

Feature Extraction through Sentiment Analysis of Tourist Sentiments using Deep Learning Techniques like CNN, RNN and LSTM

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Abstract— Sentiments are the emotions which are communicated among individuals. These are opinions given by people on any item, product or service availed or experience online. This paper discusses that part of research area which involves the analysis of sentiments exchanged by people online that further tells how sentiments and features through online tourist reviews are extracted using deep learning techniques. Tourist behavior can be judged by tourists reviews for various tourist places, hotels and other services provided by tourism industry. The proposed idea of the paper is to show the high efficiency of deep learning techniques like CNN, RNN, LSTM to extract the features online by use of extra hidden layers. Further, comparison of these techniques as well as comparison of these techniques with machine learning classical algorithms like SVM, Naïve Bayes, KNN, RF etc has been done to show that deep learning methods are more efficient than classical machine learning algorithms. The accurate capturing of attitudes of tourists towards tourist places, hotels & other services of tourism industry plays utmost important role to enhance the business model of tourism industry. This can be done through sentiment analysis using deep learning methods efficiently. Classification of polarity will be done by extracting textual features using CNN, RNN, LSTM deep learning algorithms. Extracting features are fed to deep learning classifier to classify the review into either positive, negative or neutral type of reviews. After comparing various deep learning and classical techniques of machine learning, it has been concluded that LSTM, RNN give best results to classify reviews into positive and negative reviews rather than SVM, KNN classical techniques. In this way sentiment analysis has been done and the proposed idea of this research paper is change in the machine learning techniques or methods from classical algorithms to neural network deep learning methods which in future definitely will give better results to analyze deeply the sentiments of tourists to find out the liking and disliking of various tourist places, hotels and related tourism services that will help tourism business industry to work on the gap in existing services provided by them and system can become more efficient in future. Such improved tourism system will give benefits to tourists or users in terms of better services and undoubtedly it will help tourism industry to enhance business in future.

Keywords: Sentiment analysis, feature extraction, machine learning, deep learning, CNN, RNN, LSTM tourist reviews.

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I. INTRODUCTION

In the course of recent years, online tools have changed the tourism industry. This is critical to comprehend venture out patterns to give simple and energizing travel encounters to the vacationer so as to build up the new plan of action in the field of the travel industry. Over many past years, data has been generated at very high speed and loaded on internet again with both structured and unstructured data. As far as tourism and travel industry is concerned, abundant data is present on the internet but to handle this bulk of data, it needs to be extracted properly analyzed in depth. It is very important to analyse the complicated data and channelize in proper direction through artificial intelligence techniques. Hence, Information is being created at extremely high rates and can be both organized and unstructured. The thought is to break down online surveys by notions arrangement different techniques utilizing AI. The key issue emerges is that there is no known method of utilizing information to produce esteems to realize how to get profit by these information. The objective is to provide easy and exciting services to customers or tourists in order to develop the new business model in the field of tourism industry. As we know tourism and travel is very exciting area present over the internet in the form of social media and it will not be surprising that tourism field has been recognized as number one field in the online environment. The four V's of data called volume, variety, velocity and value superfluous with the requirement for continuous and altered data. The travel and tourism industry is that part of business model where customers or clients experience better growth has exceptionally adjusted to the advancing technology. Age off automatic tools in social networks for tourism sector stated the importance of influencing the customer's involvement. Many tourist services are now available on the internet through online booking websites or portals. The scores that are obtained by the predictive analytics from different model pictures that should be taken for the retainment of the client by offering the new services. Predicting behavior we need the reliable consistent and persistent information. It is opportune to inspect how the travel industry analysts are utilizing these information new sorts of information structure a piece of another examination worldview. In view of the travel industry an assistance put together industry that depends with respect to positive client feeling and input of guest fulfillment is of basic significance. Social communication trademark is the principle focal point of the advanced discussion utilizing new tools, methods and strategies.

