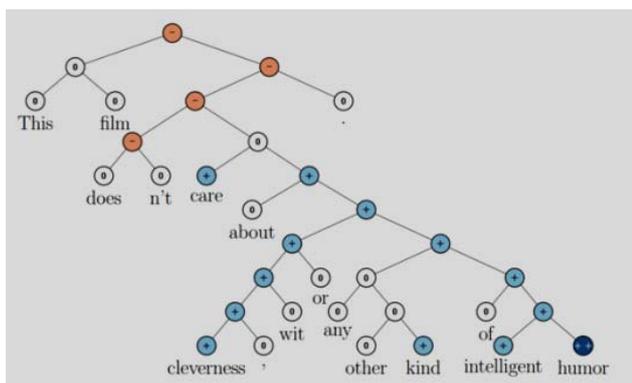
Figure 6: Artificial Neural Network (Recursive Model for sentiment analysis

Figure 6 shows that the ANN (R) model for sentiment analysis. The Deep Learning procedure is applied on ANN (R) model for sentiment analysis. Deep Learning may be a new space of Machine Learning analysis that has been gaining important significant interest attributable to the role it is taking part in computing applications like citation analysis. A Recursive Neural Network may be a generalization of an Artificial Neural Network and is generated by applying a set and consistent set of weights repetitively, or recursively, over the structure. Recursive Neural Networks take the shape of a tree, whereas perennial may be a chain. Recursive Neural Nets are utilized in decision making process for tasks admire Sentiment Analysis.

V. METHODOLOGY

ANNs used primarily in issues of approximation, prediction, classification, categorization and improvement in citation content analysis. Two databases were prepared. The primary one was composed of titles of articles, keywords, publication year, variety of references cited every paper and also the numeric codes related to each of the references cited by the paper. These cited references for every paper of the primary information were recorded within the second information that listed its numeric code, title, authors and publication year for every citation. Once the information was designed, a comprehensive preprocessing section was developed to eliminate inconsistencies within the information. A lot of concentration is given to the pre-processing of real applications measure spent on information cleanup. Missing data, incorrect or inconsistent records within the information ought to be corrected to avoid compromising information quality. Additionally to iteration errors known within the information, some linguistics inconsistency may even be found when this method. Throughout their recording, all of the citations received a numeric code. Because the citations were recurrent in many articles, it had been essential that everyone was registered with a singular numeric code, though it recurrent totally different mechanism of the information related to different papers. To make sure this condition and assign a singular code variety to an equivalent publication, though documented by separate papers, a computer program written in MATLAB and Java was designed to search out duplicates and properly conciliate them into the ultimate information. To come up with an information sequence to be employed in the input ANN, the program created a logical quality for every paper containing the data on the presence or absence of every one amongst the references registered. The presence of every reference during a paper was delineating by the worth one within the position relative to the numeric code appointed thereto citation and also the absence by a value poor. The ANN was fed solely with information concerning the citations of every paper and their various year of publication.

A. Preprocessing

The datasets can undergo the pre-processing task of the text documents comparable to tokenization, stop word removal, lowercase conversion and stemming. Tokenization is that the procedure of harsh a text into words, phrases, or different important components, namely tokens. Stop words literature measure the words that square measure unremarkably encountered in texts while not dependency to a selected topic such as conjunctions, prepositions, etc. Another preprocessing step is very small conversion. All small characters measure typically converted to their small forms before the classification stages. Finally, stemming

method wherever we tend to get root, stem of derived words.

B. Sentiment Analysis (SA)

To conduct sentimental analysis, the primary step is to construct a proper illustration of the target documents. During this analysis, the input to the projected model is literature sentences in terms of sequences of words, and conferred as their word embedding to create the input matrix. Assuming that we have a sentence of n token words S = {w1, · · · , wn} words are corresponded with their retrained vectors w ∈ R1×d looked up in a vocabulary of the embed matrix W ∈ Rd×V, where V is the total count of the words vocabulary. This matrix is a stack of all the embed items in the vocabulary. In this research do map words onto the indices 1, · · ·, Vin the vocabulary. After the words processing, a sentence input is treated as a concatenation of word embedding S ∈ Rd×n, where each column i-vector stands for a word's embedding wi ∈ R1×d. Afterwards we can now input this matrix into the proposed model for further processing.

