Sentiment/Opinion Review Analysis: Detecting spams from the good ones!

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***Abstract*—In this era of Whatsapp, Facebook, Twitter, Instagram, and various other social media platforms, we all are connected to each other's thought in one way or another. The Internet has brought us closer to everybody's work, place, plans, ethics, feelings, and emotions. We are much more interested in showing off our day, commenting and reviewing each and everything we came across throughout the day, knowing others opinion on the same and identifying how and why are they different from ours. Reviews also help in identifying the market conditions and strategies, and it could be done via Sentimental analysis as it helps us in identifying the things that are in trend and helps the organizations, businesses to utilize and expand accordingly. It can also be used in general by people themselves to look for which movie to watch to which laptop to buy, but when we encounter spam reviews we sometimes do not know whether they are fake or not in reality, but they do change our point of view. In this article, we go through this in a step by step format of different papers and summarize for other readers how we can identify the correct emotions and differentiate between the real and fake reviews. Using some researches, we get to know in-depth about how to choose the correct dataset, and the challenges faced.**

Keywords— Sentimental analysis, opinion mining, review analysis, fake review, spam detection.

I. INTRODUCTION

There have been generations and generations involved in studying the human mind about why we say what we say. However, to date, nobody is lucky enough to say for sure the reasons behind every action. Since everything is correlated in one way or the other, it may be seen as a "butterfly effect." Nowadays, studies are going on to identify human emotions behind the texts, comments, reviews done by users on online sites or social media on various occasions. Some may be due to the expanding market or to gather new ideas on how to improve them in their field because when we take suggestions from all the people around us, we have a massive box of ideas. Sentimental analysis is a field in which we try to understand the emotional aspect of a sentence or a word according to some keywords or the aspect terms or the subject in which the comment is made. It is also crucial to connect the whole sentence since many people who use irony or sarcasm while exhibiting their feelings [27,29, 30].

We live in the world where each and every person has a different set of mindsets, views, and suggestions and when dealing with such a vast market, we have to realize the demands of each and every one of them. This can be done efficiently if we apply review analysis instead of reading and extracting information from each one of them. But, we all know that fake news travels like wildfire and can affect our analysis in a very dire way. Thus, it's necessary to separate fake or spam reviews from the real ones.

Now, more than ever, it's necessary for businesses, organizations, companies to understand the customer and listen to their voice if they want to thrive in this fast-growing society. It is known as Voice of Customer (VoC) [1]. As these days there are many companies who make similar products and there is a mere difference between the characteristics which differentiates them. Therefore, the consumer has many options to choose from, and he will tend to look into the one that has the specifications according to his requirements.

Every day, 2.5 quintillion bytes of data are generated each day, and a significant share of data is in the form of texts. Reviews are necessary and are often gone through by people to rate movies, songs, videos, articles, blogs, etc. It can be used by various business users [2] to hunt customers and make appropriate business customers. Sentiments are of different polarity positive, negative, or neutral. The task of identifying the polarity of emotion requires a whole lot of work since they can be affected by the subject of talk, ironical statements, and sarcasm or even just by using an emoticon.

Review analysis can be done at various levels of granularity [14], i.e., Word level, sentence level, document level, and feature-based, as shown in figure 1.

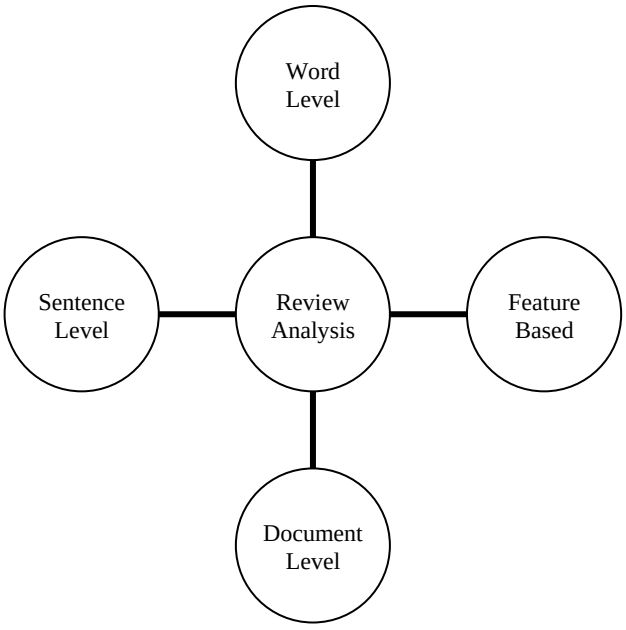

Fig. 1. Different techniques used for Review analysis

In this paper, we have highlighted the problem of fake and spam reviews given by some people. Since in today's society, 90% of people consult online and read the customer reviews and comments before buying or going anywhere, it plays an important role.

