Trojan Horses in Amazon's Castle:

Understanding the Incentivized Online Reviews

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***Abstract*—During the past few years, sellers have increasingly offered discounted or free products to selected reviewers of e-commerce platforms in exchange for their reviews. Such incentivized (and often very positive) reviews can improve the rating of a product which in turn sways other users' opinions about the product. Despite their importance, the prevalence, characteristics, and the influence of incentivized reviews in a major e-commerce platform have not been systematically and quantitatively studied.**

This paper examines the problem of detecting and characterizing incentivized reviews in two primary categories of Amazon products. We describe a new method to identify Explicitly Incentivized Reviews (EIRs) and then collect a few datasets to capture an extensive collection of EIRs along with their associated products and reviewers. We show that the key features of EIRs and normal reviews exhibit different characteristics. Furthermore, we illustrate how the prevalence of EIRs has evolved and been affected by Amazon ban. Our examination of the temporal pattern of submitted reviews for sample products reveals promotional campaigns by the corresponding sellers and their effectiveness in attracting other users. Finally, we demonstrate that a classifier that is trained by EIRs (without explicit keywords) and normal reviews can accurately detect other EIRs as well as implicitly incentivized reviews. Overall, this analysis shed an insightful light on the impact of EIRs on Amazon products and users.

I. Introduction

As the popularity of online shopping has rapidly grown during the past decade, the shoppers have increasingly relied on the online reviews and rating provided by other users to make more informed purchases. In response to shoppers' behavior, product sellers have deployed various strategies to attract more positive reviews for their products as this could directly affect their popularity among users and thus their ability to sell more products online. Several prior studies have examined different aspects of online reviews including fake or spam [8], [12], [9], [15], [11], [2] and also biased and paid reviews [19], [20], [21], [16], [5] in different online shopping platforms.

The importance of online reviews has also prompted major e-commerce sites (*e.g.*, Amazon) to implement certain policies to ensure that the provided user reviews and ratings are legitimate and unbiased to maintain the trust of online shoppers. In response to these policies, seller's strategies for boosting their product rating have further evolved. In particular, in the past few years, some sellers have increasingly offered discounted or free products to selected online shoppers in exchange for their (presumably positive) reviews. We refer to these reviews as *incentivized reviews*. Major e-commerce sites such as Amazon require reviewers to disclose any financial or close personal connection to the brand or the seller of the reviewed products [3]. However, it is unlikely that average shoppers who solely rely on product ratings notice the biased nature of such reviews. Intuitively, the reviewers who provide incentivized reviews may behave differently than other reviewers for the following reasons: *(i)* They might feel obligated to post positive reviews as the products are provided for free or with a considerable discount, *(ii)* Their expectations might be lower than other users as they do not pay the full price, and *(iii)* They do not often consider the long-term usage of the product (*e.g.*, product return or customer service) in their reviews. The presence of such incentivized reviews in Amazon has been reported in 2016 [18], however, to our knowledge, the prevalence of incentivized reviews, their characteristics, and their impact on the ecosystem of a major e-commerce site have not been systematically and quantitatively studied. Although Amazon has officially banned submission of incentivized reviews in October of 2016 [1], it is important to study such reviews to be able to determine whether Amazon's new policy solved the issue or just forced reviewers to go under cover.

To tackle this important problem, this paper focuses on capturing and characterizing several aspects of incentivized reviews in the Amazon.com environment. We leverage the hierarchical organization of Amazon products into categories/subcategories and collect all the information for top-20 best-seller products in all subcategories of two major categories. The first contribution of this paper is a method to identify explicitly incentivized reviews (EIRs) on Amazon. We identify a number of textual patterns that indicate explicitly incentivized reviews (EIRs). We carefully fine-tune and capture these textual patterns using a regular expression. We then use these patterns to identify a large number of EIRs along with their associated products and reviewers.

