

Deep Learning Based Sentiment Analysis Technique On Qualitative Student's Feedback Dataset

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Abstract— In sentiment analysis, the student feedback engaged from the students helped the teaching, learning more efficient. Feedback of the students received from the real-time environment to decide the behavior of the student. Generally, the feedback of the students collected through surveys or student feedback forms. Students give their reviews through the feedback forms that helped to improve the teaching and learning phase. Sentiment analysis is the procedure for the identification and detection of the subjective data using natural language processing (NLP), textual analysis. Precisely, the main goal of the SA is the extraction of the data on the feeling of the author or speaker towards a specific theme. It is the procedure to identify the sentiment from the set of words. Moreover, it helped in gaining the feelings and movement after the series of the word. In this paper, optimized feature extraction and deep learning classification methods developed for identifying the feedback of students through ALO and RNN algorithms. Additionally, the feedback of the students is determined through the normalization process of the preprocessing stage. Independent Component Analysis (ICA) extracted the sentiment words. Also, it calculates the feature set by improving the loss of data and understandability using Principal Component Analysis (PCA) method. Then, the optimal feature set improved the classification result using the ant lion optimization (ALO). Along with that, the sequence of the data in a given period is achieved using a recurrent neural network (RNN) based deep learning method. Experiment analysis is done to determine the performance using parameters, namely such as accuracy, precision, and recall rate. The achieved accuracy rate is 99.0%, the precision value is 98.0%, and the recall value 98.7%.

Keywords—*Sentiment Analysis; Optimized ICA and PCA algorithm; Instance Selection using ALO; RNN classification Model.*

I. INTRODUCTION

Feedback plays a significant role in teaching and learning by helping to acquire new data and avoid repeated faults. This procedure helped the association to monitor, compute, and control the complete operational setting. Based on the feedback provided by the students, it can be categorized as text or grade form. This method focused on a question that is related to a similar topic and it cannot express the accurate sentiment of the students. However, to identify the correct sentiment of the

student's text feedback method is used. A set of the queries given in the textual form to the students and they answer the queries in the form of a sentence. Sentiment analysis has become the main technology, mostly used by people. It is measured to work the calculation, opinion, sentiments, and selection of the text, emotions, and attitudes about the entities. The entities demonstrate the individuals, events, and specific topics [1]. The method of sentiment analysis is utilized in the extraction, analysis of the sentiments about the entity. SA is developed because of the development of technology, and it is required for various reasons [2]. The main requirements of the SA are described as; Analyze and convey the sentiments of the clients in e-commerce, review the posts forwarded by the clients, producer, and service provider. To improve the quality of online applications like surveillance, blogging, conferencing and online transactions, and so forth. The need is to determine the sentiments of people for learning the behavior of the clients, pattern market, and the newest trend of society [3]. The voice of the clients, social media network, learning model identified through the detection of sentiment analysis. SA is classified on various levels as [4] document level [5], aspect [6], and sentence level [7]. In the given figure 1, Sentiments are classified by product or students' review. After that, features are analyzed through the selection and classification of the sentiments. Then, the polarity of the sentiments is considered. Some of the problems that took place in the present methods are incapable of performing definitely in various domains, indefinite accuracy, and sentiment based on unrequited marked information, usability to deal with the complicated sentence that needs more than sentiment words and normal analyzation [8].

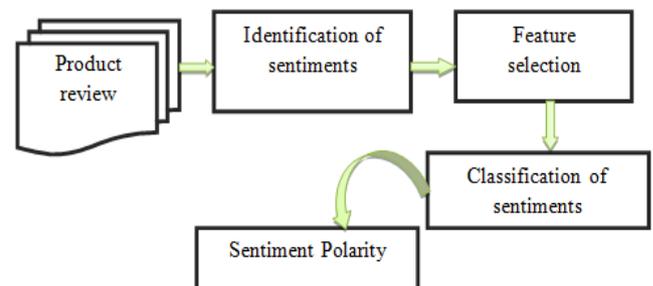


Figure 1. The basic Process of Sentiment Analysis[8]