Electronic verbal exchange is acquainted element which drove with totally various outcomes from customary conversation. Using these, Google began making their own substance utilizing web 2.0 innovations which centers around the straightforwardness with which the message is handily circulated by means of web-based social networking. As a piece of artificial Intelligence, ML is another Shine. By utilizing machine learning algorithms on the enormous information we are upgrading the terms of the travel industry. Similarly, sentimental analysis technique has become a new verge. Now moving on the area of opinion mining and sentiment analysis that is the main platform for analyzing emotions of tourists and further features are extracted and analyzed with clarity and more refinement with the help of deep learning methods and algorithms. The thought is to take care of the issue of unstructured opinions of tourist surveys or reviews and how we can take profit by these information and how to utilize them to produce helpful values. We can not foresee the future information however it is conceivable to anticipate what will happen dependent on past information by procedure of predictive examination. The utilization of programmed devices in social networks for the travel industry area has produced plentiful writing because of the significance of impacting the customer's investment and influencing the manner by which customers see their experience[2]. Now in order to predict the tourist behavior through online reviews, reliable and consistent information is required. Deep learning methods will be used on this reliable tourism data taken from reliable tourism websites. Rather than the customary discussions that happen in explicit physical locations, the computerized discussion is molded utilizing new strategies and devices for connecting with the public, whose social cooperation characteristics is the focal point of its dynamic[3,4]. The analysis of feelings is an innovation which is possible through machine learning techniques called deep learning methods with great efficiency. With opinion mining, we can get high quality data. Assessment of these feelings is finished by deep learning procedures like convolution neural networks (CNN), recurrent neural networks (RNN) and long short term memory networks (LSTM). Further in sentiment analysis, methods can be commonly separated into two classifications, machine learning and lexicon-based methods. The previous uses ML procedures for sentiment polarity classification. Multiple labeled data is required in these kinds of methods. In any case, gathering adequate marked information is a test in itself. Lexicon based methods use sentiment lexicons to compute sentiment scores of given reviews. At that point, they group the scored reviews into positive or negative categories by the opinion scores[5]. Moving on to deep learning which is the buzzword in today's time, the technique of machine learning but much more efficient than classical machine learning algorithms. Deep learning comes in to the picture from the concept of neural network where multiple functions, methods and hidden layers are used to give wonderful results. CNN, RNN and LSTM are the neural network techniques associated with deep learning. Convolution neural networks are very effective in image analysis. Recurrent neural networks are very successful in textual data analysis and interpretation. If we talk about recurrent neural networks, LSTM that is long short term memory networks contribute the major efficient part in RNN that stores feedback in memory to have complete information completed so far[6].

II. METHODOLOGY

A. Machine learning basic classification algorithms

- Linear regression:

Connection between the info variable x and yield variable y is communicated as a condition of the structure $y = a + bx$.

In this way, the objective of direct relapse is to discover the estimations of coefficient a and b . here a is the intercept and b is the slope of line.

- CART (Classification And Regression Trees):

Decision Trees are usually utilized with the goal of making a model that predicts the estimation of an objective (or ward variable) in light of the estimations of a few inputs. In the present post, we examine the CART decision tree strategy. The CART calculation is organized as a succession of inquiries, the responses to which figure out what the following inquiry, if any ought to be. The after effect of these inquiries is a tree like structure where the finishes are terminal nodes so, all in all there are no more inquiries.

These are execution and implementation of decision trees. The non-terminal nodes of CART are the root nodes and the internal nodes. Non terminal node represent a single input variable x and a splitting point on that variable and the leaf nodes represent the output variable y . It is utilized as follows to make forecast the parts of the trees to show up at a leaf node and yield the worth present at the leaf node.

Classification Trees:

In this algorithm, there is fixed target variable and it mainly focuses on the class where this variable will lie. The example we can take for the classification tree like who will or who will not pass the entrance test, or which country will be able to or will not be able to make COVID-19 vaccine to cure this disease.

Regression Trees:

A regression tree leads to a calculation where the objective variable or target variable is and the calculation is utilized to foresee it's worth. For instance of a relapse type issue, you might need to foresee the selling costs of a private house, which is a consistent ward variable.