C. Convolution Operation

The convolution operation is implemented to go across the whole input matrix and to extract sentiment features from the N-grams which the filters convolved them with. A filter F ∈ Rd×hof size h convolves the weights with the window of word embed in wi:i+h−1 to generate the features. Learning the weights F and biases b is the main process of convolution layers training. Here g is a non-linear function such as hyperbolic tangent in our experiment. A feature ci is generated as follows:

$$c_i = g (F *w_{i:i+h-1} + b) \quad (1)$$

The filter scans across all the N-grams of size h in the sentence, the segmented sequence of the sentence of length n {w1: h, w2: h+1, · · ·, wn−h+1: n}. Thus the filtering procedure produces a feature of size n-h+1 over one sentence input. A set of filters generates feature maps that need pooling operation to extract the most sensitive responses over the features. In this paper, we use filters of varying sizes to extract features from different views of the sentences.

D. Pooling

The feature maps are then passed onto the pooling operation layer to aggregate the best responses while keeping the sequential information of the features. We apply the max-overtime pooling method and take the maximum feature value cmax among one map C:

$$Cmax = max\{C\} = max \{c_1, · · ·, c_{n-h+1}\} \quad (2)$$

This method renders the architecture aware of both the special order and distribution of the sentiment information of the whole sentence and this scheme can enable us to deal with variable sentence lengths since the number of features is now aligned with the number the filters. The pooled features are then processed by a non-linear before injection into the classifier.

E. Deep Learning Training

Training is completed through random gradient descent over shuffled mini-batches; we have a tendency to willy-nilly split the complete coaching examples into coaching and validation. The scale of the validation is that the same because the corresponding checks size and is balanced in every category. We have a tendency to train the model by minimizing the negative log-likelihood or cross entropy loss. The gradient of the literature perform is computed with back propagation through time (BPTT). Early stopping strategy is used to stop overfitting. Before coaching we have a tendency to utilized unsupervised learning of word-level embedding mistreatment the word2vec, which enforced the continual bag-of-words and architectures for computing vector illustration of word.

F. ANN Algorithm using Deep learning

Output of neuron of row k , column y in the l th convolution layer and k th feature pattern:

$$O_{x,y}^{(l,k)} = \tanh\left(\sum_{t=0}^{f-1}\sum_{r=0}^{k_h}\sum_{c=0}^{k_w} W_{(r,c)}^{(k,t)} O_{(x+r,x+c)}^{(l-1,t)} + Bias^{(l,k)}\right)$$

Where f is the number of convolution cores in a feature patter. Output of neuron of row x , column y in the l th sub sample layer and k th feature pattern:

$$O_{x,y}^{(l,k)} = \tanh\left(W^{(k)}\sum_{r=0}^{S_h}\sum_{c=0}^{S_w} O_{(x\times S_h+r, y\times S_w+c)}^{(l-1,k)} + Bias^{(l,k)}\right)$$

the output of the j th neuron in l th hidden layer H:

$$O_{(l,j)} = \tanh\left(\sum_{k=0}^{s-1}\sum_{x=0}^{S_h}\sum_{y=0}^{S_w} W_{(x,y)}^{(j,k)} O_{(x,y)}^{(l-1,k)} + Bias^{(l,j)}\right)$$

where s is the number of feature patterns in sample layer. Output of the ith neuron l th output layer F:

$$O_{(l,i)} = \tanh\left(\sum_{j=0}^{H} O_{(l-1,j)} W_{(i,j)}^{l} + Bias^{(l,i)}\right)$$