Some of the advantages of the SA are the creation of production [9], identification of selling chances [10], and Prevent negative brand pictures [11], etc. In table 1, the

detailed study of advantages, issues, and methods of different sentiment analysis articles are given. In table 2, the dataset along with a classifier, and performance parameters are given as:

TABLE I. ANALYSIS WITH DIFFERENT RESEARCH ARTICLES BASED ON SENTIMENT ANALYSIS (SA)

Author	Year	Technique	Advantages	Issues
Souma, W. et al., [12]	2019	Deep Learning	Extract Additional Data	Repeated Patterns
Al-Smadi, M. et al., [13]	2019	Deep Neural Network	Classify aspect based SA	NLP problem, sequence Labeling
Al-Ayyoub, M. et al., [14]	2019	Corpus and Lexicon method	Identify Arabic language, sentiments	Subjective program
Lu, Z et al., [15]	2020	End to End Automatic Speech Recognition	Resolve pre-trained Features	Automatic Recognition Issue
Alsaeedi, A. et al., [16]	2019	Machine Learning	Gather Sentiments	Optimization Problem

TABLE II. ANALYSIS WITH TOOLS, DATA SETS, VARIOUS CLASSIFIERS AND EXISTING PERFORMANCE METRICS

Tool /Dataset used	Classifier	Parameters	References
Thomson Reuters News Archive (TRNA) and Thomson Reuters Tick History (TRTH)	RNN	Accuracy	[12]
Web Tool	BI-LSTM	Accuracy, sentiment polarity rate	[13]
Twendz, social mention	K nearest neighbor	-	[14]
IEMOCAP	RNN	Accuracy	[15]
OMD and STS dataset	Naïve Bayes	-	[16]

One of the major applications in the student feedback Sentiment analysis is that it presents useful insights into complete teaching excellence and suggests significant methods for enhancing teaching methods. However, student feedback has become a major aid in the development of an organization. For instance, the information from students received for study purpose. Hence, to analyze the student feedback further help to resolve the student-related issues and make the learning more oriented. Along with that, the two problems faced in sentiment analysis are sentiment polarity (SP) and sentiment score (SS). The other issue is the repeated words, punctuation, and textual data that affect the performance of the classifier. However, there is a need to remove those features that are not appropriate and storing the significant features that further help to distinguish the sentence into class labels like as positive and negative. Hence, this research article is based on the development of sentiment analysis methods and which comprises feedback from students for teaching performance. Initially, the problem is identified from the existing papers. Secondly, set the research objectives

and then implement a novel approach to improve the performance of the SA system. The major concept that we use in the SA extraction process is the ICA and PCA algorithm. Feature extraction calculated the original features in the form of a vector set or matrix. Those features processed by ant lion optimization method, classified the sentiment of the teacher, assessment, and course, and reviewed as positive, negative, and average or neutral in MATLAB simulation tool.

II. RELATED WORK

Various papers have explained along with details of the results. In addition, the parameter analysis has given in the detailed description. Different authors have studied various papers where machine and deep learning models are also given to algorithms. The source of getting reviews may be Facebook, Instagram and so forth. **Souma, W et al., 2019 [12]** proposed research on the predictive energy of the historical news sentiment dependent on the market presently to broadcast the economic news sentiments. They defined the sentiment news dependent on the stock cost returns averaged single exactly after newscast article that have been unconstrained. In case the cost exhibits positive or the negative return, they classified the newscast article analyzed just previously to the examined stock return as positive or negative. They used Wikipedia and gig word five corpus articles that were globalized vectors in the deep learning (DL) tensor flow systems (TFS). They analyzed the higher frequency Thompson Reuter's news and the frequency cost history of the down Jones industrial average time-period. They applied the linking of the deep learning method of the recurrent neural system (RNS) with longer, shorter term memory (LSTM) components to train and test the forecast energy of the proposed method of archived information. They found the predicting accuracy of the proposed method improving when they switched from the random selection of the positive and negative newscast for selecting the newscast with the highest scores as positive and negative newscast for selecting the newscast with higher positive scores and negative positive scores to generate the trained database. **Vateekul, P et al., 2016 [18]** aimed to study the sentiment analysis of the twitter information by employing the desired deep learning methods. They studied the major goals:

- To study the influence of every parameter on deep neural network.
- Compare the LSTM and DCNN to other techniques using the bag of words.
- Search the value of the series of the words in Thai Twitter data.