The second contribution of this paper is the characterization of key features of EIRs and associated reviewers and products. Our analysis demonstrates the effect of Amazon ban on the prevalence of EIRs as well as the difference between the features of EIRs and normal reviews. We also examine the temporal pattern of EIR, and non-EIR reviews that a product receives and a reviewer produces to address two questions: *(i)* how the arrival pattern of EIRs for a specific product affects

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A

B

C

Which one would you Buy?


1
Galaxy Note 4 Screen Protector,AMCHOICE(TM) 2.5d Rounded Edges 0.3mm Thin Premium...
1
$6.99 Prime
2
Galaxy Note 4 Screen Protector,AMCHOICE(TM) 2.5d Rounded Edges 0.3mm Thin Premium...
225
$6.99 Prime
3
Galaxy Note 4 Screen Protector,AMCHOICE(TM) 2.5d Rounded Edges 0.3mm Thin Premium...
1,117
$9.99 Prime
*
Galaxy Note 4 Screen Protector,AMCHOICE(TM) 2.5d Rounded Edges 0.3mm Thin Premium...
225
$9.99 Prime

Incentivized Reviews

- Incentivized review?
    - Seller's strategy to attract more positive reviews and gain reputation

- Why are they important to be studied?
    - They are different from normal reviews and can improve the sentiment of the product. They are different as by getting a free or discounted product:
        1. Customers feel obligated to post positive reviews,
        2. paid a fraction of retailer price, their expectations are lower
        3. As it becomes a business for some users, they prefer to post positive reviews to attract more sellers and get more free/discounted offers.
        4. Not going through the return process, dealing with customer service, short-term

Process

- Here the process to study IRs

Dataset

Data Scraping From Amazon

Labeling

Incentivized and normal sets

Analyzing

Insights, scope, are they any different?

ML Modeling

Can we find implicit biased ones?

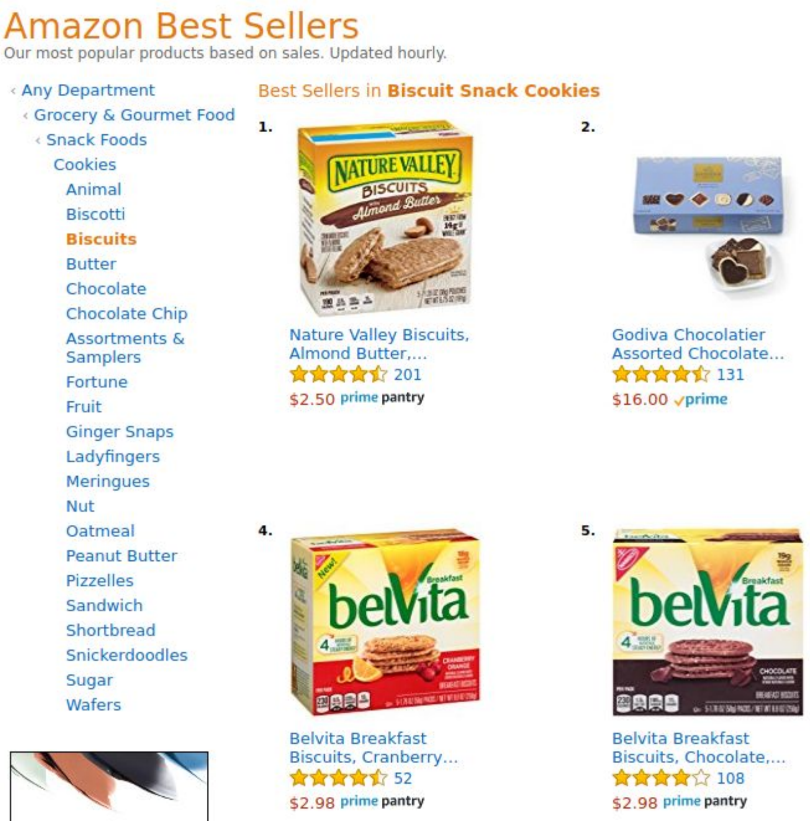
1. Dataset Characteristics

- Scraping product reviews from Amazon.com
  - Focusing on Top 20 products per category

