

Incentivized review identification on Sephora

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Project Design

User review has become increasingly important for online shopping, especially for beauty products. According to a recent *Influenster* survey, 85% of women read reviews for beauty products, and 68% of women say they rely on reviews when making purchasing decisions. User reviews are so important that companies start to pay consumers to write reviews based on free products, which are known as incentivized reviews. Because of potential conflict of interests, incentivized reviews are likely to be biased, leading to inflated product ratings. People even call incentivized reviews fake reviews. In this project, I aim to train a model to identify incentivized reviews by using data from Sephora.com. Sephora is the largest retailer of beauty products in the US. It carries about 300 brands and a large body of high-quality user reviews.

Methods

The pipeline for extracting topical features from reviews is as follows. For example, if a review is written as “I love this product. It feels amazing!”, I first tokenized the two sentences that constitute the review; then for each sentence, I tokenized individual words. After that, I encoded each word into a vector of length 300 using word2vec. Using TF-IDF, I calculated a weight for each word. By multiplying each word’s vector with its weight, I first weight each word vector, and calculated the average sentence vectors. After this step, I have a matrix of sentence vectors. To extract topical features, I clustered the sentence matrix into 25 latent topics by using K means. Then I aggregated these topics by reviews so that I can know what topical features were included in each review. Combined with product and reviewer features, I trained a classification model by using naive Bayes and gradient boosting.

Results

In order to see if the topical features could provide useful information in identifying incentivized reviews, I first tried to use non-topical features to fit models. The grey line represents its performance, which yielded an AUC of 0.58 and a recall score of 0.25

(Figure 1). After adding the topic features, auc increased to 0.75 and recall increased to 0.76, which means the topical features greatly improved the model’s sensitivity to incentivized reviews.

Figure 1. Model performance

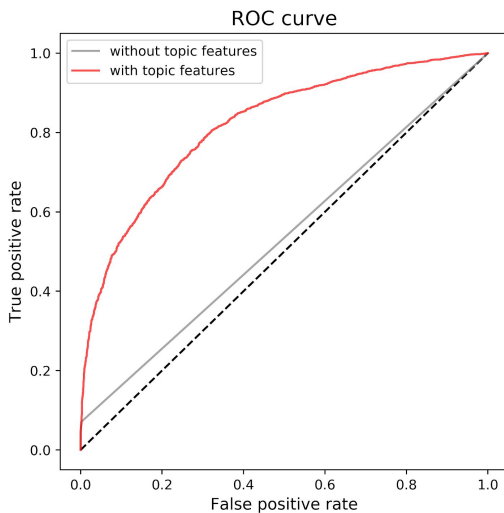
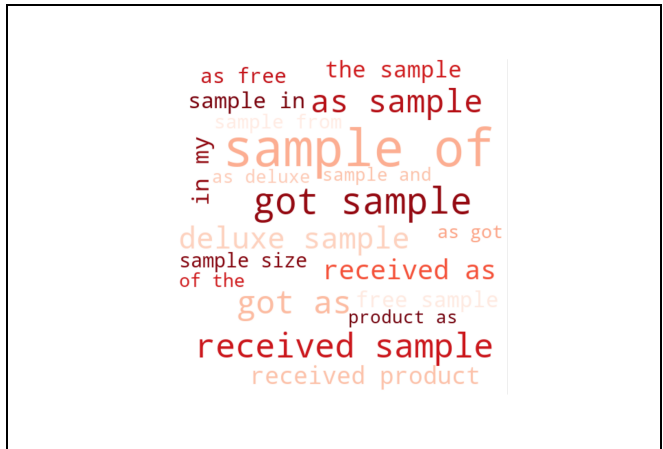


Figure 2. Word cloud of topical feature #15



By examining the performance of individual features in the Naive Bayes model (Figure 3), the top 3 features are product price, topical feature #15 which mostly indicates if the reviewer received a free sample (Figure 2), and Sephora membership.