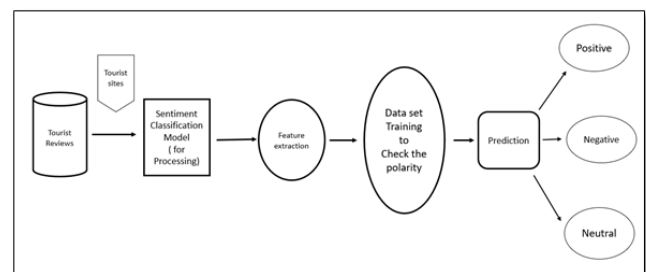


Fig1: Tourist data set pre-processing and prediction

- Naive Bayes Classifier:

This classifier plays very important role as probabilistic machine learning model. This classifier is used for task classification which is based on Bayes theorem.

$$P(A/B)=P(B/A)P(A)/P(B)$$

On the basis of this, we can define B here as evidence and A as hypothesis. Basically Bayes Theorem helps in finding probability of A to be happened when B has occurred. Overall we can say, as far as features or predictors are concerned, they are treated as

independent attributes which become the part of assumption. Moreover, we can say that existence of one variable, factor or feature will never affect the other variable. That is why it is called naive. In other sense, we can say that attributes here in naive bayes classifiers do not affect or interact each other but this is a very powerful assumption. It is also known as generative learning model. Naive bayes classifier is very useful for enormous data sets and very easy to build. That is why it is used to perform highly sophisticated classification method as well.

Basically putting some light on the probabilities then to learn naive bayes model, there are two types, one is class probabilities and another is conditional probabilities.

Types of Naive Bayes classifier:

- a. Multinomial
 - b. Bernoulli Naive Bayes
 - c. Gaussian Naive Bayes
- K-Nearest Neighbors:

K-Nearest Neighbor algorithm is used for regression problem and classification problem. It basically takes a bunch of all available cases and then learns how to classify other new cases. This technique looks at all the available cases close to the new case by majority vote of its K neighbors measured by distance function.

Here in this algorithm, the criteria is to utilize the whole informational index as the preparation set instead of parting the informational collection into a preparation set and test set. At the point when a result is required for another information case, the KNN calculation experience the whole informational collection to discover k closest neighbor tensors to the new examples or the k number of occurrences generally like the new record and afterward yield results for relapse issue for the Mode most regular class for grouping issue. The estimation of k is client indicated.

- Random Forest:

Random forest is a method used for both classification as well as regression. This algorithm is operated by controlling decision trees samples and get the production from each of the trees and the best solution by means of majority voting. While constructing a tree at training time and outputting the class made up of predictions of the individual tree. It is better than single decision tree because it reduces the habit of over fitting to their training set.

- Support vector machine:

SVM is a supervised machine learning algorithm which can be utilized for classification and regression problems. It utilizes a method called the kernel trick to change the information and afterward dependent on these changes it

finds an ideal limit between the conceivable outputs. A support vector machine (SVM) utilizes classification algorithms for two-bunch grouping issues. In the wake of giving a SVM model arrangements of marked preparing information for every class, they're ready to sort new text. Machine learning includes foreseeing and grouping information and to do so we utilize different AI calculations as indicated by the dataset. Linear and Non linear problems can be implemented or solved by SVM. The possibility of SVM is straightforward: The calculation makes a line or a hyperplane which isolates the information into classes. Support vector machine classifier executes the classification by finding the variance between two classes using hyper-plane or line.

- Neural network:

Neural networks are human brain neurons based algorithms which are artificially designed in such a way so that they can recognize different patterns. Basically, it is a process that makes the way a human brain operates according to the real world underlying relationships in a set of real world data. Here machine works like human brain and takes input and process the input in the same manner as neurons work in human brain. The input data for neural network layers can be real world data that can be images, text, time series or sound that must be translated. Classification and clustering can be done efficiently with the help of neural networks. So it refers to the system of neurons, original or artificial in nature. It interprets the sensory data through a machine like structure, clustering raw input or labeling that recognizes the numeric facts, all real world data, text, sound, time series, images. Neural network help in classification and clustering which can adapt to changing inputs, then network generate the best result without altering the design of output criteria. It forms the unlabeled data according to the similarities among the input and then it classified the data to have a labelled data set to train on. Neural Network is a mathematical function that collects and then classify according to a designed architecture. So, we can think of neural network as a component of larger deep learning applications.