VI. RESULTS AND DISCUSSION

ANN strategies collectively implement feature extraction and classification for document classification. The deep neural network based mostly approach convention, in most cases, is an input document drawn as a sequence of words, and every sequence is then drawn as one vector, each word within the sequence is projected into a continuous vector house by multiplying it with weight matrix, forming a sequence of dense, real valued vector. This sequence is then fed into a deep neural network, which processes the sequence in multiple layers, finally leading to prediction likelihood. This pipeline is tuned collectively to maximize the classification accuracy on coaching set.ANN has recently accomplished a motivating performance on the basically very important task of sentiment analysis and classification. However, these models need professionals to specify an explicit model design and set related hyper-parameters, together with the filter region size. Projected work consists of multi layers of ANN (Deep Learning based Deep Neural Network) and goop pooling, the same as the design projected in pc vision.
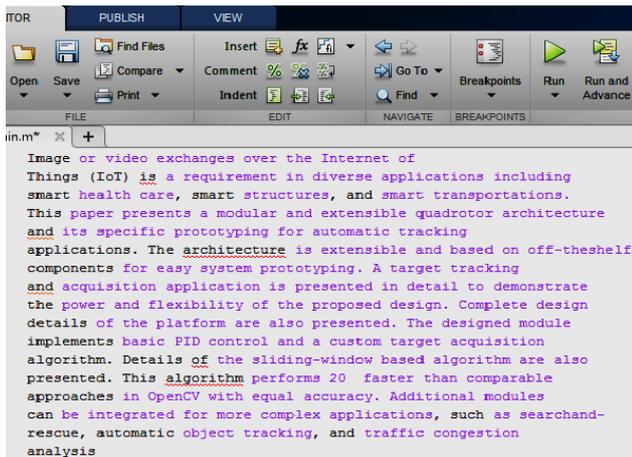
Figure 7 (a)
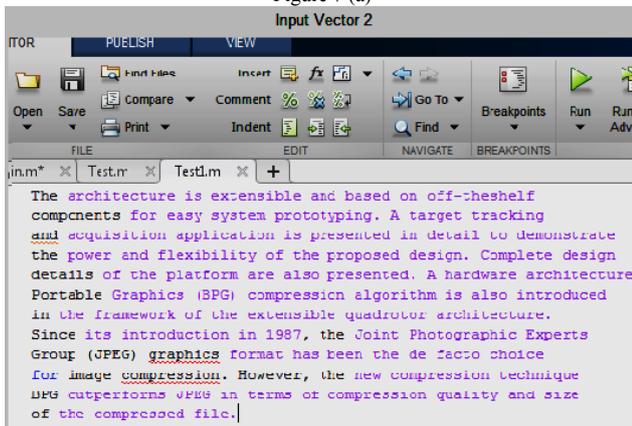
Figure 7 (b)

Figure 7 (a) and (b): Input testing vector to Deep Learning (ANN).

Within the 1st stage, every layer can extract options from little overlapping windows of the input sequence and pools over little non-overlapping windows by taking the most activation within the window.

Figure 7 shows that the input vector is given to the input layer of the ANN as vector format for citation analysis.
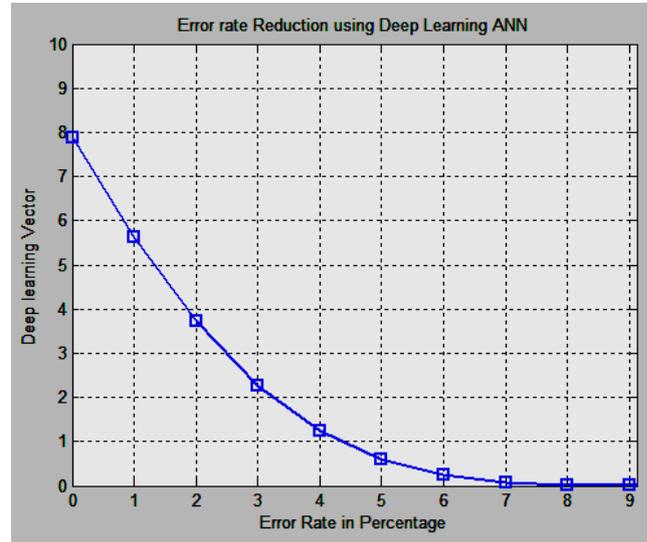
Figure 8: Error rate reduction using Deep learning ANN

Figure 8 shows that the error rate reduction using deep learning artificial neural network. The error rate is reduced till 9.12 percentages when deep learning input vectors are given entirely to the neural network input layer.

