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(Review Article)

Sentiment Analysis of Online Product Reviews Using Modified Deep Learning Model

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Abstract

These days, digital evaluations are absolutely necessary for enhancing consumer communications all around the world and for influencing the shopping behaviours of consumers. E-commerce behemoths like as Amazon, Flipkart, Snap deal, Jio, and others let users to share their experiences and provide prospective customers true information into the functioning of a product. Utilizing and analysing the sentiment of customers' product evaluations on e-commerce platforms may be beneficial to both businesses and the academics who work in those platforms. E-commerce product quality management places a significant emphasis on the practise of sentiment analysis of e-commerce reviews. The polarity of emotion expressed in customer reviews is a burgeoning field within the field of sentiment analysis. Businesses make use of consumer feedback, both positive and negative, in order to gain a better understanding of how customers feel about different products and to determine which are the most popular. This study conducts an analysis of previously published research and sets out to construct a new model known as Modified Deep Learning Neural Network Models (MDLNNM), with the goal of automatically detecting and classifying the polarity of sentiment in Product Review Dataset. This system can classify user reviews based on the features of product reviews by using the data from those reviews. According to the findings of the survey, companies have the ability to keep an eye on their customers in real time and request guidance on how to better comprehend them. They will then be able to improve their product options and provide customers with dependable after-sales support.

Keywords: Text Analytics, Long Short Term Memory, Support Vector Machine, Modified Deep Learning Neural Network.

1. Introduction

In latest days, developments in information technology (IT) and apps for the internet have made it possible for individuals all over the world to generate an enormous amount of information. On a daily basis, new content is generated across a variety of online platforms, including social media status feeds, films or photographs uploaded to e-commerce websites, applications, and so on. People are able to exchange information and convey their attitudes, views, and opinions about products and services, as well as other societal concerns, thanks to platforms such as social media, e-commerce websites, mobile platforms, and applications, amongst others. Customers' reliance on product reviews as part of their decision-making process for making purchases [1] increases in importance. Reviewing the feedback received from customers is an excellent strategy for growing businesses. This strategy entails gaining an understanding of the benefits and drawbacks of a company's products and services in order to meet the requirements of customers and provide them with the most suitable options. Businesses in a wide variety of industries, but notably those operating in the e-commerce space, can gain an edge by mining and analyzing evaluations of their products written by customers.

It used to be the norm in the past for humans to be in charge of addressing client thoughts and feedback. These methods of processing resulted in errors that were not essential and drove up the costs for corporations and other organizations. In an effort to assist in the resolution of this issue, natural language processing technologies as well as language mining strategies have been provided [2–4]. When it comes to e-commerce, the Amazon platform is frequently used for research regarding categorization and sentiment analysis. Amazon is the largest online provider in the world and features a diverse selection of items along with a significant number of customer evaluations. For instance, using data crawled from Amazon, a model was developed to extract characteristics from user opinion information and assess customer opinions about iPhone 5 reviews using three fundamental levels: excellent, average, and terrible [2]. This model rated customer opinions about iPhone 5 reviews. [3] The classification of sentiments

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expressed in product reviews is accomplished by using a continuous naive Bayes learning system. At the moment, emotion analysis typically makes use of three primary methods: The most important way is one that is based on a dictionary of emotional words; another important method is a deep learning neural network method that combines rule-bases and corpus-bases. In recent times, the challenge of evaluating user emotions based on reviews has primarily been carried out in the English language, and a wide variety of methods and models have been utilized. On the other hand, the examination of reviews, and in particular product reviews, has not been used to the study of popularity. Our challenge is to identify and extract the discussion sentences of each assessment feature contained within the article while simultaneously predicting the user's rating of each aspect and the priority they place on it.

