

## DETECTING AND CHARACTERIZING EXTRIMIST REVIEWER GROUPS IN ONLINE PRODUCT REVIEW

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### ABSTRACT

Online marketplaces often witness opinion spam in the form of reviews. People are often hired to target specific brands for promoting or impeding them by writing highly positive or negative reviews. This often is done collectively in groups. Although some previous studies attempted to identify and analyze such opinion spam groups, little has been explored to spot those groups who target a brand as a whole, instead of just products. In this article, we collected the reviews from the Amazon product review site and manually labeled a set of 923 candidate reviewer groups. The groups are extracted using frequent item set mining over brand similarities such that users are clustered together if they have mutually reviewed (products of) a lot of brands. We hypothesize that the nature of the reviewer groups is dependent on eight features specific to a (group, brand) pair. We develop a feature-based supervised model to classify candidate groups as extremist entities. We run multiple classifiers for the task of classifying a group based on the reviews written by the users of that group to determine whether the group shows signs of extremity. A three-layer perception-based classifier turns out to be the best classifier. We further study behaviors of such groups in detail to understand the dynamics of brand-level opinion fraud better. These behaviors include consistency in ratings, review sentiment, verified purchase, review dates, and helpful votes received on reviews. Surprisingly, we observe that there are a lot of verified reviewers

showing extreme sentiment, which, on further investigation, leads to ways to circumvent the existing mechanisms in place to prevent unofficial incentives on Amazon.

### 1. INTRODUCTION

IN TODAY'S world dominated by online marketplaces, review portals and websites play a crucial role in the buyer's decision for their next purchase. *"It is a virtuous cycle—the more reviews, the more buys. The more buys, the more reviews. The more buys, the higher your rank in search and the more sales you get,"* says Alice [1], the owner of online cosmetic brand Elizabeth Mott. Undoubtedly, it is highly likely that some people write reviews that are less than truthful to manipulate widespread decision of buyers in their favor. These people act either individually or in groups. While individual reviewers write such reviews in a matter of frustration or joy, they do not influence the overall opinion on a product to a large extent but help other buyers by stating their experiences. However, a more compelling case is when multiple individuals form an intricate web, and due to sheer higher number of people reviewing (and certain other techniques, discussed in Section VIII), they end up being a major influence on the overall sentiment of the product. The extent of such influence is not just limited to the reviews by opinion spam. Previous work [2] has shown that 10%–15% reviews are essentially echoing the earliest reviews, and thus, a misleading early review has an even higher influential potential.

This is widespread opinion spam, and every review website must be aware of this activity and take appropriate measures for the identification and/or prevention of this phenomenon. This is a classic example of collective fraud behavior, where several users are part of a business network and work together to target and influence a particular product. This is a lesser known phenomenon, and most groups work following certain techniques to not make their collaboration obvious. However, since such groups are economically or otherwise incentivized, and several of these are generally run by a given organization, they have several targets for opinion spam, which often share certain common characteristics in their nature of reviews. These characteristics can be exploited to classify them better using a robust and thorough an analysis technique. Amazon India, to prevent opinion spam, has brought about a new policy that limits the number of reviews on a product in a day, as stated in [3].

In order to still be effective, we claim that certain groups target brands in general and post extreme reviews across multiple products for a given target brand. This is a higher level of opinion spamming, deliberately writing highly positive or negative reviews for a brand in general in order to promote or demote them in the cut-throat competition of the online marketplace. Studies have been conducted to identify such groups that try to influence a product [4]–[6]; however, groups exhibiting a brand-based opinion spamming is a phenomenon that remains widely unexplored. A detailed discussion is required for these brand-related activities because these practices are against the code of conduct of these review websites since they negatively skew the brand-based competition, giving innate (dis)advantages to certain brands. Since only the nonverified reviews are limited by the policies, reviewers from these groups can often purchase the product via Amazon in exchange for

unofficial discounts (e.g., cash backs) and postverified reviews since they did not receive a discount via amazon's mechanisms (e.g., coupons) (see further discussed in Section VIII). Fig. 1 shows an example of such extremist groups (taken from our annotated data set as mentioned in Section III). Four rows correspond to the products belonging to four different brands. Four columns represent four different reviewers who, according to our annotation, are part of the same group. Each box represents the review information. This is an example of reviewers showing extreme likeliness toward these products/ brands as can be seen from the extreme ratings, similar comments, and almost the same date [7]. It is clear that this group of reviewers had extreme sentiments toward the brands reviewed, both in terms of the ratings and the review content. While this has a large overlap with the classic collusion in which reviewers target a product to bring up its ratings, this kind of extremism in reviews is not in order to promote/demote the ranking of a product, but rather to influence the perception of people for a brand.