They prepared the emotional information by finding the desired feelings in every tweet. For illustrating the outcome, the intensive experiment was experienced. The outcomes showed that DCNN have better performance as compared to LSTM in the form of the accuracy and deep learning methods that have maximum accuracy as compared to traditional techniques except the MaxEnt. Finally, they showed that the series of the words in Thai was essential. **Day, M. Y et al., 2017 [19]** proposed research on the deep learning (DL) for the

analysis of the sentiments on the Google play clients comments in china. A web mining scheme was computed for collecting the data after the survey from Google play. They used the long short term memory model, DL and Naïve Bayes(NB), support vector machine(SVM) models for researches examining the outputs. Experimental results determined that the accuracy of the DL for the observation of the Google play was accomplished up to 94% and DL was 45.25%, SVM was 74.5% in the current research. **Dholpuria, T., et al., 2018 [20]** presented the different Deep Learning (DL) methods using sentiment analysis of the views of the movie. By and by, posting audits on films was one of the celebrated methodologies for communicating assessments and complaints toward the movies assortment achievement brought or watcher remarks got. The developing significance of slant examination matches with the development of online life alongside scrutinizes, gathering conversations, web journals, miniaturized scale web journals, Twitter, and informal communities. The field of the assessment of assessment was eagerly attached to normal language preparing and message mining. Analysing Examination, which was in like manner called sentiment analysis, was the circle of viewing which breaks down individuals' surveys as considerations to comprehend if the character seemed to be "happy", "troubled", "irate, etc. The basic objective of this research was to outline the exploration on deep learning model by utilizing Convolutional Neural Systems (CNN) regarding administered AI classifiers (Naive Bayes, SVM, Logical Regression, FFNN and KNN).

III. RESEARCH METHODOLOGY

The proposed system used the machine learning method for the classification and analysis of the sentiments. It expressed the brands and products through text, Twitter, and conversation to recognize, if the sentiments are positive, negative, or neutral. Some methods helped the brands group to recognize, if the brands are good and, if it is not good, then the costs are improved or the cost method is not about the people require for a variety of reasons [17].

A. Data Set Description

This dataset is gathered from the students of the famous Institution of the Higher Education in North India. It is used to generate the complete organization record based on the information on student feedback. The data set contains the six classes that include teaching, the content of the course, exams, laboratory tasks, laboratory services and additional-curricular activities. The information about every class contains two columns and every column has three labels as;

- Neutral (0)
- Positive (1), and
- Negative (-1).

TABLE III. SENTIMENT ANALYSIS DATA SET

Teaching	Teaching	Course content	Course content	Exam	Exam
0	the teacher is punctual	0	content of courses	1	the examination

	but they should also give us some practical knowledge other than theoretical		are average		pattern is good
1	Good	-1	Not good	1	Good
1	Yes	1	Yes	1	Yes
1	good and punctual	1	Good	1	Good
1	It is good	1	This semester university has provided better teachers	1	I like the question pattern

As Proposed methodology flow chart figure 2 follows as; the initialization, the database is searched in feedback: teacher, student, lab job, coursework, and examination, etc. from the www.kaggle.com site. Firstly, the database uploaded in the form of the EXCEL datasheet and, shown in table format in GUI (Graphical User Interface). In the second stage, the normal selection of the standard operations that contained the distinct data elements for the next stage of SA, and some of the features are examined. After that phase, all the punctuation removed in the dataset. The next phase is to eliminate the vowels repeated in the series at least three times since by doing so the words are normalized.