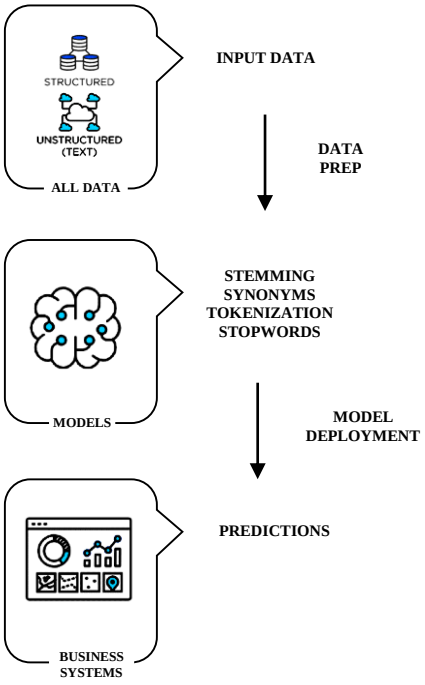

Figure 1. Text analytics architecture

Text analytics refers to the process of converting documents that contain unstructured text into data that is organized and useable. Text analysis is accomplished by disassembling phrases and sentences into their constituent parts, followed by the determination of the function and significance of each component by using intricate software rules and machine learning algorithms [11]. Text analytics serves as the basis for a wide variety of natural language processing (NLP) functions, such as named entity identification, classification, and sentiment analysis. The Text Analytics Architecture is illustrated in Figure 1.

This project seeks to address an issue by developing a system that can crawl realistic data on an e-commerce website and automatically aggregate it. Our system has been built to do this. Our model will be updated using the processed and inputted results of these data. Then, the system will make use of all of the characteristics of the items that buyers were interested in through reviews in the e-commerce market and various comments on shopping procedures based on the types of products being sold. We had the intention of developing a brand new model that we called Modified Deep Learning Neural Network Models (MDLNNM), which would automatically identify and categories the polarity of the emotions expressed in Product Review Dataset. Text categorization and time series prediction are both common applications for algorithms that are based on the LSTM (Long Short Term Memory) data structure. When we are working on an issue that is dependent on text classification, we frequently work with a variety of scenarios, such as sentiment analysis, determining the polarity of phrases, multiple text classification, such as poisonous comment classification, support ticket classification, and so on. Because they are not limited to being feed forward networks, LSTMs have become quite popular for usage in text and time series related challenges. Back propagation describes what happens when they are able to keep memories from the past in their networks. Because they are able to remember the past, they are quite effective at working on these difficulties. SVM stands for Support Vector Machine, and for the purpose of classification, we will utilize SVM in the very last layer of our deep learning model.

2. Related Study

This paper is based on the latest developments in sentiment analysis. While sentiment analysis has been extensively researched, most studies have relied on conventional machine learning classifiers such as Naive Bayes and SVM. However, this paper takes inspiration from these studies to propose a novel model that leverages the power of deep learning to improve the accuracy of sentiment analysis.

Here, are some examples of prior research in the field of sentiment analysis of product review based on unsupervised technique [1]. These studies have focused on identifying and analyzing specific aspects of products or services that are mentioned in user reviews, and extracting sentiment information related to those aspects.

- Limitation: This particular technique achieves an accuracy of 67 percent with aspect-based sentiment system.
- Conclusion: Real-time applications require high accuracy as inaccurate predictions can have an inimical impact on a company's reputation. Therefore, the model's poor accuracy makes it unsuitable for such applications.

Feature extraction and visualization of reviews are popular methods used for sentiment analysis of product reviews. These techniques involve identifying key aspects in the text and

visualizing them in a way that helps to identify patterns in the sentiment [2].

- Limitation: The limitation of feature extraction and visualization in sentiment analysis of product reviews is that they may not capture the full context and meaning of the text. The accuracy of feature extraction and visualization techniques heavily relies on the quality of the data used. Poorly written or ambiguous reviews can be challenging to analyze and may result in inaccurate or incomplete results.
- Conclusion: Therefore, feature extraction and visualization techniques should be used in conjunction with other methods and approaches to ensure a comprehensive and accurate analysis of the sentiment in product reviews.