B. Deep learning and its future

Deep learning comes in the type category of machine learning and part of artificial intelligence. It works in the ways as like human brains and certain types of knowledge. It is an essential part of data science, which include statistics and predictive modelling. These days deep learning techniques work best on bulk of data taken through various websites in order to analyze the tourist reviews. In simple terms, we can think of deep learning as a way to automate predictive analytics. Algorithms of deep learning are stacked in a hierarchy of high to low complexity and abstraction. There is a non linear transformation of the input and uses what it learn to obtain a statistical model as output. As the process continues, number of layer from which the data passes through also increase which give the inspiration of its name deep learning.

Future of deep learning:

- Core set of standard tools and methods will be embraced by deep learning industry.
- Deep learning will increase local help inside Spark.
- Deep learning will locate a steady specialty inside the open investigation environment.
- Deep learning devices will fuse streamlined programming structures for quick coding .
- Deep learning toolkits will bolster visual improvement of reusable segments.

C. Comparison of machine learning and deep learning approach.

Both Machine learning and Deep learning find designs in information, yet they include drastically extraordinary techniques. Both deep learning and normal ML are strategies for instructing AI to perform errands. Machine learning and deep learning comes under the field of artificial intelligence. we can likewise say, effectively, that deep learning is a particular kind of machine learning. Both machine learning and deep learning start with preparing and test information and a model and experience a streamlining procedure to discover the loads that make the model best fit the information. Both can deal with numeric and non-numeric issues and related problems despite the fact that there are a few application territories.

The following differences exist between machine learning and deep learning:

Volume of Data dependencies:

The greatest distinction between machine learning and deep learning lies in their presentation as the volume of information increases. Normally machine learning works well on small amount or volume of data. Then again, deep learning algorithms require a monstrous measure of information to perform impeccably.

Extraction of features engineering:

In machine learning, execution relies upon hand-created includes as inputs. Here, inputs are pixel, surfaces, shape, position, direction, and shading etc. The presentation relies upon how well these highlights are recognized and extracted. On the other hand, deep learning doesn't depend close by created includes and plays out a various leveled strategy for include feature extraction, which implies it learns features layer-wise.

Criteria of Problem-solving method:

We have to separate an issue into various parts so as to tackle it utilizing in machine learning and we have to do different item discovery. The errand includes distinguishing what's the article and where is it really present in a picture. In machine learning, the problem can be partitioned into two stages: first is object location and second is object acknowledgment. Then again, in deep learning approach, the procedure would be done start to finish. For example, we have to go in the picture, and it would come out with the area along with the item's name using hidden layers technique.

Platform dependencies:

As deep learning works efficiently on large amount of data and hence deep learning is highly dependent on high-end machines while if we compare it with machine learning then it can be performed on low-end machines.

Requirement of training time for data:

Deep learning algorithms require much more time to train the data because a big amount of data and related parameters are present to be handled by deep learning techniques or neural network algorithms like CNN,RNN, LSTM and comparing it with machine learning where it needs much less time from a few seconds to a few hours to train the data.

