

Fake Product Review Monitoring Using Opinion Mining

Anusha Sinha, Nishant Arora, Shipra Singh, Mohita Cheema, Akhtar Nazir, mailme.anusha1@gmail.com,
aronish23@gmail.com, Shiprasingh1909@gmail.com, mohitacheema1@gmail.com,
aktharnazir532@gmail.com.

Abstract- Product reviews play an important role in deciding the sale of a particular product on the e-commerce websites or applications like Flipkart, Amazon, Snapdeal, etc. In this paper, we propose a framework to detect fake product reviews or spam reviews by using Opinion Mining. The Opinion mining is also known as Sentiment Analysis. In sentiment analysis, we try to figure out the opinion of a customer through a piece of text. We first take the review and check if the review is related to the specific product with the help of Decision tree. We use Spam dictionary to identify the spam words in the reviews. In Text Mining we apply several algorithms and on the basis of these algorithms we get the specific results.

Keywords- spam review detection; opinion mining, decision tree, text mining.

I. INTRODUCTION

In today's trade market, product reviews play a vital role for consumers' online shopping activities. Most of the people go through these reviews before buying any product online. These reviews for a product may turn out to be positive or negative. The positive product review will grab much more attention of the customer than the negative reviews. Therefore, these product reviews can affect any business and they also have the potential to bring along financial losses or profits. There are many reviews posted by the customers to put forward their views regarding the product they have bought. But along with these true reviews, there are many fake reviews which can affect the purchase of a good product.

Generally, reviews appear in the e-commerce web sites and applications like Amazon, Flipkart and many more because of financial reasons. Although lots of product reviews are posted by real consumers to express their views and share their shopping experience with other people, more untruthful reviews appear in the e-business web sites because of financial reasons. For example, if a customer writes very negative reviews for a mobile phone say I-phone 8 on a apple review website due

to its bad service. This review will present an unfavourable impression of I-phone 8 to its potential customers and damage its business. Therefore to avoid business losses caused by this kind of truthful reviews, the owner of Apple Inc. Company could plot some people to write untruthful reviews to improve its reputation. Because of these fake reviews a customer is trapped and he makes a purchase of a low quality product, while decent services or good quality products could be defamed by untruthful reviews. The ones who post these malicious reviews to intentionally mislead consumers or opinion analysis systems are usually called spammers and the deceptive reviews are called spam reviews. To understand how difficult spam detection is, we first depict a simple example of reviews which was posted to oyo.com (Indian version). This review was posted by a person who tries to promote that hotel and it is hard to identify if it is a fake review or not: "If you are fine with a small size of the room (normally found in India) then you will be in love with this place. Ten minutes walk from the railway station, cleanliness of room is top priority for the hotel, and great OYO breakfast with tea/coffee, outstanding service at a very cheap price. There is not even a single thing to complain about it."

"What other people thoughts are and their thinking" has always remained an important source of information for the decision making process in today's time. Long before the internet came into being or more so, became as popular as it is today, people still used to ask each other's opinions about goods and products, or consulted surveys to come to a conclusion.

Times have changed and people have now started buying products online, thanks to the increasing popularity of the World Wide Web. With more and more people becoming comfortable and finding ease in using the internet, an increasing number of people post their reviews, ratings and comments online. This posting of reviews is also resulting to be highly beneficial for other users who use online platform to buy products.

Hence, this is resulting in an increased number of reviews and thus its impact on the purchase of goods is also increasing. Popular products get hundreds of reviews which make or break their sales and thus hold large importance. Our

application, thus, proposes to filter these reviews and separate the spammers from the non-spammers in order to guarantee more accuracy in the existing system and enhancing the sales of genuine products based on real reviews.