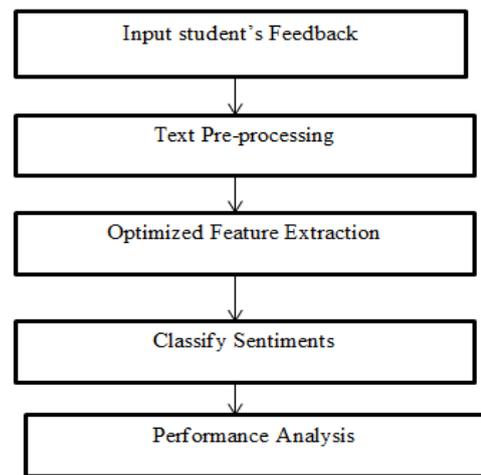


Figure 2. Proposed Methodology FlowChart

Stop words are words filtered out in the preprocessing phase. In this proposed process, feature extraction is used to remove highlights by using the PCA method. This phase is connected to the same network to diminish the network, so preparation is done splendidly. The steps for the extraction of the significant features are: (i) Exchange the rows and columns (ii) Evaluate the mean (iii) Repeat the matrix using real data matrix (iv) Compute Eigenvalue (v) Find non zero values (vi) Compute the eigenvector with +ve matrix, and (vii) Extraction of the feature sets. ALO algorithm is used to select the instance values and reliable selected feature etc. After that, the

proposed method using Hybridization used an Optimized RNN (ALO+RNN) classification algorithm to select the features and classify the sentiment or opinion of the teacher, examination, and courses, as entailment review analysis Positive and Negative. The ORNN classification method is used to analyze the reviews. Planning of ORNN classification is evaluated in MATLAB 2016a. The test section is done with a 70-30 ratio. The representation of each review analyzed and calculates the performance metrics such as accuracy rate, precision, recall rate, and compared with the existing one.

IV. EXPERIMENT RESULT ANALYSIS

In this section, described the result and comparison with a proposed and existing system. To upload a dataset and, applying the pre-processing steps is defined. A feature extraction algorithm is used to extract the unique properties with the help of PCA and ICA algorithm. After that, this research work has implemented an instance selection algorithm to select the valuable feature values in sentiment analysis. The research techniques of sentiment analysis and the ORNN Classification approach is simulated using GUI with MATLAB toolbox with the defined performance metrics.

Review Representation				Text Pre-Processing Phase			
1	Sr no.	Review	Useful	1	Review	1	2
2	0	He was borin	0	2	He	was	borin
3	1	extremely dif	1	3	extremely	diffout	course
4	2	Hard to unde	1	4	Hard	to	understand
5	3	SO glad to b	0	5	SO	glad	to
6	4	great teache	1	6	great	teacher	and
7	5	Do not take h	0	7	Do	not	take
8	6	Awesome te	0	8	Awesome	teacher	He's
9	7	very good te	1	9	very	good	teacher
10	8	I thought his	1	10	I	thought	his
11	9	I feel like pec	1	11	I	feel	like
12	10	The class w	1	12	This	class	was
13	11	I find everyth	1	13	I	find	everything
14	12	Best calc tea	1	14	Best	calc	teacher
15	13	the class is	1	15	the	class	is
16	14	She is the be	0	16	She	is	the
17	15	She is my be	1	17	She	is	my
18	16	She spends	1	18	She	spends	about
19	17	He's an inter	1	19	He's	an	interesting
20	18	He is brillian	1	20	He	is	brilliant

Figure 3. Uploading and Tokenization Phase

The above figure 3 shows to fetch the review values from the excel sheet for both +ive and -ive sentiments toward a particular object. The extracted information is stored in the .mat files and, handled by the system for several other sections and permanent storage of the data values. The stored values are used to train the system with different properties and their possible valuable cases toward a category (Positive and Negative). Tokenization procedure is the act of breaking-up a series of characters and strings into different segments such as (i) Words (ii) Sentences (iii) Phrases and (iv) Symbols etc.

Below Figure 4 (i) and (ii) shows the feature extraction and selection process and it plays a significant role in this SA system. Feature extraction algorithms are used to extract the unique properties of the uploaded data set. The sentiment analysis system classifies the input value entered by the consumer on behalf of the same factor. In this section, the

values of features are extracted. In the next stage, the classification algorithm acquired better accuracy by training. The proposed system has improved accuracy rate and, reduce the error rate.