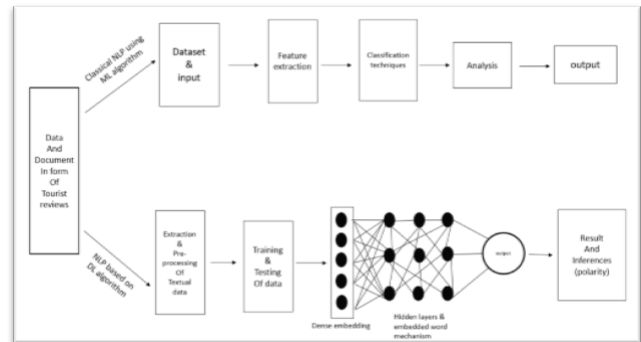


Fig2: Comparison of ML based NLP vs DL based NLP

III. ONLINE TOURIST REVIEWS

Online client created surveys are changing business and client conduct and could majorly affect deals. The essential point of this examination was to quantify the effect of online surveys in correlation with the effect of an old buddy's feeling. Excellent (or awful) reviews have a method of rapidly spreading. Urging customers to survey your organization is a simple method to extend your image's scope. When individuals have beneficial comments, they are additionally bound to share their surveys on more sites. What spurs customers to compose online travel reviews? The outcomes demonstrate that online travel survey journalists are for the most part propelled by helping a movement specialist co-op, worries for different buyers, and requirements for delight/positive self-upgrade. Venting negative emotions through postings is plainly not seen as a significant motive. Many tourists or customers utilize online reviews to assist them with making sense of where to remain, where to eat, or what to do while around. This result gives tips and recommendations on the best way to oversee Online Reviews to guarantee more noteworthy customer. Very regularly, clients will utilize Online Travel Agency reviews to assist them with deciding, regardless of whether they don't book the outing on the web. Surveys that have been composed by genuine individuals are trusted over any ad that the business itself may distribute. Despite the fact that there have been known to be phony surveys, individuals are keeping watch for them and still utilize online reviews to decide. Hence online reviews whether they are positive, negative or neutral play extremely important role in the field of tourism and travel industry that helps alot to customers or clients to know about the tourist place or hotel or any other related service before they experience it in future.

When we talk about the hospitality business or tourism



business model from e commerce point of view whether it is about a hotel, a restaurant or any other travel and tourism business service ,informal exchange is probably the best kind of ad and in this online age, it's a higher priority than any time in recent memory. Review or feedback about services, hotels, places etc can be negative also but even if we get a negative comment or review, regardless of whether we get a contrary remark or audit, this offers a chance to show individuals that we really care by dealing with the problems and the visitor. To make things work in proper direction, every kind of review is utmost important .

IV. DEEP LEARNING-THE CONCEPT OF NEURAL NETWORKS : WHY SO IMPORTANT?

The base of the tourism industry is a services that include travel, transportation, accommodation and similar services. Everyday billions of dollars changes hands in the complex ecosystem. It is that kind of industry where the customers wishes meet more than their needs. Machine learning and deep learning can improve the strategies of competitors to offer a better service.

- Prediction of seasonal demands for services:

Tourism is a business which is marked by the seasonality of demand. At the peak season, tourism Product Suppliers have the opportunity to earn more. It is easy and accurate to find the correlation between the deep learning algorithm and protecting the trends for future. This is called predictive analytics on time series.

- Pricing strategies:

One of the major strategies of the tourism Product Suppliers is to attract the customer by using competitive prices. Companies adjust the price without compromising their profits. Here, deep learning prove to be useful by analysing the data like history of Hotel, local events, competitions or promotions. These data can be analyzed through predictive model which provides best possible prices.

- Personalized recommendations:

For a long time, many known travel sites have used recommendation engines. Travel sites offers their user the holiday packages which best fit their customers profile. These engines collect the information like preferences, budget related data, and customers detail to give the customer a personalized travel recommendation. Information acquired is used to find best possible alternative by comparing the option.

- Customer experience:

In customers profile, there is a large variation as their demands and expectations are different. Every customer want that they should be treated according to their preferences. So, area of the sector apply market segmentation. The entire chain of customer is divided into segments and then subdivided on the factor of similar characteristic, demand and expectation. By this process, customer can be offered a much more personalized and specialized service[7].

V. SENTIMENT ANALYSIS OF TOURIST REVIEWS USING DEEP LEARNING TECHNIQUES

Sentiment Analysis:

Sentiment analysis discusses with the opinions and emotions or we can say behavior and attitude of customers or tourists here towards tourism services like tourist places, hotels, travel services etc. On platform of social media, people give different opinions towards the same service or entity. Analysis of emotions predicted or expressed on social media or internet can be broadly categorized into three types:

Document based opinion:

In this there is discussion on one topic and polarity is decided on the basis of classification on entity.

Aspect based opinion:

Different aspects of services are classified in aspect level.

Sentence based opinion:

Sentences are small parts of the document where the polarity of data is determined in the form of sentence.