Every single one of the corporations that sell products on the internet uses something called sentimental analysis. Reviewing products that one has personally experimented with is a common practise among internet users who make use of websites, blogs, or who buy for goods on the internet in this day and age. By employing the concept of emotion classification and basing one‘s choices on the feedback given by other clients, the corporate world has solved the riddle about how to give individuals with both the specific product those who are going to look for. As a result, the corporate world has discovered the secret about how to give individuals with specific item they are looking for. In the field of data analysis, the concept of sentimental analysis refers to the consideration of collections of reviews, the subsequent analysis and processing of those reviews, and the formulation of recommendations for the individual user on those evaluations and suggestions. Sentimental analysis begins with the consideration of collections of reviews. The dataset that was utilised in the research presented in article [5] was acquired from the official websites of the products. In the beginning, these evaluations went through a procedure known as pre-processing, which comprised the elimination of unneeded components such stop words, be verbs, punctuation, and conjunctions. After the preceding phase of pre-processing has been finished, the dataset that has been trained is next categorised through the use of the Naive Bayes and SVM algorithms.

- Algorithm(s) used: Naive Bayes and Support Vector Machine algorithms. A straightforward technique that is based on probability, the Naive Bayes classifier. It makes use of the Bayes theorem but operates under the premise that each case may be considered independent of the others, which is an impractical assumption in the actual world. The Naive Bayes classifier performs admirably in difficult real-world circumstances. In regression analysis and classification, support vector machines, or SVMs, are employed with training sets that include a variety of shapes and classifications. Determine the measure of correlation between two sets using just a selected subset of the training points that were previously computed.
- Advantages: A formation theory is a collection of algorithms in which one or more procedures are classed and the output is delivered depending on the vote of the predictions. This type of technique is also known as a multi-algorithm approach. In this case, the Ensemble technique is utilised by merging the SVM and Naive Bayes models. Therefore, the suggested technique will generate more accuracy in comparison to the algorithms that are now in use, which produce results that are less precise than that of the recommended one. The ensemble technique often yields higher accuracy than other approaches because it incorporates many algorithms that contribute to efficient operation. This strategy delivers superior performance compared to that which might be achieved by using each of the algorithms individually.
- Limitation: The categorization in this work is not dependent on the aspect level, which is one of the limitations of this study. An aspect level categorization, on the other hand, is something that will have a particular statement made about it in the evaluation. This stands in contrast to a conventional categorization. The categorization of aspects at a higher level requires the specification and processing of characteristics for the applicable algorithms.
- Conclusion: They came up with a method called the Ensemble approach, which assists in giving higher accuracy than the algorithm that is currently in use. The issues of efficiency, reliability, and quickness in the execution of the program were also properly addressed and resolved by us. The precision produced by the suggested method is superior to that produced by the present system. However, the amount of accuracy varies depending on the total number of the classifiers that are being combined in order to provide a projected output of the review.

Evaluation of emotion is the process of determining if a piece of writing conveys a good or negative attitude and then categorizing it as either one or the other. Customers have the ability to post reviews including a polarity score on e-commerce websites like Amazon.com. These ratings can be positive, negative, or neutral. There are several cases in which the review and the rating don't line up properly with one another. We performed sentiment classification utilizing deep learning on the data from Amazon.com product information so that we could detect reviews that had scores that did not match up. A back - propagation neural network containing gated recurrent units was trained with the vectors that were generated from the product reviews after they were first transformed to vectors utilizing paragraph vector. Both the semantic link between the review text and product information were integrated into the author's paper [6]. They also constructed a web service application which forecasts the overall rating for a submitted review by making use of the trained model.

- Algorithm(s) used: RNNs with rectified linear units are a kind of recurrent neural networks (GRU). In recurrent neural networks, the inputs are treated as though they are

independent of one another. However, the RNN technique fails miserably when used to tasks like predicting the following word in a text. The word that comes after this one is determined by the word or words that came before it in this context. RNNs are helpful in circumstances like this because they are excellent at collecting sequential data. Whenever an RNN is starting to learn long-term background, guess it depends on the kernel function, the gradient has a tendency to get narrower (the disappearing gradient issue) or bigger (the blowing up slope problem) towards to the previous layer, that also finds it challenging to apply this technique. These problems are caused by the fact that the gradient can either get smaller or bigger. By utilizing a gating mechanism, Gated Recurrent Units (GRU) was implemented as a solution to the problem of disappearing gradients.