It is worth noting that such a kind of characterization is different from just combining the groups of people who provide extreme reviews on a product, because while the groups focusing on a product may be extreme in their opinion, they do not necessarily intend to influence the brand image. This, coupled with the fact that the same product may be sold by different sellers, reduces the chance that a product-level opinion spamming reviewer group would target products of the same brand. Sellers may not have any inclination toward promoting any particular brand's products; rather, they would prefer to gain a better revenue on all products (may belong to different brands) by their promotional campaigns. Hence, such a group is more likely to have a very narrow and specialized source, e.g., the competing brands or the manufacturing brand itself. (Additional results of

experiments for distinguishing between the product level and the brand level are available in Section IV of the Supplementary Material).

## 2. SYSTEM ANALYSIS

### EXISTING SYSTEM

- ❖ Pang *et al.* [20] showed the progression of reviews as an important part of the decision-making process with the advent of Web 2.0 and studied them from retrieval perspective. Since it is difficult for the buyer to wade through volumes of reviews, researchers have conducted studies on summarizing reviews based on user sentiment [21] and other features [22]–[24] as well under the umbrella of opinion summarization. All these studies indicated that product reviews are an invaluable resource for determining the quality of a product.
- ❖ Various marketing studies have also shown that reviews play an important role in maintaining the online reputation of a brand as well [25], [26]. A review usually consists of a star rating that helps to influence a product's overall ratings, but a review becomes even more impactful when people read it. It has been found that people read a review only when it is perceived as helpful by them, which may be through various means—the helpful up votes by other consumers, the length of the review, star ratings, readability, and so on. [27], [28].
- ❖ Jindal and Liu [38] made a pioneering effort to detect fake reviews. They introduced the problem of opinion spam and analyzed online reviews in three varieties—untruthful opinions, seller/brand only reviews (no product involved), and non reviews using near-

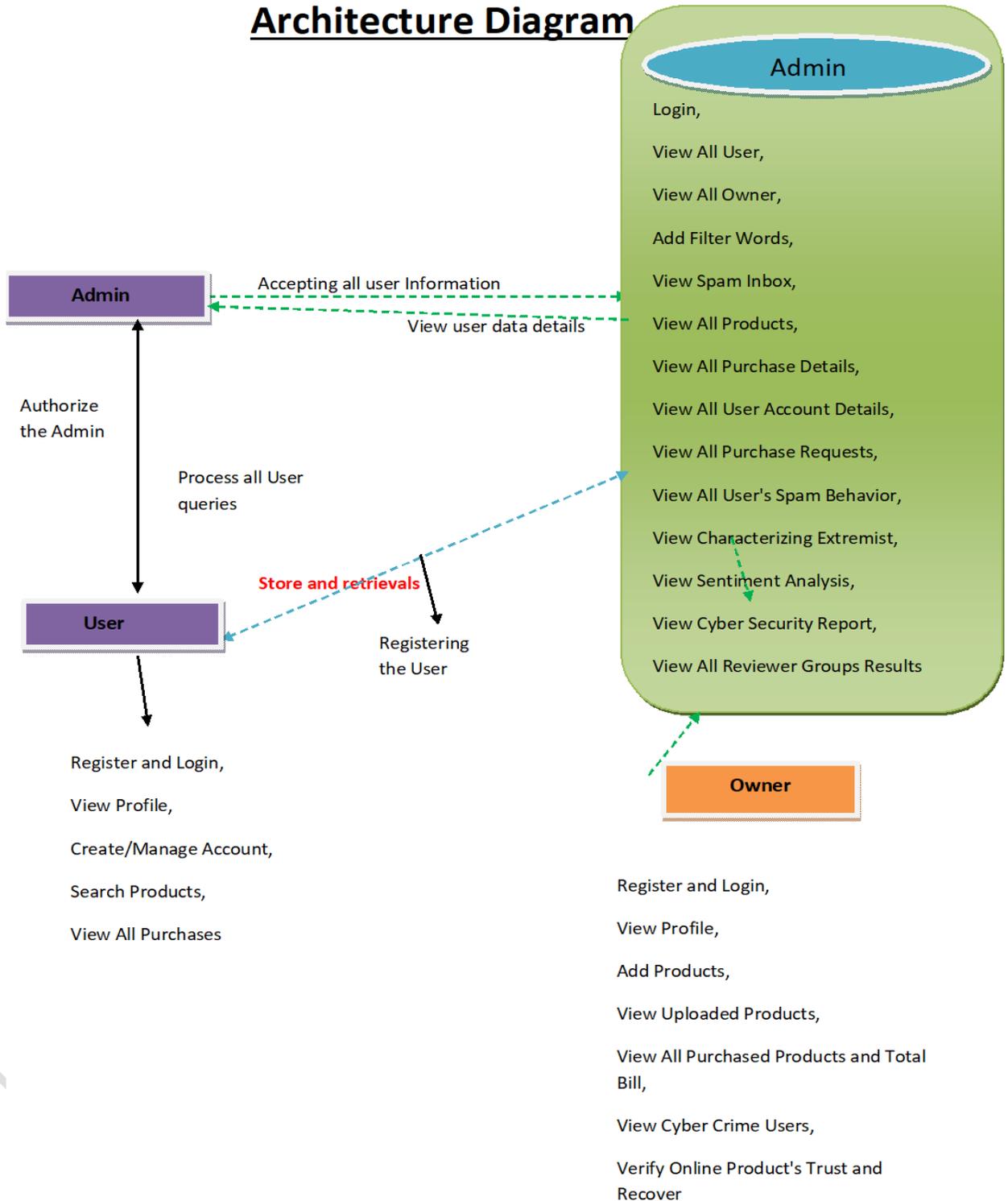
duplicate content as an indicator of fake reviews. Other studies dealing with the detection of review-level spam explored linguistic features of text [39], handmade rules [40], and combination of review and reviewer features [41]. A probabilistic framework for the same has also been proposed in [42].