Example:

https://www.amazon.com/gp/bestsellers/grocery/

	Product-centric (DS1)	EIRs (DS2)	Normal	User-centric (DS3)
Reviews	3,797,575	100,086	100,086	217,000
Users	2,654,048	39,886	98,809	2,627
Products	8,383	1,850	1,641	184,124



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Reviewers	2,654,048	39,886	98,809	2,627
Products	8,383	1,850	1,641	184,124

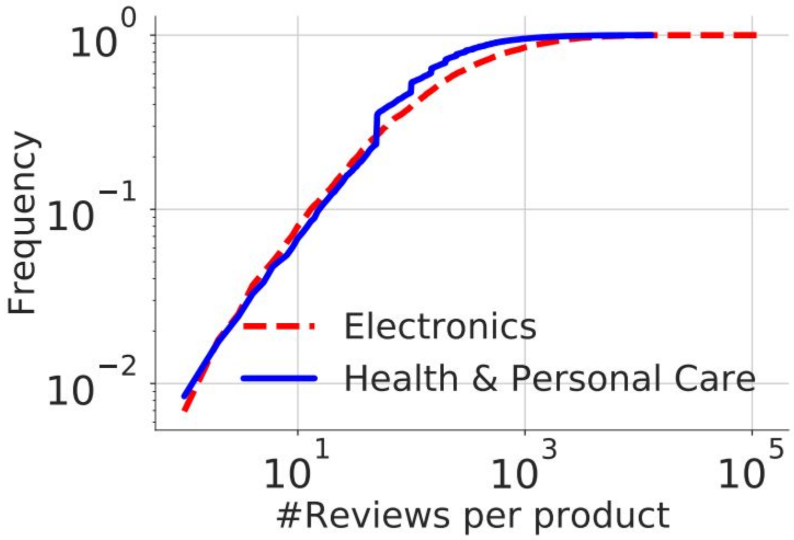
TABLE II. ATTRIBUTES CRAWLED FOR DATASET ENTITIES

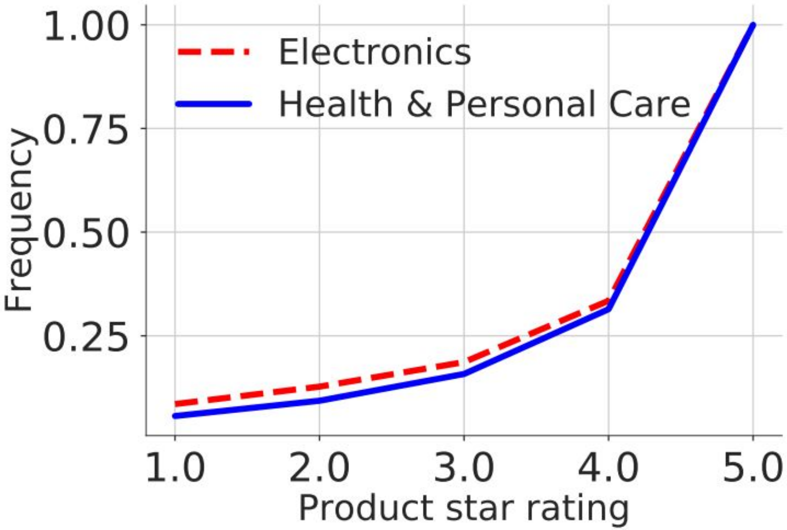
Reviews
id
user_id
Product_id
isVerified
Date
rate
likes
title
text
ImageURL