II. LITERATURE SURVEY

To accomplish the objectives of the research, the following methodology will be followed (see Figure 2.1):

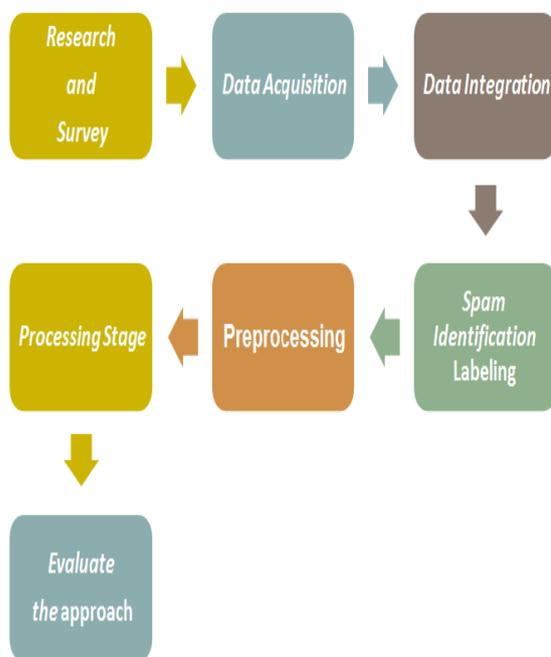


Fig. 2.1 Methodology to accomplish objectives of the research.

- **Research and Survey:** In this one review’s the most recent researches minutely related in the theory problem statement and the question. Once we analyse the thesis, the existing procedures in spam detection for non-Arabic opinion reviews, identifying the drawbacks or the flaws in the existing approaches, we prepare the strategies and solutions on how to proceed or extend in order to be overcome in our research.
- **Data Acquisition:** In this step, we prepare an in-house data set of spam reviews and reviewers using human collected from online e-commerce websites or application like Amazon, Flipkart with different characteristics and sizes. The records are

chosen randomly from any of the records that are available on the website.

- **Data Integration:** In this step, we combine the data from multiple review source data sets into a coherent form.
- **Spam Identification Labelling:** In this step, we look for various types of the spam in the data integrated set, and labelled each record as spam and non-spam manually.
- **Pre-processing:** In this step, we use various types of pre-processing techniques to handle the missing, noisy and inconsistent data. There are a number of pre-processing techniques such as case folding dam character erase, tokenization, slang word handling, stop word removal, stemming and number handling.
- **Processing Stage:** In this step, we will first have to implement the following steps:
 1. Data mining classification.
 2. Text mining classification.
 3. Data-Text mining classification.

Now we apply each preceding step by more than one classification method.
- **Evaluate the Approach:** In this step, analyzation of the outcome and rationalize the feasibility of the approach we followed by comparing it with other previous approaches.

The Public Opinion Survey conducted consisted of several questions relating to the purpose about analysing the importance of product review for various customers while buying any product. The participants in the survey are mostly the frequent online buyers. The survey is designed as such to know the public opinion about referring to the product review while buying it. The result of the survey was as expected and was in favour of the arguments proposed earlier.

III. PROBLEM DISCRPTION

The main agenda is to further improve customer satisfaction and online shopping experience. In order to do so, it has become a common practice for online merchants to enable their customers to put forward their reviews on the products that they have purchased. With more computer users

becoming comfortable with the Web, a huge number of people are coming forward to write the reviews and post them on website which is becoming beneficial for other customers. It also decides profit or loss for any e-commerce merchant.

As an outcome of this, the number of reviews that a product receives is growing quickly. Most of the famous products get thousands of reviews at some large merchant sites. Now any customer can write any opinion text or review, this can draw the individual's attention and organizations to give undeserving spam opinions to promote or to discredit some target products. The existing system doesn't restrict spam and invalid reviews and comments.

So there is a need to develop a smart system which automatically mine opinions and classify them into spam and non-spam category.

IV. EXISTING APPROACH

By conducting several public opinion surveys, based on their results it can be evaluated that people do read and get influenced by ratings and reviews of the products online. A survey performed by a leading site has shown that:

- More than 80% of the online customers look at the reviews available.
- 50% base their purchase on the ratings of the products.
- 30% of the customers compare the ratings of similar products before making their decision.

Clearly consumers value the feedback given by other users as do the companies that sell such products. Blogs, websites, discussion boards etc. are a repository of customer suggestions which are valuable and important sources of textual data. Therefore, today's individuals and older ones extensively rely on reviews available on line. It means that people make their decisions of whether to purchase the products or not by analyzing and reflecting the existing opinions on those products.

The fact that is if the potential customer or users gets a genuine overall impression of a product by considering the present affect for that product, it is highly probable that he will actually purchase the product. Normally if the percentage of positive and effective opinions is considerable, it is likely that the overall impression will be highly positive. Likewise, if the overall impression is not proper, it is doubtful that they don't buy the product.

