



Online Review Manipulation Detection using Decision Tree and SVM

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Abstract— *In today's world of web 2.0, many people share their views, thought and opinions on internet. Because of this lot of semantic data is generated. Same thing is applicable for online shopping. Users make their shopping decisions based on reviews left by another users. So reviews have importance for users and vendors both. Customers can decide the quality of product and vendors can analyse it to improve their sale. But many times these reviews are fake or manipulated. So identifying such manipulated reviews is hot issue in e-commerce. This paper aims to identify such manipulated or fake reviews using decision tree (DT) and support vector machine (SVM). For this we have considered 11 attributes of review for classifying them into manipulated or non-manipulated class.*

Keywords— *Manipulated Reviews, Data Mining, Classification Techniques,*

I. INTRODUCTION

Internet has changed the way people interact with each other. It has become essential part of human's life. Along with getting information about particular topic, people can add their thoughts and views also. Especially social networking sites made it easier to interact and share thoughts online and that can affect the thinking of other users.

Online shopping is one of the great applications of web. This makes shopping as a quick and easy process. You can see variety of products of different brands at one place. You can make your purchase decision by comparing features of these products. Also after purchasing or using these products you can leave a review about product. These reviews are helpful for other users to make a purchase decision. Your experience about product will help them. As per the studies 71% of US adults can be affected by the product review of their friends and family. Reviews will help you to choose a product from different models and brands. We call it as a word of mouth and it is an important factor for changing customer's behaviour [1]. When you have trust on company, after buying a product you give review for product.

On the other hand reputation is important asset for any enterprise; it needs a long term investment in keeping positive image in consumers. Some negative comments about product bring fatal damage to enterprise. Users and vendors have importance of these reviews. Hence processing these reviews is hot topic in data mining. Many researchers are working on text analysis, sentiment analysis etc. These work will be truthful if we sure about the trustworthiness of reviews. And also for users before making any purchase decision based reviews. An enterprises study these reviews for improving their product. If these reviews are not real, it will direct company into wrong direction.

Now-a-days sentiment analysis is hot research topic for researchers. Lots of research work is carrying forwarded using these online reviews. Starting from extracting sentiments from reviews till extracting summary of reviews, much more operations are performed on these reviews. If these reviews are true or written by real reviews then only this work is fruitful.

So identifying fake reviews is important for researchers, users and vendors.

This paper identifies different attributes of reviews, and provides a way to classify these reviews into manipulated or non-manipulated reviews using DT and SVM and finally provides comparison of it.

II. LITERATURE SURVEY

A. Review Manipulation

As we already have seen more and more users now preferring online shopping because of convenient platform like internet. This shopping is largely influenced by reviews. But research has shown all these reviews might not be real or trustworthy. Many suppliers, vendors or publishers tend to manipulate these reviews to promote their sales or on other hand they might post negative reviews to demote other product. Writing such fake or untrue reviews is called as review manipulation.

Paper [1] has employed decision tree to classify such manipulated reviews from real one by using eight review manipulation attributes. Also they used correlation analysis and extracted knowledge rules to discover important factors of identifying manipulated reviews.

This review manipulation attributes are:

- *Text difficulty*
- *TTR(Type Token Ratio)*

- *Tokens*
- *Positive Sentiment*
- *Negative Sentiment*
- *Sentiment*
- *Product Characteristics*
- *Expertise*

First attempt for calculating manipulated reviews is described in paper [2]. This paper studied review spam and tried to detect it. According to study they have determined two types of review spam. First type is that which deliberately misleads users or opinion mining system by giving fake positive or negative review. And second type is non-reviews which does not contain any opinion. It could be for advertisement purpose.

This paper includes spam detection using two methods:

- *Duplicate Detection*
- *Spam Classification(i.e spam or non-spam)*

Paper [3] is extension of work done in paper [2]. This paper says there are three types of spam reviews.

Those are:

- *Untruthful Opinions*
- *Review on brands only*
- *Non-review*

This classification is done using machine learning techniques and manually labelled examples.

Paper [4], this paper talks about Singleton Review (SR) i.e. the reviewer who writes only one review. Other works ignores such reviews because it is generally said these reviews are genuine. The proposed work determines hierarchical detection criteria to detect SR spam. To address this problem, this paper states that the normal reviewers' arrival pattern is stable and uncorrelated to their rating pattern temporally. In contrast, spam attacks are usually unstable and either positively or negatively correlated to the rating. Thus, it is proposed that to detect such attacks via unusually correlated temporal patterns.