The remaining paper comprises of VII sections: the II section comprises of the literature review, Section III lists the limitations of review analysis, Section IV presents the identification techniques of spam reviews, V represents metrics used in sentimental review analysis, VI lists the Datasets characteristics and reliable data sources and finally Section VII provides the Conclusion and Future work and then we have listed all the References.

II. Literature Review

Review analysis has been studied in-depth for many years. In today's fast-evolving world, the hype of data and to analyze to gain knowledge has increased exponentially. But, with the increase of the exposure fake data [11] also increases and it affects the understanding of the reviews. Most of the overall reviews focus on the rating and less on the texts. There can be some reviews in which the punctuations or the emoticons change the whole meaning of the sentence. For example: "Let's eat Dad!" and "Let's eat, Dad!" or "Man-eating fish" and "Man eating fish". Earlier, words like lmao, lol, xoxo, hahaha etc. but today emojis have replaced them.

In this section, we will study the levels and classification of review analysis as it is based on sentiments of people we will first study the sentimental analysis and the various tools used to identify the sentiments of reviewers, and in the next section, we will study about review analysis.

A. Sentiment analysis

Sentimental analysis is a framework in which we categories emotions from various data sources and analyze the reviews and demands. It can be used to examine various features such as product analytics, monitoring of the brand and social media, services provided to the customer and their voices (VoC), analysis of workforce and the voice of employees as well as market analysis and research [15]. Emotions can be of various types such as there can be negative emotions, positive emotions, as well as neutral statements [3]. Neutral statements can also be further divided into facts and a non-aligned opinion. They are often confused as to which of them to be marked as neutral and which to be ignored. Further, Sentiments can be classified according to the approach by which we find them. There are mainly three types of approaches that can be used to classify sentiments that are the lexicon-based approach, machine learning approach and hybrid approach.

1) Lexicon based approach:

It is based on the hypothesis that the sum of the orientation of each phrase or word is the contextual orientation of that statement [4]. It is further divided into a Dictionary based approach and Corpus-based approach. In Dictionary based approach [5] [23], a technique is used that first some words are listed manually then the model converts all the words in a particular sentence to their synonyms via a dictionary which are available in the lists. This process is repeated iteratively till all the words belong from our lists. Then the list is cleaned using a manual inception step. We only judge the emotions in this via some keywords.

In Corpus-based method, context is also taken in the account, which helps in understanding the emotions at a deeper level. It can understand the text based on the subject on which the speaker is trying to make us understand his thoughts. The corpus-based approach is further divided into statistical and semantic. These approaches in statistical focus on the statistics and in semantic, we focus on the semantical aspects of our statement.

2) Machine learning-based approach:

It is based on building classifiers from labelled instances [6] from posts that contain textual information. It is further divided into two different groups that are supervised and unsupervised learning.

Supervised learning is used when pre-defined labels are provided, and it is based on the automatic classification of texts. There are many different classifiers in supervised learning such as decision tree classifiers; that are divided into K-nearest neighbour, Conditional Random field, Hidden Marcov model, single-dimension classification and sequential minimal optimization [13], linear classifiers, Rule-based classifiers and probabilistic classifiers. Linear classifiers are further divided into SVM (Support Vector Machines) and neural networks; that can be subdivided into Feedforward neural network, Radial basis function, neural network, Multilayer Perceptron, Convolutional neural network (CNN), Recurrent neural network (RNN) – long short term memory, modular neural network and sequence to sequence models [12]. Probabilistic classifier gets divided into three categories Naïve Bayes, Bayesian Network and Maximum Entropy.

Unsupervised learning is used when we do not want to be depended on training data labels or domains. Here we can work without the labelled dataset.

Semi-Supervised learning [22] is quite different from the above two approaches. It uses both unlabelled as well as labelled data. It is commonly used when we have limited labelled data. It gives better results over supervised and unsupervised learning.

Reinforcement learning is commonly used when we want to take continuous decisions and is commonly used to find the best possible solution for a particular problem.