Products
id
Seller_id
Price
Category
URL
Rate
Cmnt_number
Title

Users
id
rank
Helpful
Following
Lists
MoreInfo
Name
Location

Two Categories



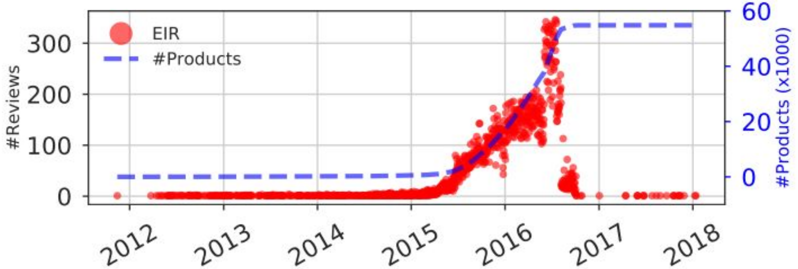


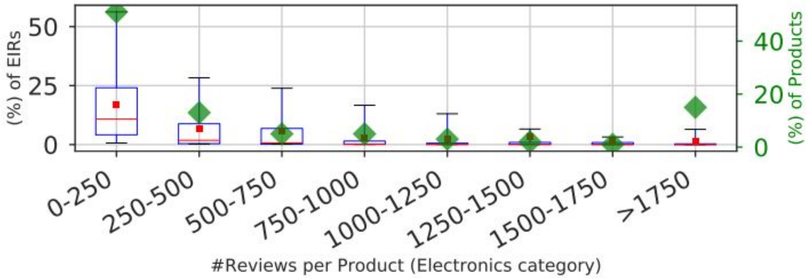
2. Detecting Incentivized Reviews

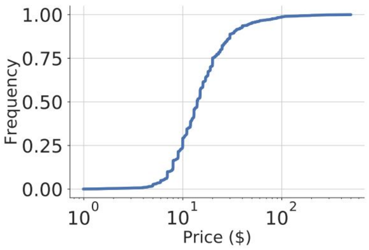
- Absence of labeled data
- Required reliable way to label them manually
- Large dataset
  - Required to be done automatically
- After extensive manual inspection, we used the following Regex:

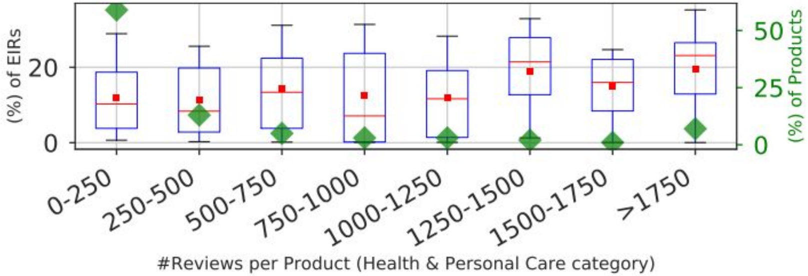
$$
\begin{array}{l}
'(sent|receive|provide)[\hat{}\backslash.!?]* \\
(discount|free|in-trade|in-exchange)[\hat{}\backslash.!?]* \\
(unbiased|honest)[\hat{}\backslash.!?]* \\
(review|opinion|feedback|experience)'
\end{array}
$$