- Advantages: This research demonstrated how reviewer language and product details can be used to construct a strong deep learning approach that can be utilized for sentiment classification. It gives feedback to the reviewer if the anticipated rating score is significantly different from the rating score that was actually supplied.
- Limitation: This particular classifier achieves an accuracy of 81.29 percent with simply review embedding being used. Even when product embedding is taken into account, the accuracy still manages to improve to 81.82 percent. Real-time applications are not suitable for the poor accuracy of the model since they would provide inaccurate predictions.
- Conclusion: The purpose of this work is to offer a deep learning strategy as a solution to a common issue that occurs on e-commerce websites, which is that the review that the user submits does not match its rating. Within this approach, they began by utilising paragraph vectors to understand the syntactic and semantic link between a ‘review texts.' They then took the review embedding and grouped and ordered it to produce a product sequence. This product sequence was then sent to a gated recurrent unit (GRU) so that it could learn product embedding. In order to train a support vector machine (SVM) for sentiment classification, a concatenation of review embedding created from paragraph vectors and product embedding derived from GRU is employed. They later utilise a web service to access this classifier in order to predict the score of a post and contrast it to the actual rating that was provided. This web service takes into consideration both the ‘review text' and the 'review rating' of a particular review and issues an alert to the critic if there is indeed a discrepancy between the rating and the review.

The vast majority of e-commerce platforms now enable customers to publish reviews of products, which has led to an increase in the frequency with which customers read reviews before making a purchase. These internet evaluations provide emotional feedback of the product experience that customers have had and contain a lot of useful information; but unfortunately, there are also reviews that are malevolent or irrelevant. As a result, model for classifying the real-world emotion of online customers based on deep learning has been suggested [7]. First, a mapping link between online evaluations of products and sentiment characteristics is formed on the basis of expert knowledge and by making use of fuzzy mathematics. This maps the high-dimensional original text data into a continuous low-dimensional space. Second, after the local contextual features have been obtained through the use of convolution processes, a bidirectional long- and short-term memory network is used to take into account all of the long-term relationships between the features. After that, the level of contribution that various words have made to the text is taken into consideration by including an attention mechanism, and a limitation on the use of regular terms is incorporated into the goal function.

- Algorithm(s) used: Model of selective attention–long as well as short-term memory networks, often known as CA–LSTM. The CA-LSTM model is presented to compute the interest value of each word in a sentence by adding a learning algorithm. This is done in order to ensure that the hidden layer at the period of the emotion word makes a bigger input to the categorization of the sentiment.
- Advantages: The CA-LSTM model makes extensive use of the spatial Boolean model to elucidate the link between customers' actual psychology and review qualities, which subsequently assists in directly quantifying the sentiment characteristics. The incorporation of attention mechanisms and convolution operations into LSTM, which makes it possible to extract real consumer sentiment feature indicators from the context of reviews, is another factor that contributes to an increase in the percentage of times that review text is correctly classified.
- Limitation: While working with genuine sentiment analysis in the same particular domain, the CA-LSTM system needs to be reeducated and then tested each time; nevertheless, cross-domain sentiment identification cannot be done. As a consequence of this, further work will be carried out in upcoming studies in attempt to face the migrating of the concepts.
- Conclusion: Inside this article, we propose a fully attempting to learn true consumer online emotion classification method called CA-LSTM. This prototype obviously makes use of such a geographic Boolean prototype to define the connection among consumers' true psychoanalytic theory and evaluation qualities, which helps to directly accurately measure the sentiment features. The results of the experiments demonstrate that the CA-LSTM models have the higher precision in each sentiment analysis job, with an average accuracy of 83.3 percent. This enables major e-commerce websites to reliably discern the genuine sentiment tendency in comments.

