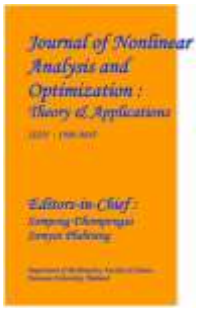
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 16, Issue. 1: 2025
ISSN : **1906-9685**



DETECTING FRAUD IN ONLINE PRODUCT REVIEWS USING HETEROGENEOUS GRAPH TRANSFORMERS

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ABSTRACT— Online reviews have great impact on today's business and commerce. Decision making for purchase of online products mostly depends on reviews given by the users. Hence, opportunistic individuals or groups try to manipulate product reviews for their own interests. This project introduces some semi-supervised and supervised text mining models to detect fake online reviews as well as compares the efficiency of both techniques on dataset containing hotel reviews.

Index terms— online reviews, machine learning, Naïve bayes, SVM, Decision tree.

I. INTRODUCTION

Technologies are changing rapidly. Old technologies are continuously being replaced by new and sophisticated ones. These new technologies are enabling people to have their work done efficiently. Such an evolution of technology is online marketplace. We can shop and make reservation using online websites. Almost, everyone of us checks out reviews before purchasing some products or services. Hence, online reviews have become a great source of reputation for the companies. Also, they have large impact on advertisement and promotion of products and services. With the spread of online marketplace, fake online reviews are becoming great matter of concern. People can make false reviews for promotion of their own products that harms the actual users. Also, competitive companies can try to damage each others reputation by providing fake negative reviews. Researchers have been studying about many approaches for detection of these fake online reviews. Some approaches are review content based and

some are based on behavior of the user who is posting reviews. Content based study focuses on what is written on the review that is the text of the review where user behavior based method focuses on country, ip - address, number of posts of the reviewer etc. Most of the proposed approaches are supervised classification models. Few researchers, also have worked with semi-supervised models. Semi-supervised methods are being introduced for lack of reliable labeling of the reviews. In this paper, we make some classification approaches for detecting fake online reviews, some of which are semi supervised and others are supervised. For semi-supervised learning, we use Expectation-maximization algorithm. Statistical Naive Bayes classifier and Support Vector Machines(SVM) are used as classifiers in our research work to improve the performance of classification. We have mainly focused on the content of the review based approaches. As feature we have used word frequency count, sentiment polarity and length of review.

II. LITERATURE SURVEY

Many approaches and techniques have been proposed in the field of fake review detection. The following methods have been able to detect fake online review with higher accuracy. Sun et al. [1] divided these approaches into two categories.

a) Content Based Method: Content based methods focus on what is the content of the review. That is the text of the review or what is told in it. Heydari et al. [2] have attempted to detect spam review by analyzing the linguistic features of the review. Ott et al. [3] used three techniques to perform classification. These three techniques are- genre identification, detection of psycholinguistic deception and text categorization [1]–[3].

1) Genre Identification: The parts-of-speech (POS) distribution of the review are explored by Ott et al. [3]. They used frequency count of POS tags as the features representing the review for classification.

2) Detection of Psycholinguistic Deception: The psycholinguistic method approaches to assign psycholinguistic meanings to the important features of a review. Linguistic Inquiry and Word Count (LIWC) software was used by Pennebaker et al. [4] to build their features for the reviews.

3) Text Categorization: Ott et al. experimented n-gram that is now

popularly used as an important feature in fake review detection. Other linguistic features are also explored. Such as, Feng et al. [5] took lexicalized and un lexicalized syntactic features by constructing sentence parse trees for fake review detection. They shown experimentally that the deep syntactic features improve the accuracy of prediction. Li et al. [6] explored a variety of generic deceptive signals which contribute to the fake review detection. They also concluded that combined general features such as LIWC or POS with bag of words will be more robust than bag of words alone. Metadata about reviews such as reviews length, date, time and rating are also used as features by some researchers.

b) Behavior Feature Based Methods: Behavior feature based study focuses on the reviewer that includes characteristics of the person who is giving the review. Lim et al. [7] addressed the problem of review spammer detection, or finding users who are the source of spam reviews. People who post intentional fake reviews have significantly different behavior than the normal user. They have identified the following deceptive rating and review behaviors.