Paper [5] used several supervised methods to identify review spam. They used SVM, logistic regression and Naive Bayes. They find Naïve Bayes as a best classifier among all. For classification following features are used:

- *Review Related Features*
- *Sentiment Features*
- *Product Features*
- *Reviewer Related Features*

Paper [6] proposed a system for detecting untruthful reviews using n-gram language model and brand spam detection feature selection.

B. Decision Tree (DT)

Feature selection aims to select a subset of features that can lead to a highest performance in classification task. Decision tree has a built-in feature selection. Decision tree learns from class labelled training tuples. A decision tree is a tree like structure, where each internal node represents a test on an attribute, each branch represent outcome of the test and each leaf node holds a class label [10].

III. PROPOSED WORK

The proposed work tries to classify online reviews into manipulated and non-manipulated class using machine learning technique. In this paper we propose a system for identifying manipulated reviews using SVM and DT. Before applying classifier we need to find out different attributes of review. This step is included in pre-processing of reviews. First we will discuss different attributes related to reviews.

Following are attributes we have selected:

Content Related Features:

- *Text Difficulty:*

Given by following formula,

$$\text{Text Difficulty} = 206.835 - 1.015 \times ASL - (84.6 \times ASW)$$

- *TTR (Token Type Ratio):*

Type-Token Ratio (TTR) is an index to measure the readability of review. It is given by following formula,

$$TTR = \text{Types} / \text{Tokens}$$

“Tokens” is the number of individual words in the text and “Types” is the number word types in reviews.

- *Length:*
According to research length also affects readability
- *High similarity Square*

Sentiment Related Features:

- Positive Sentiment
- Negative Sentiment
- Sentiment

Product Related Features:

- Product Specification
- Product Description

Reviewer Related Features:

- Profile Specification
- Behaviour Specification

We have collected review data from Amazon.in for Samsung Galaxy Note II. Following figure shows architecture of proposed system.

After collecting reviews we have pre-processed it to find out different feature of reviews as we have discussed earlier. With the help of available literature we have set certain threshold values for classification. Classifier C4.5 and SVM is used for classifying available reviews in manipulated or non manipulated class.

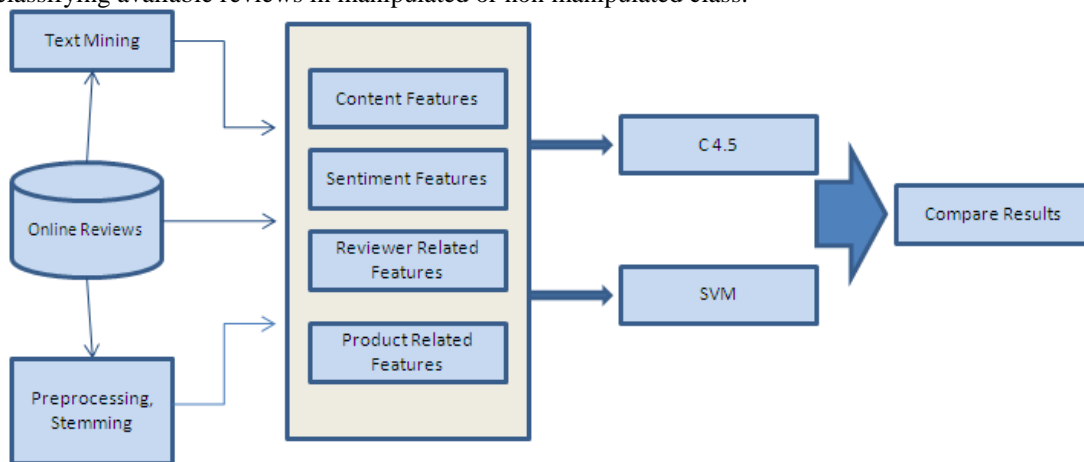


Fig 1 : Proposed Architecture

By considering above features of review we built a mathematical model to classify review into manipulated or non-manipulated class.

We are defining mathematical model in term of set theory [11].