The information assumes an incredibly significant job in this space. Generally, such informational index is gathered which is important from business point of view as future strategies and decisions are made on the basis of these customer reviews. Sentiment analysis can be done on any area like recommendation system of products or any other entity but here in this paper we focus on tourist online reviews only that is the base of sentiment analysis which will be finally executed with the help of deep learning techniques. Social media is the platform where many people give their reviews on products and services and in context of this paper the services will be related to travel and tourism industry .These reviews can be positive, negative or neutral depending upon the experience of every individual. Further, moving on Sentiment analysis can be classified in the following steps:

1. Retrieval of data
2. Extraction of data
3. Preprocessing of data
4. Feature Extraction
5. Topic Detection
6. Data Mining Process

Information recovery requires the recognizable proof and meaning of the information source. To gather the survey information from these sources a particular web crawling instrument is important to bring the information and afterward spare them in a database. In the wake of gathering information in a database see information should be removed at that point set of heterogeneous information fields. The review message should remove utilizing proper articulations. Is remove survey contains one or a few sentences sway the audits supposition. Grammatical form labeling is a significant preprocessing task .It is a piece of feeling investigation by selecting each word a specific name. Highlight extraction is known as the way toward pulling out a lot of discriminative enlightening and non-comparative qualities to numerically speak to an review or text[8]. Now in context of sentiment analysis, deep learning comes in the picture in order to work on

structured, semi structured and unstructured tourist reviews data. With the help of this ,data of any type is cleaned first and then fed to machine to apply algorithms on every part of text so that it can be understood by machine with clarity so that machine will be able to give output efficiently with high accuracy either in positive or negative review about tourism services. In this manner a machine is trained. This can be possible by using deep learning methods like CNN,RNN and LSTM by the use of optimum number of hidden neural network layers. As the data is present in bulk or big amount in this case deep learning is more efficient in giving quality and refined output rather than classical algorithm of machine learning. Hence ,a model is prepared by giving training to machine to work on neural networks which further work on data in the same manner as human brain neuron works on input signal.

A. Convolution Neural Networks

Convolution Neural Networks are based on neurons with weights and biases. They mechanism is like normal neurons and it is deep neural network having convolution structure. It is a feed forward neural network. Following quite a while of improvement, the use of convolution neural network has gained incredible ground and infiltrated into numerous aspects of our lives. Since the convolution neural system doesn't require complex preprocessing of the information, and it can gain a lot of highlight data, particularly in the field of example acknowledgment, the convolution neural system doesn't require complex preprocessing of the image, and straightforwardly utilizes the image as a system. The information makes the convolution neural system have incredible focal points in image comprehension, and it tends to be applied to numerous fields of our lives, which has increased extraordinary worth. Basically convolution neural network is composed of the following layers:

1. Input Layer
2. Convolution layer
3. Down sampling layer
4. Fully connected layer
5. Output layer

Each layer has a majority of highlight maps, every one of which separates an element of the contribution through a convolution channel, each component map having a majority of neurons. Picture understanding has gained exceptional ground with individuals' slow understanding and application, yet the rise of a wide range of issues is the rise of different issues. The most noticeable is the expansion of information, the speed and capacity to manage information, the cross appearance of different items in the picture, and the unavoidable impact of shadow .These are the remarkable issues to manage.

Although CNN can work both on images as well as textual data and give best results in the form of output but it has been experienced that CNN work best on images and give wonderful results in the form of image recognition.

CNN models are deep learning models which are used to train and test data mostly in the form of images as input. Technically many convolution layers are present in form of a series and each input in form of image is passed or fed to these convolution layers with kernals or filters, pooling layer, fully connected layer and then apply softmax capacity to arrange

and classify entity or item with probabilistic qualities in range between 0 and 1.

A convolution is the straightforward use of a channel to an info that outcomes in an actuation. Rehashed utilization of a similar channel to an information brings about a guide of initiations called an element map, demonstrating the areas and quality of a recognized element in an information, for example, a picture.

Convolution neural networks apply a channel to a contribution to make an element map that sums up the nearness of identified highlights in the information .