III. PROPOSED SYSTEM

The overview of our proposed system is shown in the below figure.

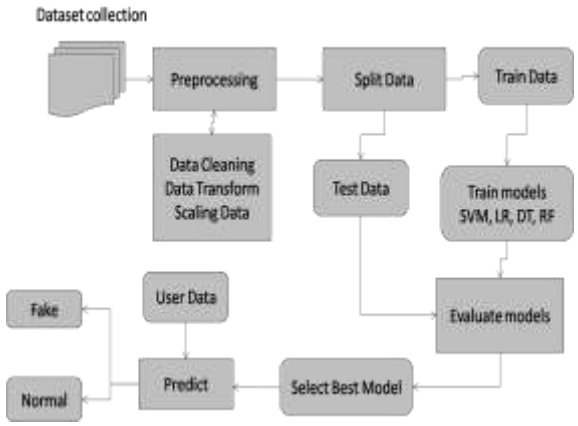

Fig. 1: System Overview

Implementation Modules

Service Provider Module

In this module, service provider login to the system using valid username and password. After login successful, he can perform the following operations like add movies, view uploaded movies, view positive/negative/neutral reviews, dislikes/likes, view trending movies, view movie recommended, and view fake reviews.

Remote User

In this module, the remote user register to the system, and login to the system valid username, and password. After login successful, he can perform view profile, view added movies information, view trending movies, and view all movie reviews.

Implementation Algorithms

Logistic Regression

- In LR class probabilities are estimated on the basis of output such as they predict if the input is from class X with probability x and from class Y with probability y. If x is greater than y, then predicted output class is X, otherwise Y. Insight, a logistic approach used for demonstrating the probability of a precise group or else, occurrence is obtainable, e.g., top/bottom, white/black, up/down, positive/negative or happy/unhappy.

Support Vector Machine

- In machine learning, support-vector machines (SVMs, also support-vector networks) are supervised learning models with associated learning algorithms that analyze data for classification and regression analysis. An SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier.

Navie Bayes

- Naïve Bayes algorithm is a supervised learning algorithm, which is based on Bayes theorem and used for solving classification problems.
- It is mainly used in text classification that includes a high-dimensional training dataset.
- Naïve Bayes Classifier is one of the simple and most effective Classification algorithms which helps in building the fast machine learning models that can make quick predictions.
- It is a probabilistic classifier, which means it predicts on the basis of the probability of an object.

Decision tree

- Trees are constructed through an algorithmic approach that identifies ways to split the data set based on different conditions.
- It is one of the most widely used practical methods for supervised learning.
- These are non-parametric method used for both classification and regression.

IV. RESULTS

Fig. 2: Model Accuracies

Fig. 3: Model Accuracies in Bar chart

Fig. 4: Model Accuracies in Line Chart

Fig. 5: Models accuracies in Pie chart

Fig. 6: View All Detected Product Reviews

V. CONCLUSION

We have shown several semi-supervised and supervised text mining techniques for detecting fake online reviews in this research. We have combined features from several research works to create a better feature set. Also we have tried some other classifer that were not used on the previous work. Thus, we have been able to increase the accuracy of previous semi supervised techniques done by Jiten et al. [8]. We have also found out that supervised Naive Bayes classifier gives the highest accuracy. This ensures that our dataset is labeled well as we know semi-supervised model works well when reliable labeling is not available. In our research work we have worked on just user reviews. In future, user behaviors can be combined with texts to construct a better model for classification. Advanced preprocessing tools for tokenization can be used to make the

dataset more precise. Evaluation of the effectiveness of the proposed methodology can be done for a larger data set. This research work is being done only for English reviews. It can be done for Bangla and several other languages.

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