Input and output of the system will be set of reviews.

$$\begin{aligned}
 & \text{Input} = R \\
 & \text{Output} = R_m \\
 & \text{Where} \\
 & R = \{r_1, r_2, r_2 \dots r_n\} \\
 & \text{Where,} \\
 & R = \text{Set of all Reviews.} \\
 & r_i = \text{Review.} \\
 & R_m = \{r_1, r_2, r_2 \dots r_n\} \\
 & \text{Where} \\
 & R_m = \text{Set of Manipulated Reviews} \\
 & r_i = \{CF, SF, PF, RF\} \\
 & \text{Where,} \\
 & CF = \text{ContentFeature} \\
 & SF = \text{SentimentFeature} \\
 & PF = \text{ProductFeature} \\
 & RF = \text{ReviewerFeature}
 \end{aligned}$$

$$r_i \in R_m, \text{If } CF > 45, SF = 0, PF \geq 2, RF \geq 2.$$

Algorithm : To classifying reviews using C 4.5
1. Check for base cases
2. For each feature

1. Find the normalized information gain ratio from splitting on feature
3. Let feature_best be the attribute with the highest normalized information gain
4. Create a decision node that splits on feature_best
5. Recur on the sublists obtained by splitting on feature_best, and add those nodes as children of node

IV. RESULT

Following figures shows the screen shots of output. Fig 2 and fig 3 shows the features calculated for individual review file. At the bottom it shows the class of selected review. Review is manipulated if it has a class as -1 and vice a versa.

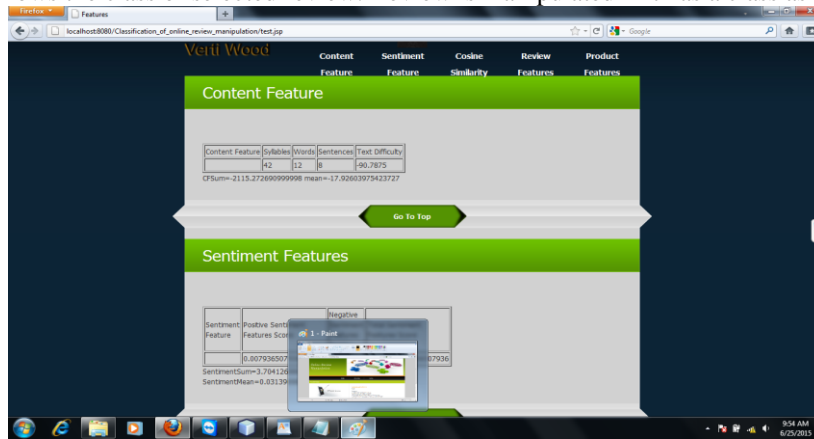


Fig 2: Shows content feature and sentiment feature

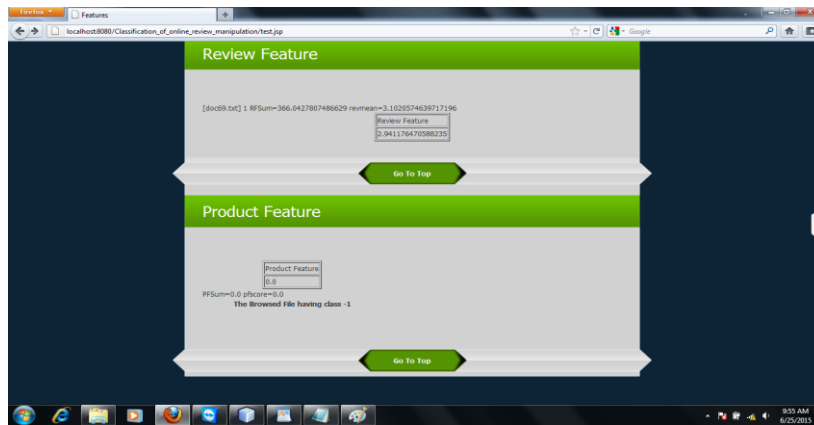


Fig 3: Shows reviewer feature and product feature

V. CONCLUSIONS

In this paper, we studied different techniques available for finding manipulated reviews and proposed a new way of identifying those manipulated reviews. In today's world of e-commerce, there is a strong need of identifying fake reviews as it greatly affects the behavior of customer. Many of the papers are using machine learning algorithm for finding manipulated reviews. More focus is given on the behavior of the reviewer and different text properties comments. The proposed method employs decision tree algorithm and SVM to classify manipulated reviews using features related to content, sentiment, product and reviewer. By comparison we found that Decision Tree has more accuracy than SVM.

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