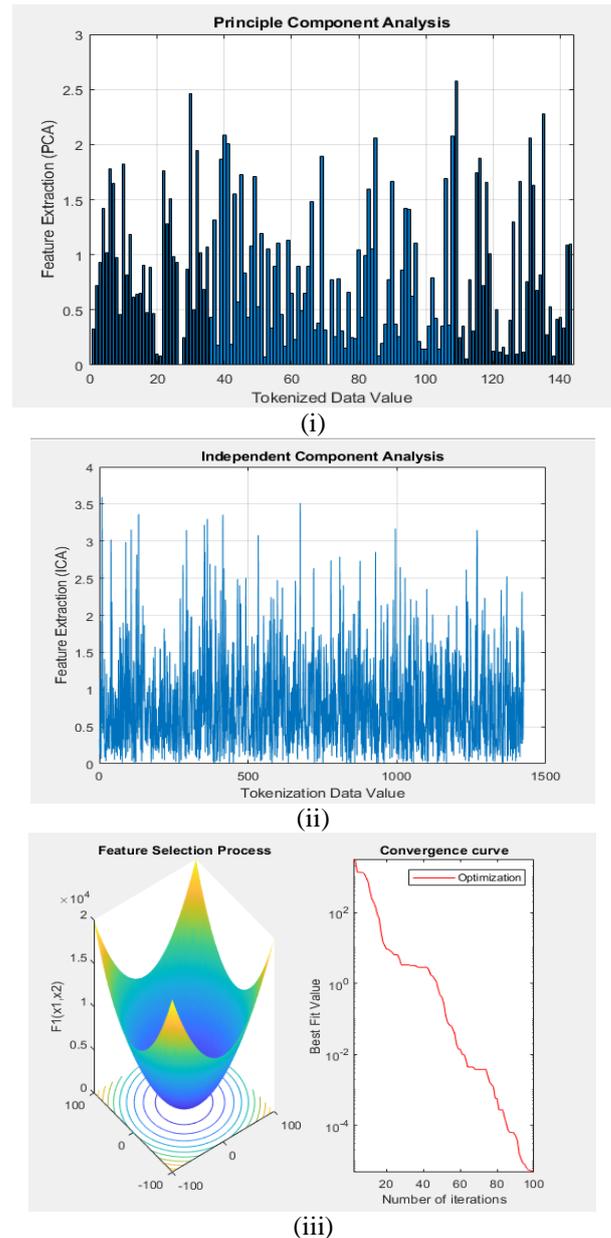


Figure 4. (i) Feature Extraction using PCA, (ii) Feature Extraction using ICA, and (iii) Selection Process using ALO

Above fig 4(iii) shows the resulting feature selection method executes the simulation processes of real features in-order to resolve the issues and, to model using ant lion optimization systems. It selects the valuable feature sets using the ALO algorithm.

The proposed values of hyper parameters are set as follows:

Batch-Size = 27;

Embedding Dimension = 12;

Embedding Epochs = 2;

Output classes = 3 (average ~ neutral, positive and negative),

Max Sequence Length = 98.

Here, the research method adopted numbers, which are frequently used in the study of student review, lab work, examination, and library, for the batch size and the no. of recurrent units.

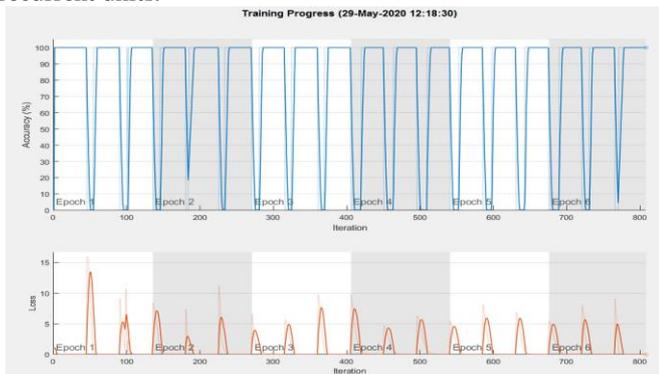


Figure 5. Training Process and Loss

Above figure 5, we consider the change of loss during training progress and which is similar to the accuracy rate, the blue line corresponds to the random selection phase of the training data and the orange line shows the loss of the training progress.