B. Recurrent Neural Networks

Recurrent neural networks are deep neural networks. All RNN results or outputs are based on LSTM.RNN work on sequential data like audio, video and text.RNN are composed of sigma cells or tanh cells. But at times, this is not enough to get the relevant information from input values or data when the case is of more gap in input values. Further, LSTM comes into the picture when with the introduction of gate functions in cells, then it becomes easy to manage long term dependencies. So most of the time , wonderful results of RNN are due to the presence of LSTM technique in such a way that LSTM has become the center of deep learning. LSTM networks are further classified into two types where one is LSTM dominated network and another is integrated LSTM network. In order to predict exact output or review, undoubtedly we use neural network based models like CNN and RNN but when we see the comment in form of feedback or review in detail then we find that it is the combination of various words which are further processed as time series. When it is the case of feed forward neural network which are considered as common or normal neural network,they actually lack memory to store data over the period of time. Recurrent neural network plays very important role in such a situation by solving this matter related to no storage of data for long by making network output y_j at step J depending upon previous computations which is possible through hidden state s_j that is basically the memory for network. So we can say that LSTM networks are refined version of recurrent neural networks that remembers or stores the past or the previous data over the period of time in memory. There has been experienced a problem in RNN called vanishing gradient problem which is not able to store the past data over the period of time but this problem can be easily handled by LSTM utilization. LSTM is best suited for classifying and predict time series data efficiently. LSTM gives us better results and has the complete control ability. In other way, we can say that LSTM is an artificial recurrent neural network used as deep neural network because of its hidden layers and cells architecture, it is widely used and advantage of LSTM is having in the form of reduced gap in length of data. This is the advantage over RNN. Further, discussing about RNN, the problem called vanishing gradient problem exists which can be more efficiently resolved by residual neural networks or they can be written as ResNets. The output in LSTM cells is actually a hidden state and this is not the actual output as each LSTM cell keeps an internal state which cannot be the output that is cell state.

The equations for cell state, candidate cell state and final output is as follows:

$$\begin{aligned} \tilde{c}_t &= \tanh(w_c[h_{t-1}, x_t] + b_c) \\ c_t &= f_t * c_{t-1} + i_t * \tilde{c}_t \\ h_t &= o_t * \tanh(c^t) \end{aligned}$$

$c_t \rightarrow$ cell state(memory) at timestamp(t).
 $\tilde{c}_t \rightarrow$ represents candidate for cell state at timestamp(t).

From the above equation we can observe that for any timeslot, cell state knows what is required to forget or not to be remembered from previous state and what is required to consider from current time slot.

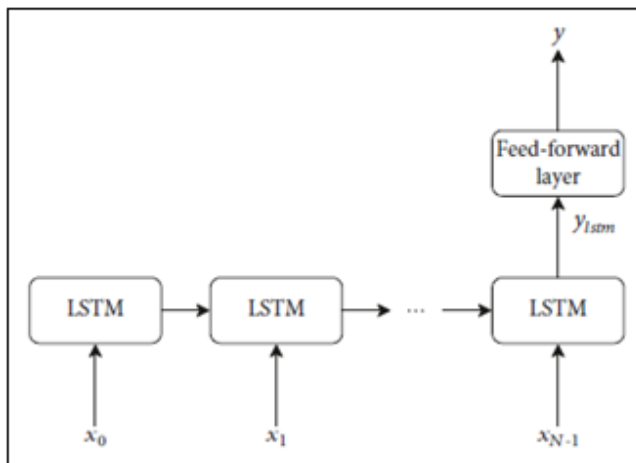


Fig3: LSTM in a full network.