Figure 9 shows that the citation content analysis using two different vectors using ANN. The input vectors 1 and 2 are given to the two nodes of input layer of ANN. This is then given to the sigmoid function of ANN. The sigmoid function is used to process the convolution between input vectors and weight vector.
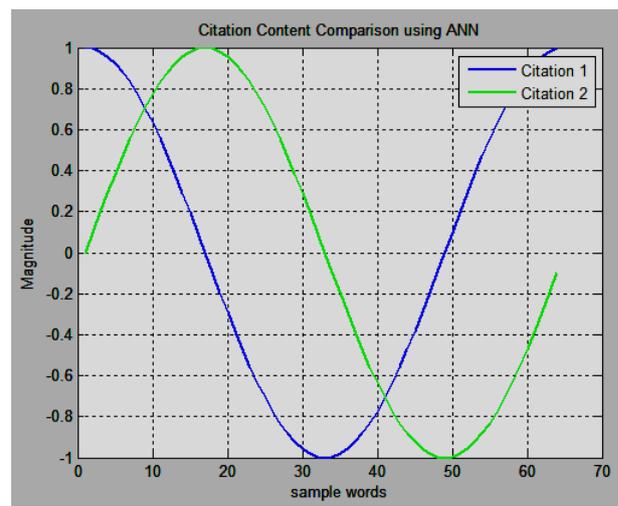
Figure 9: Citation content analysis for two different vectors using ANN

Then the weighted input vector is fed to the hidden layer for sentiment analysis.

Figure 10: Bag of Words searching for Sentiment Analysis

Figure 10 shows that the collection of bag words for searching and finalizing the sentiment analysis. The model archives comparable performances with considerably less parameters. We have a tendency to achieved higher results compared to convolution solely models; it possible elaborated native options as a result of the amount of the pooling layers.

The confusion matrix is used to measure the accuracy in terms of percentage as shown in figure 11. We have a tendency to assume that the projected model is additional compact asa result of the little variety of parameters and fewer disposed to over-fitting.
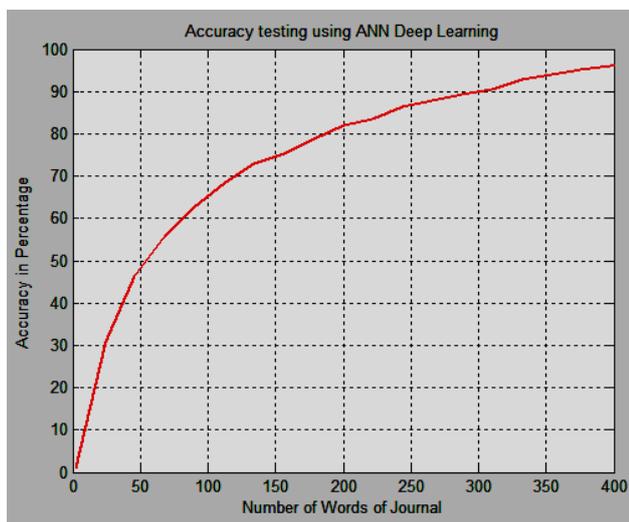
Figure 11: performance analysis using Confusion Matrix

Hence, it generalizes higher once the coaching size is restricted. It is attainable to use additional filters within the convolution layer while not ever-changing the dimensional

within the repeated layer that probably will increase the performance.

TABLE 1: SENTIMENT ANALYSIS ALGORITHMS COMPARISON

Type of sentiment Analysis	Error rate in %
NBSVM-uni	11.71
SVM-uni	13.05
SVM-bi	10.84
Full+Unlabeled+BoW	11.l1
Bo W -bnc	12.20
ConvLstm	11.00
ANN (Deep Learning)	9.12

VII. CONCLUSION

In this paper, proposed an artificial neural network based on deep learning for citation analysis. The citation analysis is measured using deep learning and decision making of ANN and same proposed based on the sentiment analysis. The ANN for web-mining and sentiment analysis with meaning based retrieval on web database also implemented to prevent the forgeries. The confusion matrix is used to measure the accuracy of the ANN tool performance for sentiment analysis. The grading is allocated to the authors to confirm the priority in terms of first come first out (FIFO).

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