Now the customers can write any opinion text, this can motivates the individuals, and organizations to give undeserving spam opinions to promote or not to credit some target products,

services, organizations, individuals, and even ideas without disclosing their true intentions. These spammed opinion information is called opinion spam.

Naïve Bayes Theorem

Naive Bayes Classification is a supervised machine learning technique. It is simple but one of the most effective techniques of classification. It is an assumption based theorem. Even a little Violation of these assumptions will not affect the performance of the algorithm. Following types of assumptions are made in the Naive Bayes theorem:

1. All features are independent conditionally.
2. All random variables in the assumptions are independent of each other and are drawn from the similar type of distribution.
3. Naive Bayes theorem is developed on the mathematical Bayes Theorem in probability.

The Bayes theorem:

$$\text{posterior probability} = \frac{\text{conditional probability} \cdot \text{prior probability}}{\text{evidence}}$$

Posterior Probability

The posterior probability can be explained as: "The probability that a particular object belongs to class i given its observed feature values?"

For example,

$$P(A_j|E_i) = \frac{P(E_i|A_j) \cdot P(A_j)}{P(E_i)}$$

Here,

A_j represent jth class of classes{1,2,3 ..m}

E_i represent features vector of ith sample of samples{1,2,3 ..n}

Posterior Probability simply means, "given the feature vector E_i, the probability of sample i belonging to class A_j."

Main Function of Naive Bayes Theorem: Maximize the posterior probability given the training data to formulate a decision rule for new data. The decision rule for above problem can be formulated as,

If a sample belongs to class j , then $P(A_j | E_i)$ will be maximum.

V. PROPOSED APPROACH

Sentiment Analysis

Analysis of reviews extract and aggregate positive and negative reviews from product reviews is done through opinion mining. The problem of generating feature-based summaries is done by the research study of customer reviews of products sold on e-commerce websites. If we are given a data set of a specific product say I-phone, the task involves three subtasks: (1) Identifying product features discussed by the customers in the review column. (2) In each and every product feature we identify the review sentences which gives an opinion (negative or positive) and (3) preparing a summary report using the various information which is discovered. The analysis of spam reviews by detecting the fake or fraudulent reviews. Those reviews with spam words can be removed to recover a fair item evaluation system.

Decision Tree

A decision tree is an important support tool used to take decisions. It is a tree-like graph or decision model and their possible outcomes, including utility, resource cost and chance event outcomes. It is one of the ways of displaying the conditional control statements.

Among the various functions of decision trees, the most commonly used are research of operations, usually in analysing decisions which may help us to identify a plan to reach our results. It is also an important tool of machine learning.

A decision tree is a graph-like structure in which each node signifies a "possible outcome" on an attribute (e.g. whether rolling a dice brings out 1, 2, 3, 4, 5 or 6), each branch signifies the result of the action, and each leaf node signifies a label of the class (decision made after computing all test cases). The route from root to leaf signifies rules of classification.

In analysis of a decision, a decision tree and the related diagram are used as a display and decision analytic support tool, where the expected utilities are calculated of competing alternatives.

Three types of nodes used in decision tree are as follows:

1. Chance nodes – It is depicted by circles.
2. Decision nodes – It is depicted by squares.
3. End nodes – It is depicted by triangles.

Operations research and its management are the two most common uses of Decision tree. If, in practice, decisions have to be taken online with no recall under incomplete knowledge, a decision tree should be paralleled by a probability model as a best choice model or online selection model algorithm.

Decision trees, influence diagrams, utility functions, and other decision analysis tools and methods are taught to undergraduate students in schools of business, health economics, and public health, and are examples of operations research or management science methods.

To create a training model, we make use of decision tree which is further used to predict value target variables or class by making it **learn the decision rules** received from training data.

Decision Trees algorithm in comparison with other classification algorithms has an easy level of understanding. A tree representation is used in decision tree to solve the problems. In a tree, each **internal node** represents an attribute, and each **leaf node** represents a class label.

Decision Tree Algorithm Pseudo code

1. Root of the tree should contain the best attribute of the dataset
2. The training set should be split into subsets. Each subset should contain same values of data for an attribute.
3. Step 1 and step 2 are repeated for each subset until the **leaf nodes are found** in all the branches of the decision tree.