3) Hybrid approach:

It is used to classify the reviews based on polarities which is a combination of both machine learning as well as lexical based approach takes a lot of time and space and thus should be used only when necessary but it provides a very high-performance rate that surpasses other techniques and overcomes the complains of other models

This is further elaborated in the given figure 2. We should also take into account that there are also some strengths and weaknesses of lexical as well as machine learning-based algorithms [17]. The lexical based approach is straightforward and easy to implement, but it requires changing in context and has low performance as compared to other techniques.

In machine learning based approaches, i.e. supervised learning and unsupervised learning; supervised learning provides high performance as well as the quality of quick

adaptability when encountered with new cases, but it is costly as it requires much time in labelling the dataset and sometimes we may not have a labelled dataset. Unsupervised learning has a high strength that it does not require a training dataset, but it cannot be applied alone since it can hinder the performance of the data model and give inaccurate results

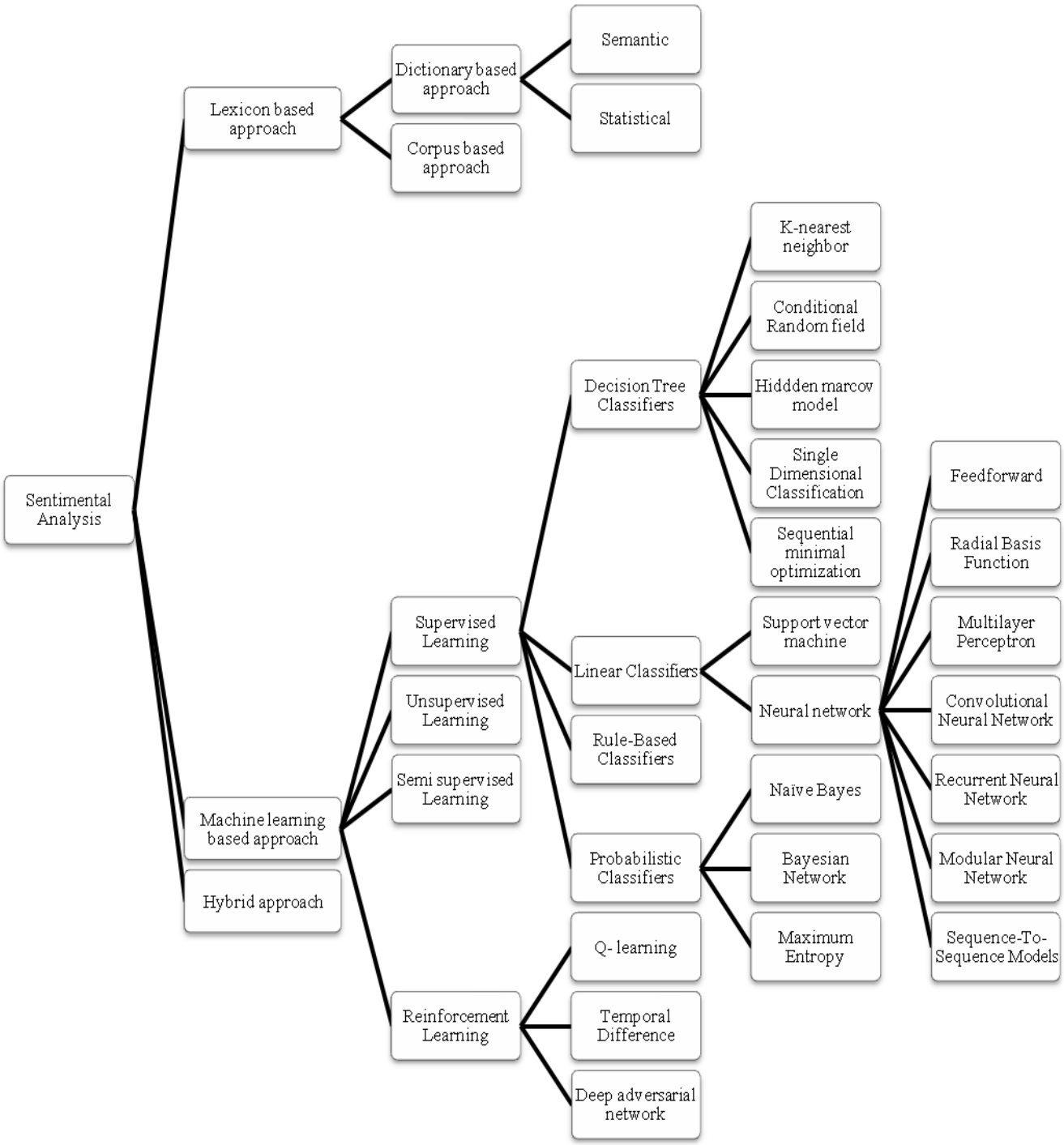

Fig. 2. Classification of Sentimental Analysis

B. Review Analysis

Review analysis even after all the researches is an area for tremendous growth. Since the languages are changing day by day, and we are using the spoken language that consists of converting your native tongue into English to write on social media. These help them to express their emotions freely, but when it comes to deploying models to gain insights on their reviews, the models have a tough time fitting into the real-world applications.