Imagine a situation in which there are hundreds or thousands of questionnaires to be filled out. Which often range from ten to fifteen pages, it is physically and mentally impossible to go through all of these surveys due to the amount of time and

effort that would be required. The importance of audits will become clear in a moment. In [8], the author offers a solution to this problem in the form of a mechanism called sentiment-based rating anticipation.

- Algorithm(s) used: Naïve Bayes, Logistic Regression, Support Vector Machines. The Naive Bayes method is a classification technique that may be used well for both binary and multiclass classification. When compared to numerical variables, the Naive Bayes algorithm performs exceptionally well when dealing with categorical input data. Logistic regression is a statistical method that may be used to predict the class of persons based on one or more predictor factors. Support vector machines, sometimes known as SVMs, are a group of supervised learning algorithms that may be used for classifying data, doing regression analysis, and finding outliers.
- Advantages: The extraction process is addressed in this study by segmenting the surveys in accordance with the characteristics of the product. The product feature extraction module of this framework is the most important module since it is responsible for extracting item includes from unstructured reviews. Another method determines which distinct item takes use of the various combinations of dependence. When a phrase has many conditions, the Stanford dependency parser is used to identify them. The Stanford deep analyzer is applied so that the presumption of the review phrase may be discovered. In the process of determining the relevance and polarity of product features, a review matrix is constructed and employed.
- Limitation: This prototype does not start investigating complicated systems for extracting opinions and technology products, and neither do new classifier model that can discuss the organized identities property in rating predictive model. Additionally, emotion lexicons need to be improved so that fine-grained emotion analysis can be performed.
- Conclusion: The researcher of this report proposed a sentiment-based result in changes and suggestion system. The objective of this model is to estimate the accuracy of items depending on user evaluations that are provided. In this method, in order to accomplish the rating prediction objective, we combine emotion similarity, social sentiment impact, and item reputational resemblance into a unified matrix factorization framework.

The writer [9] intended to create a web application that incorporates a deep learning model that delivers an analysis of customer feedback pertaining to a certain product. It displays both the positively and negatively polarities of comments for such product that is being looked for, something users will find beneficial. In this implementation, when a customer browses for a good or service, review information is compiled from online stores, and also that information is then allowed to pass to a classification model that is a naive bayes classification algorithm. The above case plans the feedback into positively and negatively feelings based on characteristics derived by the model, as well as the implementation use this information when making recommendations to the user. They display to the user the total positively and negatively polarity of evaluations for the product that was searched for, and they also display to the user how correctly we have acquired the results.

- Algorithm used: Naïve Bayes. When contrasted to quantitative variables, the Naive Bayes algorithm performs exceptionally well when dealing with categorical input data.
- Advantages: This system's advantages include the fact that it helps the user save time and makes it simple for them to assemble ratings and reviews and obtain opinions from the entirety of this page, therefore presenting an accurate picture of the product in question.
- Limitation: The accuracy of this model, which was calculated to be 76.4 percent, is considered to be rather poor. This model's ability to accurately forecast outcomes is quite low, and its dependability is very low as well.
- Conclusion: The classification of feelings according to their respective degrees of polarity is the issue that this study seeks to address. In this venture, various evaluations and ratings of the different online products are begun taking from ecommerce platforms and stored. The emotion that is created from the website is shown in the most effective way possible so that customers can readily comprehend the polarity of the reviews that are made on the e-commerce website in question.

Consumers and e-commerce companies communicate with one another all around the world through online reviews. When someone is considering making a purchase online, the first thing they do is read the comments and reviews that other customers have left about the goods. If the client is unhappy with the goods, the company has a responsibility to rectify the situation by introducing some necessary improvements. In order to do this, it is necessary to examine the written evaluations left by customers and determine their attitude. This is accomplished through the work of categorizing the comments and reviews as either positive or negative, which is referred to as sentiment analysis in this study [10]. Through the utilization of Sentiment Analysis, evaluations of a Standard dataset have been sorted into categories representing positive and negative feelings. In order to accomplish this goal, a variety of Machine Learning and Deep Learning techniques have been applied, and the performance of the word2vec-CNN Model and the FastText-CNN Model on the Amazon unlocked cell phone Dataset has been compared.