VI. PERFORMANCE ANALYSIS

Sentiment is a feeling, thought or judgement. It is also known as opinion mining, which studies people's feelings toward any entity. Internet is full of resources with respect to sentiment information. From user's point of view, people can post their own matter on several social networking websites, such as forums, micro-blogs, etc.

Figure 6.1 is a flowchart that focuses our proposed model for categorization and it is the outline of this paper also. Our contributions mainly lies in Phase 2 and 3. In Phase 2:

- 1) For negative phrase identification, an algorithm is proposed and implemented;
- 2) For sentiment score computation, a mathematical approach is proposed;
- 3) For sentiment polarity categorization, a feature called vector generation method is presented.

In Phase 3:

- 1) Based on sentence- level and review- level, two sentiment polarity categorization experiments are performed respectively;
- 2) Performance of three classification models are evaluated and compared based on their experimental results.

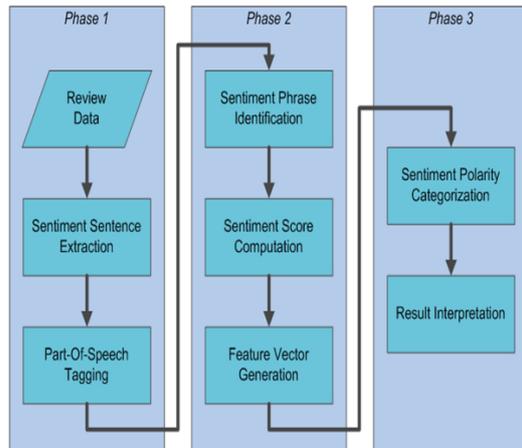


Fig 6.1: Sentiment Polarity Categorization Process

Data Collection

Information used in this paper is collected from flipcart.com. In total, we have collected, approx. 2.2 million product reviews in which the products belong to different categories, such as, beauty, book, electronic, and home (Figure 6.2(a)). Those online reviews were posted by over 3.1 million of reviewers (customers) towards 20051 products. Each review contains the following information: 1) reviewer ID; 2) product ID; 3) Ip address; 4) time of the review; 5) date of review; 6) review text.

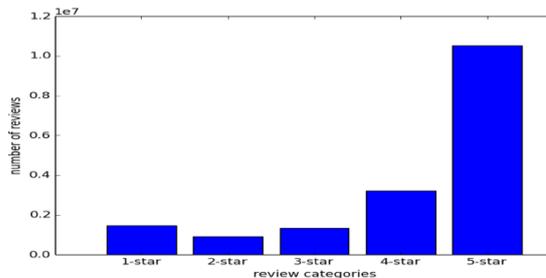
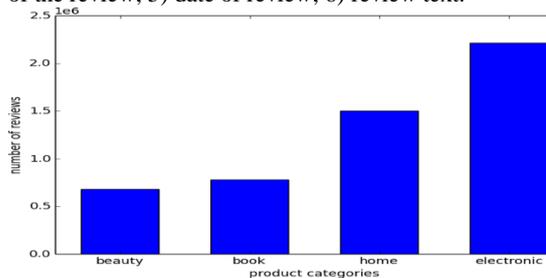


Fig 6.2: Data collection (a) Data based on product categories (b) Data based on review categories

Each and every rating is based on a 5-star scale (Figure 6.2(b)), resulting the rating to be ranged from 1- star to 5- star. It does not contain any half- star rating or quarter- star rating.

VII. CONCLUSION

There have been made several attempts for spam review detection till today. In this paper, we propose a general framework to detect spam reviews. Sentiment analysis or opinion mining is a field of study that analyzes people’s sentiments, feelings, or emotions towards certain entities. This paper tackles a fundamental problem of sentiment analysis, sentiment polarity categorization.

Now a day’s technology is growing day by day and there are so many website and application available in the online market by which they sell their product. Every product contains millions of reviews and on basis of these reviews user buy the product most of the time. There are some organizations which post fake reviews on genuine product and user gets stuck.

Our software will help the user to pay for the right product. Our software will do analysis and then if any fake review is found from any IP address consistently then admin user can block that IP address. It also sends mail to user regarding blocked IP address. In this way it monitors the fake review made on any product. And user can be sure about the products availability on that application and reviews too.

Future Work

- The restriction of requirement of product name in particular product review can be removed though it might be a tough task.
- The admin has to manually block the IP of the spammer account by identifying its pattern, automatic blocking can also be achieved in the future scope of the system.

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