Reviewers not only help us to expand and customize our business according to the need of society. It also helps in keeping up with the swiftly changing market. People are posting fictitious reviews [24] from different login ids, and it so happened some are posted in such a way that they look authentic. These are the most difficult to identify.

The common steps to identify the polarity of the review are shown in Figure 3:

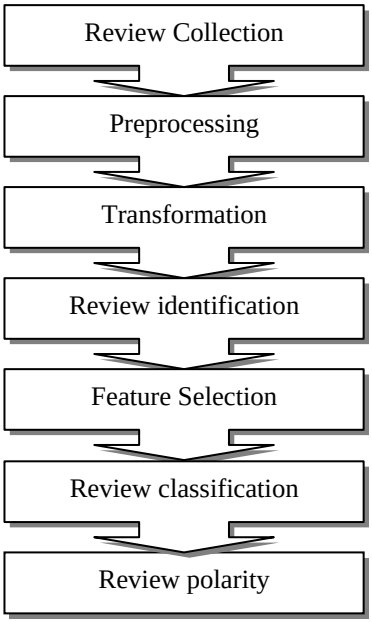

Fig. 3. Systematical approach to identify the polarity of reviews

III. Issues and Challenges in Review Analysis

In today's era, there are limitations to everything. We have to overcome the issues and challenges step by step. Review analysis is a field in which mere a single word or emoticon can change the whole meaning or polarity of the sentence. Thus, below are some challenges that are faced.

- *Punctuations*– The texts containing punctuation marks change the whole meaning of the sentence. Example: *"Most of the time, travellers worry about their luggage"* versus *"Most of the time travellers worry about their luggage"*.
- *Ironical or sarcastic*– The texts can contain ironical statements that can affect the polarity of the sentences [7]. Thus it is not essential that the sentence that has a positive meaning is of positive polarity or vice versa.
- *Neutral* – Defining neutral reviews is in itself a challenge. Since, they could be wishes, facts or just a weak response that is not correlated to the subject in any form [16].
- *Complexity* – When dealing with complex statements, the polarity of the statements may get depended and thus affecting the outcome [8].
- *Real World* – These models have high accuracy when applied on datasets and testing phases [9] but can have low accuracy when dealing with noisy data.
- *Object and Aspect terms* – When showcasing one's emotions, the user can use various methods [10] [20], and the subjectivity of the sentiment can be hindered, thus providing an incorrect output.
- *Comparative* – When comparing two or more things in a sentence, the models may provide an inaccurate result [21]. It is necessary to understand the context in which it is said.
- *Spam or Fake reviews* – Many times, some people provide spam reviews to increase or decrease the popularity of a product for their personal benefit and thus affecting the outcome.

So, these are the main features that we have to look after before diving into the field as they immensely change the meaning of the sentence. Some of these challenges are due to the understanding of the sentence; some are due to the formation, and they all play an essential role in increasing the efficiency of our model.

IV. Identification of Spam Reviews

Spam or fake reviews are often given by some people for their personal gains. These affect the final review of the product profoundly. To identify these reviews there are some techniques that when carefully implemented reduce the abundance of spams. Sometimes the truth is moulded in such a way that we think that we are unable to identify its falsity. Some conventional techniques are [7] [19]-

1. It can come from a website that is not familiar.
2. It could have come from an id that is recently made and is not used.
3. It may have an old date or does not have coverage.
4. Proof of claim may not be provided by the user.
5. The tags are despicable.
6. The matter written in the review may not match the subject.
7. On average the hashtags are more in spam reviews than in common.
8. The person reviewing would not have bought the product.

Thus, by using and applying these simple tricks and observations, we can avoid fake and spam reviews.