- Algorithm(s) used: Support Vector Machine, Convolutional Neural network. SVM stands for support vector machine and is an example of a supervised machine learning method. Its primary purpose is to classify data into a variety of categories. A hyper plane is utilized by SVM in order to partition the different classes. Image classification, object identification, recognition, and text categorization are all examples of applications for CNN.

- Advantages: The efficiency of the CNN model is improved as a result of the addition of n-grams of words, which is done as part of the FastText capability. This results in the creation of a vector of previously undiscovered words. The results of this work model were categorized as either Positive Reviews or Negative Reviews. All of these things contribute to an improvement in the performance of the FastText-CNN Model in comparison to the word2vec-CNN Model.
- Limitation: In comparison to the other Models, the accuracy produced by FastText using the CNN Model was the greatest at 94%. However, this model is tested using a more limited dataset. Larger datasets are required in order to determine the model's level of stability.
- Conclusion: Analysis of the user's feelings on the mobile phone the evaluations are carried out with the assistance of a number of distinct machine learning models, in addition to the utilization of FastText word embedding with CNN. They have experimented with a variety of factorization techniques alongside machine learning models such as naive bayes and support vector machines, and they have compared the performance of these methods with that of the FastText deep learning model. They discovered that the accuracy of the FastText-CNN Model was significantly greater than that of machine learning models. Therefore, the performance of the deep learning model is superior to that of the machine learning model.

A short summary for the same is presented in Table 1 below:

Table 1. Model / algorithm used for sentiment analysis

Sr. No.	Algorithm / model used	Description	Limitation
1	Support vector machine, convolutional neural network	CNN and SVM used to improve the accuracy and effectiveness of mining smaller datasets.	Larger datasets are required in order to determine the model's level of stability.
2	Naive Bayes algorithm	Naïve Bayes algorithm is a supervised learning algorithm, mainly used in text classification that includes a high-dimensional training dataset.	This model's ability to accurately forecast outcomes is quite low, and its dependability is very low as well.
3	Naïve Bayes, logistic regression, support vector machines	Support vector machines, naive bayes and logistic regression are used for solving clustering problems.	This prototype does not start investigating complicated systems for extracting opinions and technology products
4	CA-LSTM (Context Attention based Long-Short Term Memory)	The CA-LSTM model is presented to compute the interest value of each word in a sentence by adding a learning algorithm.	While working with genuine sentiment analysis in the same particular domain, the CA-LSTM system needs to be reeducated and then tested each time; nevertheless, cross-domain sentiment identification cannot be done.
5	RNNs (Recurrent Neural Networks)	Recurrent neural networks is excellent at collecting sequential data as in the inputs are treated as though they are independent of one another.	It provides inaccurate predictions, which will have a negative impact on the company.
6	Naive Bayes and support vector machine algorithms	By merging the SVM and Naive Bayes models, it generates more accuracy and superior performance compared to that which might be achieved by using each of the algorithms individually.	The categorization in this work is not dependent on the aspect level, which is one of the limitations of this study.

3. Research Gap

3.1 Limited availability of labeled data: One of the primary challenges in sentiment analysis is the availability of labeled data for training the deep learning models. There is a need for more labeled datasets to improve the accuracy and generalizability of sentiment analysis models.

3.2 Lack of focus on domain-specific sentiment analysis: Most of the existing research works in sentiment analysis focus on general sentiment analysis, without considering the nuances of domain-specific language. There is a need for more research in domain-specific sentiment analysis, where the models can understand the context and language of a particular domain, such as healthcare or finance.

3.3 Limited attention to non-English languages: Most of the research works in sentiment analysis have been conducted in English, while other languages have received relatively less attention. There is a need for more research in sentiment analysis of non-English languages to improve the accuracy of sentiment analysis models for a diverse range of languages.

3.4 Limited attention to the impact of fake reviews: The presence of fake reviews can significantly affect the accuracy of sentiment analysis models. There is a need for more research to explore the impact of fake reviews on sentiment analysis models and to develop robust techniques to identify and filter out fake reviews.