3. Characteristics of IRs

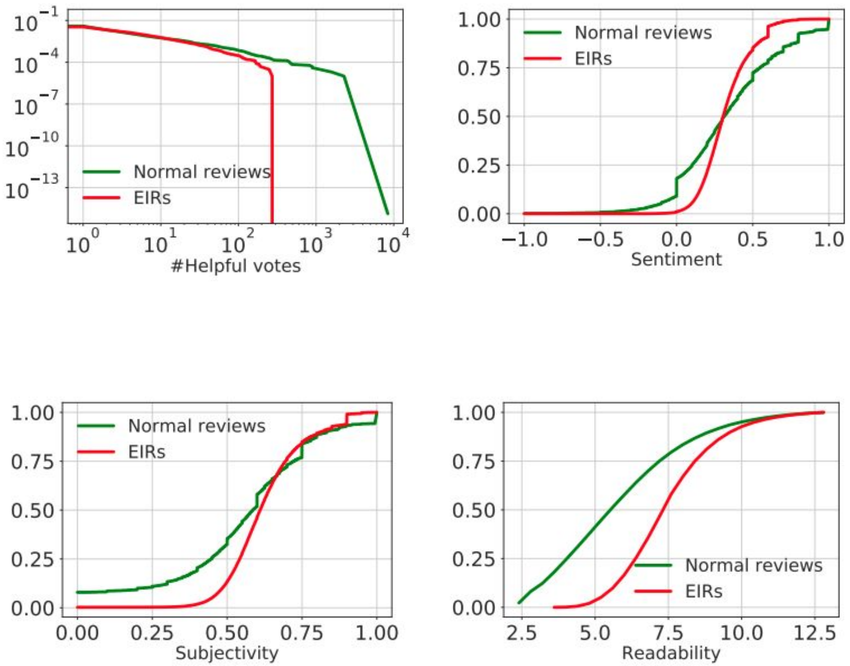




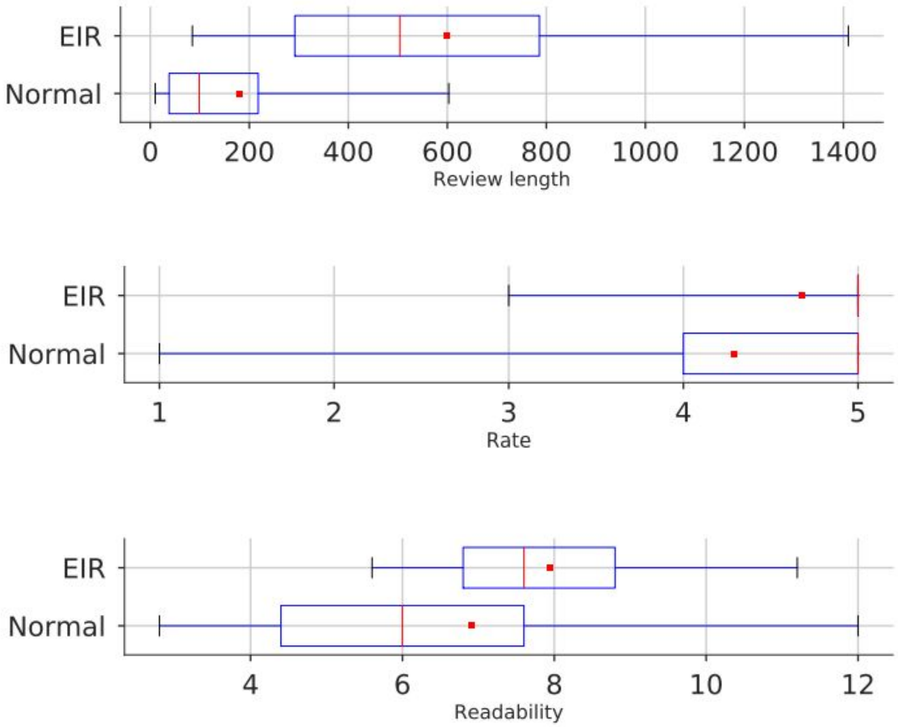




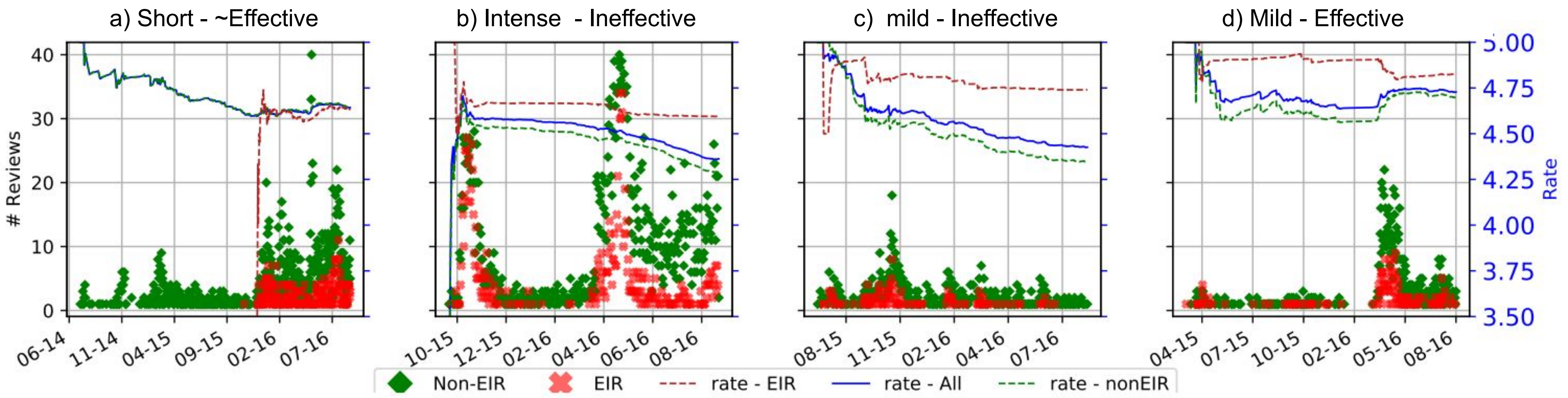
3. Characteristics of IRs

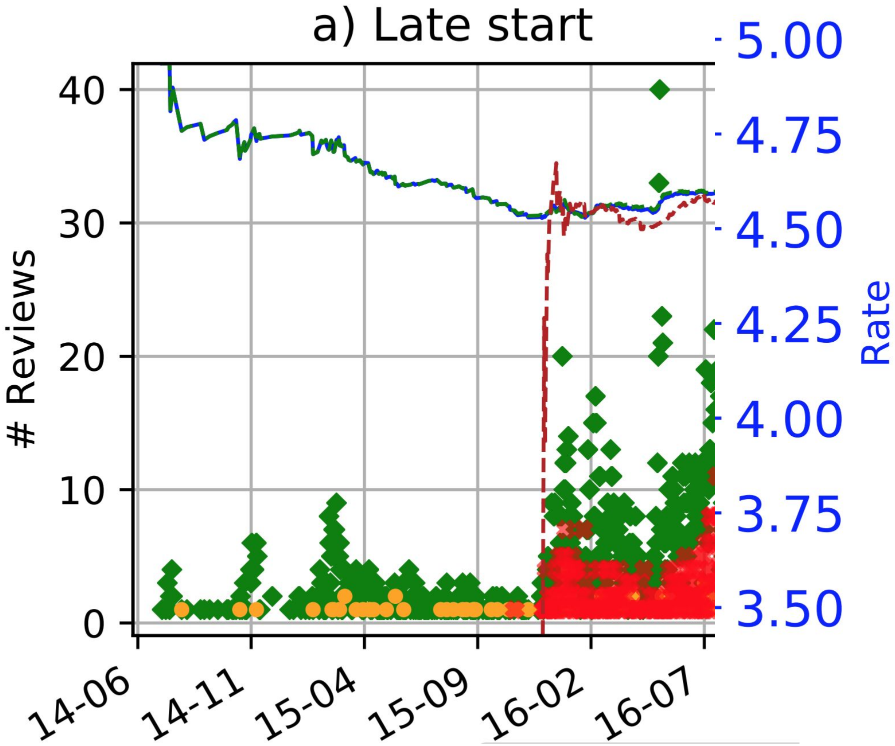


3. Characteristics of IRs

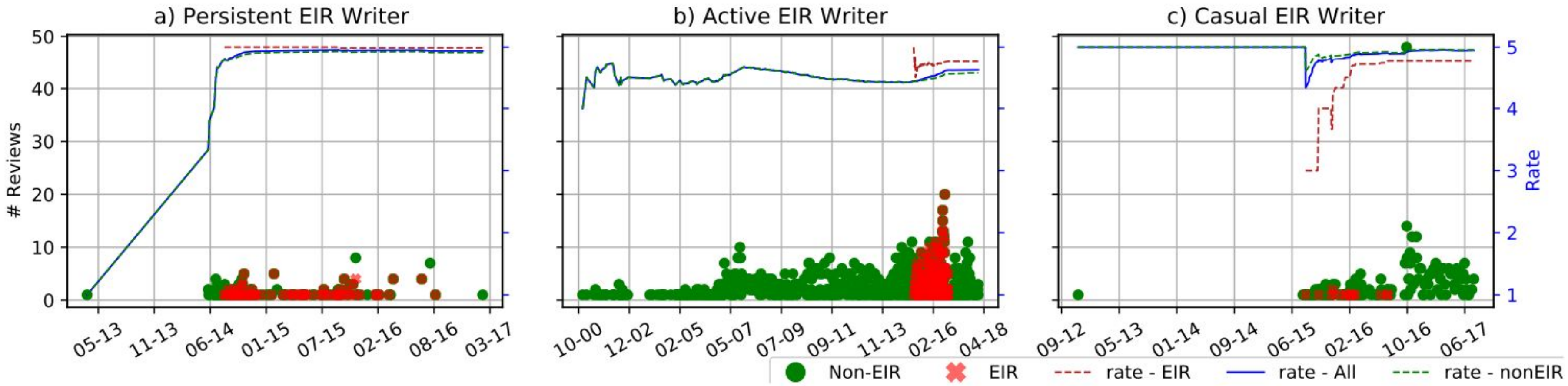


4. Temporal patterns (products)




a) Late start
Reviews
Rate
40
30
20
10
0
5.00
4.75
4.50
4.25
4.00
3.75
3.50
14-06
14-11
15-04
15-09
16-02
16-07

4. Temporal patterns (Users)



5. Detecting Other Incentivized Reviews

- Given the different characteristics of normal and EIRs
  - Modeling and detection should be possible

Text Length	Rate	Text Sentiment
Title Sentiment	Helpfulness	Title Subjectivity