V. METRICS USED IN SENTIMENTAL REVIEW ANALYSIS

The metrics that help us in identifying how well we are accomplishing our goal are defined using a table layout, i.e. Confusion matrix. Metrics that can be identified are:

TABLE I. CONFUSION MATRIX

Predicted	Actual	
	Correct	Incorrect
Correct	TP	FN
Incorrect	FN	TN

$$F-score = \frac{(2 * Recall * Precision)}{Recall + Precision}$$

$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

Here, in Table 1 it is used to define the classification model, where TP is true positive where the data that is positive and correctly identified, FP is False Positive where the data that is positive and incorrectly identified, TN is True Negative where the data that is negative and correctly identified and FN is False Negative where the data that is negative and incorrectly identified. Now, we have demonstrated in Table 2 the outcomes of some researches, the type of dataset used, the model and result of the measure applied.

TABLE II. MODELS, DATASETS, METRICS AND RESULTS PRESENTED.

Paper Title	Model	Datasets	Language	Detecting fake reviews	Metrics	Result
Sentiment Analysis from Movie Reviews Using LSTMs [25]	LSTM+DNN	IMDB	English	No	Accuracy	88.46%
Sentiment Analysis of Student's Comment by using Long-Short Term Model [26]	LSTM	IMDB	English	No	Accuracy	Positive label- 92% Negative label- 79%
A Lexical Updating Algorithm for Sentiment Analysis on Chinese Movie Reviews[28]	Lexical updating algorithm	self-built	Chinese	No	F score	0.80
Understanding emotions in text using deep learning and big data.[31]	ESS-BED	ISEAR, SemEval2007, WASSA'17	English	No	Accuracy	Happy- 0.504 Sad- 0.546 Angry- 0.689
Sentiment Analysis For Movies Reviews Dataset Using Deep Learning Models[2]	CNN-LSTM	IMDB	English	No	Accuracy	89.20%
A Knowledge-Based Recommendation System that includes Sentiment Analysis and Deep Learning[32]	CNN BiLSTM-RNN using SoftMax	Self-built	English	No	F1- Score Accuracy	0.95 0.93
Fake Reviews Detection on Movie Reviews through Sentiment Analysis Using Supervised Learning Techniques[33]	SVM	Movie Reviews dataset	English	Yes	Precision, Recall, F-measure	Positive- 62.8, 81.4, 70.9 Negative- 73.5, 51.7, 60.7

VI. DATASETS

There are well-known sites that provide various datasets. However, using a correct dataset for analysis is as vital as the model itself. Since the dataset used should have combined reviews of different polarities as well as fake ones. Some characteristics are –

1. There should be real-world examples of reviews in the dataset so that when applying it does not reject the reviews.
2. There should be reviews that contain positive, negative and neutral reviews.
3. The neutral reviews should contain facts as well so that the model understands the difference between a neutral statement and fact.
4. The use of irony and sarcasm should be there in some reviews.
5. There should be the use of emoticons in the dataset.
6. The dataset should not be inconsistent and should be from a reliable source.

These are some necessary characteristics of the datasets that are required for the model to work correctly and provide accurate results. Some sites where we can get reliable datasets are-

1. Kaggle – It is a web-based community which lets a user find and publish datasets. It is owned by Google LLC [17].
2. Knoema – It is the largest source of publicly available data on the web.
3. BuzzFeed – It provides the political and social media analytical data, libraries and analytic code.
4. Google Public Dataset – It stores data in GCP (Google Cloud Platform) and shares data to the public.
5. Github – It is a platform from where we can get open datasets on 30 different topics.
6. Quandl – It is a community in which the datasets are provided by data scientists and data is cited and provides clean data.
7. Data.gov – It provides the US government's open data to users all over the globe [18].
8. FakeNewsNet – It provides the spatial data where the datasets of fake news, social sites are there.

VII. CONCLUSION

In this paper, we dived more in-depth into the field of review analysis. This study set out to understand how we can identify the fake reviews or spam's and cleans the dataset from them. Then, there are various characteristics required for a dataset so that the model can perform its tasks accurately. We also looked into some of the limitations of review analysis and what can be avoided so that it may give more accurate responses when applied to the real world.

Although the study did not show the procedure to implement these findings, it did substantiate the different tasks required to implement it. Future research should concentrate on some more aspects to detect fake reviewers since the review may have come from the user, who is dissatisfied and had started exaggerating the bad qualities of a product. Thus, the implications of this study have several implications for the people who want to study sentiment analysis and study the reviews of customers online or on social handles.

In future, It can also focus on to understand the language of reviewers and does not dwell only on the responses that are in a particular language but also lookup into languages that have the opinions in any language even the converted ones. We can also work on the shortcomings of how to better identify the spammers and differentiate between the fake and exceptional user as specified.

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