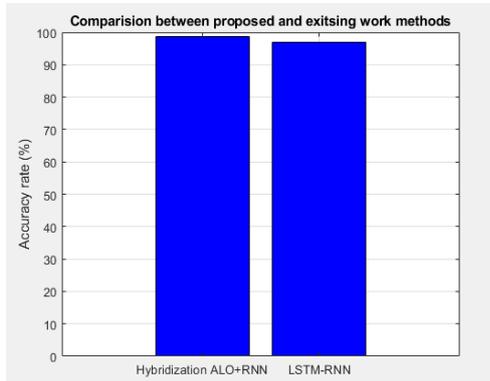


Figure 6. Comparative Analysis with Accuracy Rate (%)

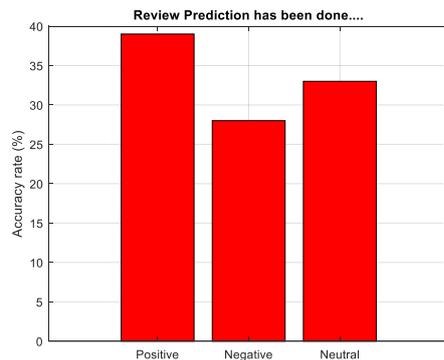


Figure 7. Review Prediction (+ive, -ive and neutral)

TABLE IV. PROPOSED PARAMETERS IN SA

Parameters	Values
Error Rate	0.0091
FAR	0.0017
FRR	0.0075
Accuracy	99.0 %
Precision	98.0 %
Recall	98.78 %

TABLE V. COMPARATIVE ANALYSIS OF PROPOSED AND EXISTING MODELS

Parameters	Hybridization using Optimized RNN	LSTM+RNN
Accuracy Rate (%)	99.0 %	97.5 %

Figure 6 shows the accuracy parameter comparison between proposed Hybrid RNN and existing LSTM classifiers in SA. Figure 7 shows the review prediction rate in three stages : (i) Positive (ii) Negative and (iii) Neutral. The proposed system is used as a novel algorithm to extract and select features and RNN is used to predict the reviews and achieved a high accuracy rate. In the existing method, the maximum loss of data in different iterations and calculate the accuracy value is 97 %. Table 4 defines the proposed parameters such as error rate = 0.0091, FAR (False Acceptance Rate) = 0.0017, FRR (False Rejection Rate) = 0.0075, Accuracy = 99.0%, Precision = 98.0 % and Recall value is 98.7%. Table 5 shows the comparison between Hybrid RNN or ORNN and LSTM with the RNN classifier. In research method calculated high accuracy, precision and recall rate and existing LSTM method evaluated 97% accuracy rate.

V. CONCLUSION AND FUTURE SCOPE

In conclusion, the internet has become a major requirement for people in every field of research. SA is the most common type of research in the decision-making process. Currently, people get the product based on the reviews given by numerous people. With the rapid growth in social networking applications, the number of people gives their reviews through this platform. Opinion mining is the major task that aimed to invent the sentiments in the textual data on unreliable subjects. Presently, the researchers have been concerned for analyzing the sentiments on various topics like movies, profitable products, and social problems. The previous work doesn't show suitable outcomes for analyzing the feedback from the students. The present research discovered the attributes of the SA method to identify the standard designs. In this paper, the sentiments are analyzed through various classifiers. ICA approach defined the normal technique for the identification of the multivariate data that contains the large quantity of the database samples. The feature sets are computed by the PCA method. The selection of features is necessary due to the elimination of distinct features. It helped in reducing the loss of the data. Moreover, the optimum feature set is searched by improving the classification performance using the ALO algorithm. It imitates the hunting behavior of the ant lions in the normal way. Also, ORNN is used to investigate the predictive power of the recognition of the future records of the sentiments. This method is related to the optimized ORNN based on the deep learning method. Numerical analysis has done to compute the parameters such as accuracy, sensitivity, and specificity. In the proposed method accuracy rate value is 99.0%, Recall value is 98.7%, a Precision rate 98.0 percent, and existing method using LSTM with RNN classifier to analyze the text or reviews and compute the accuracy rate 97 percent.

The future scope will emphasize on solving the problems of handling the phrases. Moreover, the deep learning-based classifiers will work on improving the algorithms to work on specific domains with multiple languages such as Bengali and Rajasthani.

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The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g.” Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

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