Text Subjectivity	Readability	Title Length

- We trained an accurate MLPC, using the above attributes

- Then, applied it to an evaluation set
  - Reviews that are not Incentivized nor Normal and submitted in 2016

  - Out of 78K reviews, our model labeled 5,891 (7.57%) of them as Incentivized
    - 54% of them, have Explicit signal (different than ours)
      - ”I had opportunity to get it for my review”
      - ”received with a promotion rate

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Text Length	Rate	Text Sentiment
Title Sentiment	Helpfulness	Title Subjectivity
Text Subjectivity	Readability	Title Length

- Removed the signature part of the review ("received free product in exchange ...") for text-based modeling

- We trained an accurate MLPC, using the above attributes

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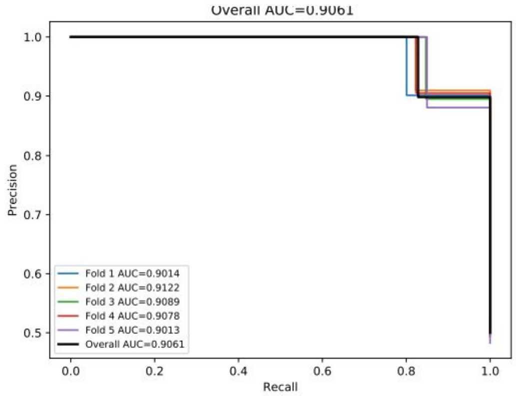

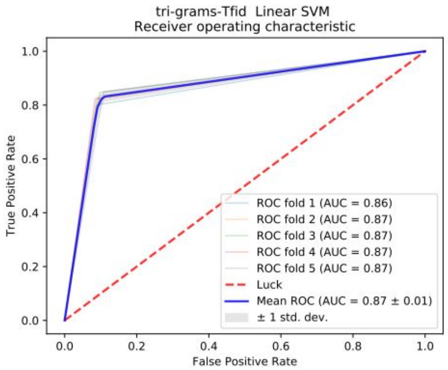

5. Detecting Other Incentivized Reviews

	Acc.	Rec.	Prec.	F1-score	P-R AUC	AUC
Basic	0.84	0.81	0.78	0.81	0.86	0.81
Text	0.88	0.89	0.89	0.89	0.91	0.89
Basic+Text	**0.92**	**0.89**	0.86	**0.89**	**0.93**	**0.89**
C-Elect.	0.8	0.8	0.79	0.8	0.85	0.8
C-Health	0.87	0.86	0.84	0.86	0.9	0.86

Conclusion

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1. Incentivized Reviews
2. Explicit Incentivized Reviews
3. Behavior Deviation of EIRs
4. Modeling and Predicting

The End

Comments and questions….