Figure 3 shows the RNN having LSTM cells we utilized, unfurled into a full system. By unfurled, we basically imply that we work out the system for a total grouping of N steps, where x_j is the j th encoded word in the remark, which we utilized as the contribution to the system in the j th step. In a RNN, the connection between yield y_j , input x_j , and state s_j in sync j is dictated by the sort of RNN cell. As Figure 3 shows, we utilized a sort of cell called LSTM where each info x_j is the coded estimation of the progressively coded grouping of words (x_j) $N-1$ at $j=0$ in the remark. The RNN cell gives a yield at each progression j , however for the expectation, just output $N-1$ of the system is thought about when the final word x_{N-1} is contribution to the system. This output is the thing that we allude to as y_{lstm} in Figure 3. Yield y_{lstm} is utilized as a contribution to a one-neuron feed forward layer with a sigmoid enactment work, the output of which, somewhere in the range of 0 and 1, is the system's expectation for regardless of whether the assessment is sure or negative.

$$y = \sigma_{\text{sigmoid}} \left(\sum_k w_k y_{lstm} + b \right) \sigma_{\text{sigmoid}}(x) = \frac{e^x}{e^x + 1},$$

The output y of that neuron can be communicated as demonstrated in where w_k is utilized to indicate the heaviness of the k -th input, b is the inclination, and $\sigma_{\text{sigmoid}}(x)$ is the sigmoid activation function of the yield neuron in the layer[9].

VI. RESULT AND DISCUSSION

It has been observed by analysing results though various studies and research done earlier in the field of tourism to check the emotions of tourists using classical algorithms of machine learning that accuracy measured by the same and by deep learning methods differs remarkably. Results of deep learning techniques are much better than classical techniques of machine learning. Deep learning techniques like CNN, RNN and LSTM will be applied in future as they all work on hidden layers and accordingly data set will trained and tested. The research will be focussed on feature extraction for sentiment analysis from tourist reviews. In order to find the simulation results, execution will be done on the data set taken from tourist sites to get to know the tourist various opinions. After that data will be fed to CNN, RNN or LSTM technique in order to work on the deep and hidden layers of data to find out the best results with high accuracy. Accuracy will be analysed and will be compared with accuracy of classical techniques of machine learning. In other words, performance comparison of accuracy of different machine learning algorithms will be done to compare it with one of the deep learning techniques to find the better efficiency. In the following proposed diagram, it has been shown that first input data will be taken from tourism dataset in raw textual form like for example any record of data like "Taj-Mehal was the best tourist place I have ever seen" will be fed to the machine and each word is examined and analysed through sentiments pre-processing stage. Further, when the data will be cleaned then deep learning hidden layers approach in form of LSTM layers would be applied on this data in order to make machine understand every single text fed in form of input in depth. This will further give the exact polarity in form of tourist positive or negative feedback which is the objective here of using deep learning rather than classical machine learning approach. This is the most efficient deep learning neural network technique to examine the polarity of sentiments of tourists given in the form of feedback or online reviews.

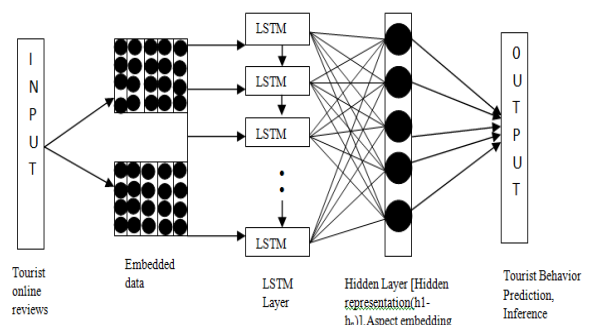


FIG4: PROPOSED DIAGRAM OF FEATURE EXTRACTION THROUGH LSTM

VII. CONCLUSION

In this paper, deep learning techniques CNN, RNN and LSTM have been proposed to work on tourist review data. The proposed framework of sentiment classification for tourist reviews is to find out positive, negative and neutral reviews and the corresponding methodology has been mentioned in this paper.

Further, comparison has been done of various classical and neural network techniques to find out which one is the better technique for future. More clarity of tourist sentiments, better will be the technique. Proposed techniques will give better results rather than existing work based on classical algorithms like SVM, KNN etc. Future work can be perused in several directions. This paper worked on the limitations of existing classical machine learning methods and proposed better techniques of deep learning to give far better accuracy of performance. By using LSTM deep learning approach, it has been seen on the working of past tourism data that LSTM layers of deep learning can give wonderful results with more accuracy. So the future work will be based on implementation of actual raw tourism data taken from tourism sites to use the LSTM techniques in order to get high accuracy results as compared to the existing research.

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