3.5 Limited attention to the impact of product attributes: The sentiment of a review can be influenced by specific product attributes, such as quality, price, and features. There is a need for more research to explore the impact of product attributes on sentiment analysis models and to develop models that can accurately capture the sentiment associated with specific product attributes.

4. Discussion

The Long Short-Term Memory (LSTM) learning method is considered to be the most advanced learning algorithm for semantic composition. Using this approach, it is possible to compute the representation of a text based on the representation of its words using several abstraction layers. All of the word vectors are arranged in a matrix that is called a word embedding matrix, and each word is "embedded" as a representation by a vector that has a low dimension, is continuous, and has real-valued components. We used a bidirectional LSTM design because this form of architecture makes it possible to record long-range dependencies coming from both the forward and backward directions of a document by establishing linkages in the network that go in both ways. In addition, we used a dropout factor for both the input gates and the recurrent connections in order to avoid over fitting.

Modified Deep Learning Neural Network Models is the term we have given to the new vehicle we were searching for (MDLNNM). SVM is indeed an amazingly effective classification technique and is difficult to outperform. On the other hand, Long Short Term Memory (LSTM) networks are a subcategory of Recurrent Neural Networks (RNN) that are able to identify long-term relationships in a phrase. These networks were developed by Google. The achievement of this type of neural network was recently evaluated on Sentiment Analysis tasks, and the results showed that it outperformed classification results in several emotion analysis and classification with reverence to commonly used learning algorithms, displaying improvements of three to four points. In the context of this study, we will employ a tandem LSTM-SVM in order to leverage the benefits offered by the two categorization approaches. We anticipate that by utilising this model, we will be able to overcome the limitations of the ways that came before it and generate a higher level of accuracy when compared to the approaches that are now in use. The suggested architecture of the LSTM-SVM may be seen in Figure 2.

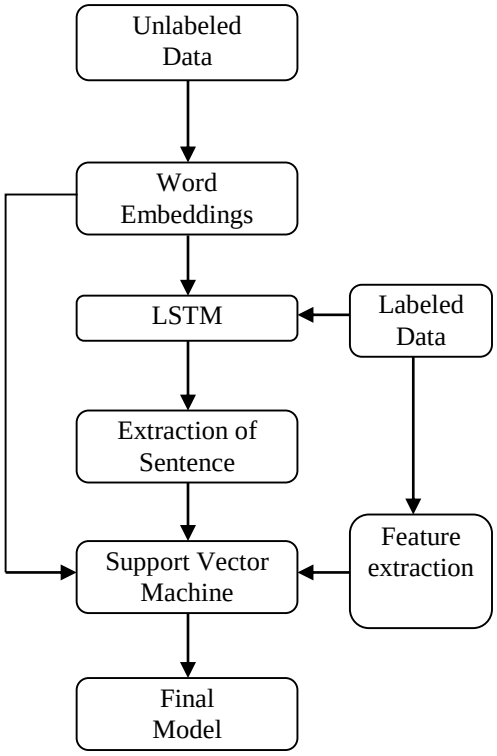

Figure 2. Architecture of LSTM-SVM

5. Conclusions

Our goal is to develop a deep learning model that cans categories product reviews according to the component of an e-commerce website that deals with the online purchasing process. We decided to design a new model that we term Modified Deep Learning Neural Network Models in order to get beyond the limitations of the works that have been done previously (MDLNNM). We are able to get a more successful conclusion in the Classification challenge by utilizing a tandem LSTM-SVM system. This tandem system combines the capability of the bidirectional LSTM to grab long-range interconnections between phrases from both instructions of a commentary with the capacity of SVMs to utilize manuscript auto encoder generated by the LSTM in combination with a broad set of universal features qualifying the lexico grammatical structure of the language. This allows the system to produce a more accurate prediction of the meaning of a text. The current path that research is on is the implementation of a character-based LSTM in the tandem system. When applied to the task of assessing product review texts, character-based LSTM has shown itself to be highly suitable.

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