- ❖ Ott *et al.* [39] synthesized fake hotel reviews using Amazon Mechanical Turk, whereas Jindal and Liu [38] worked on data scraped from Amazon and used content duplicity as ground truth. Both of them worked with features at a review level. Jindal *et al.* [40] and Li *et al.* [41] mentioned the role of brands briefly, but the main focus was on fake reviews rather than extreme reviews.

### PROPOSED SYSTEM

- ❖ In this article, we identify and study the behavioral characteristics of extremist reviewer groups. We also build a feature-based classifier based on the brand-specific activities of reviewer groups to identify the extremist groups on the Amazon India marketplace. We then further analyze our methodology to unfold behaviors that best signify such activities and compare and analyze the overall trend of these groups viz-a-viz their behaviors such as
- ❖ A manually labeled data set of 923 reviewer groups that are classified into “extremist” and “moderate” categories;
- ❖ The first-ever characterization and study of the novel problem of identifying brand-level extremism;
- ❖ Detailed characterization of extremist reviewer groups;
- ❖ Design supervised approach to detect extremist reviewer groups.

## Architecture Diagram



### SYSTEM ARCHITECTURE

### 3. IMPLEMENTATION

#### Admin

In this module, the Admin has to login by using valid user name and password. After login successful he can do some operations such as View All User, View All Owner, Add Filter Words, View All Spam Filter Words, View Spam Inbox , View All Products , View All Purchase Details , View All User Account Details , View All Purchase Requests , View All User's Spam Behavior , View All Crime Users , View Cyber Security Report , View All Account Type Results.

#### View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

#### Owner

In this module, there are n numbers of Owners are present. Owner should register before doing any operations. Once registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful Owner will do some operations like View Profile , Add Products , View Uploaded Products , View All Purchased Products and Total Bill , View Cyber Crime Users , Verify Online Product's Trust and Recover

#### User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like View Profile, Create/Manage Account , Search Products , View All Purchases.

### 4. CONCLUSION

In this article, we discussed an unexplored form of opinion spam, where spammers target brands as a whole, posting extreme reviews, to change the overall sentiment about the brand. These groups are often part of a complex business Web that is capable of influencing the overall popularity and reputation of several brands on review websites. This article is the first step toward linking brand-level group activities and extremism in reviews, which uncovers important insights about marketplace activities. These insights would help in developing a better recommendation that makes use of online reviews.

A set of candidate spam groups was retrieved using FIM, and extremist groups were identified by observing their actions as a group based on various features, using a supervised learning technique based on a ground truth of manually annotated labels. We then classified extremist and moderate groups and compared the accuracy across multiple classification methods. After classifying these groups, we observed the behaviors for extremist groups in detail to gain further insights about the phenomenon and the overall trends of how these groups target these brands. We have also released the codes and annotated data set for further studies.

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