Conclusions

My model based on product, user and topical features demonstrates great sensitivity to incentivize review. As a demo, here is a review that is not self-identified as incentivized (Figure 4), but when you read it, it is obviously a review based on free product. My model successfully identified that it is an incentivized review. In fact, 32% of all reviews are predicted as incentivized although only 7% were labelled. So, incentivized reviews may be more common than you think, and this issue needs attention.

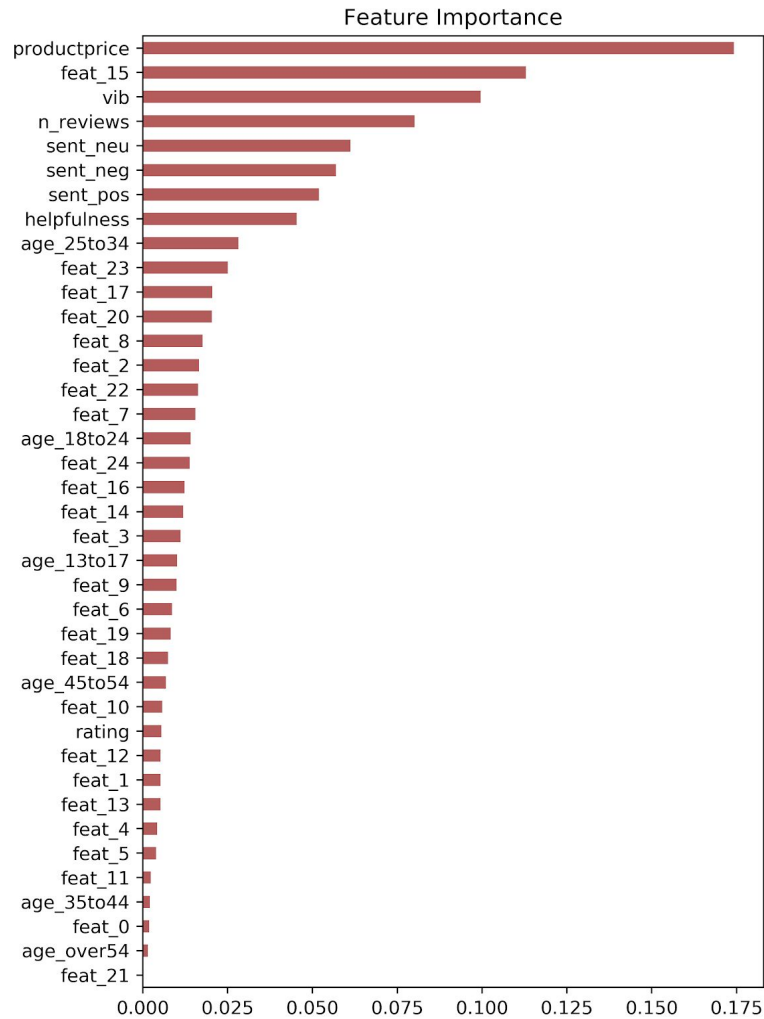


Figure 3. Feature importance in predicting incentivized review

karensj77

★★★★★
17 Aug 2016

Exceptional results

I am in total awe about the SK-II GenOptics Aura. After two weeks of usage both morning and night I can say my skin feels better, looks smooth and alive. No sensitivity after application and this product is the easiest one cream to apply. Not multiple product, just one dropper and the results are present. Simply amazing and worth every penny. I received the product complimentary in exchange for an honest review. Here is my honesty after 3 weeks of usage.

NOT HELPFUL (0)
HELPFUL (0)

Figure 4. Sample review on Sephora

Tools

- JSON, BeautifulSoup: data collect
- Jupyter notebook, Pandas, Numpy: Ingest, organize, and process data
- Matplotlib, Seaborn, Wordcloud, pyLDAvis: Data visualization
- NLTK, Gensim, spacy: natural language process
- Scikit-learn: Fit regression model

Data

I collected product information, reviewer information and reviews text by using Sephora's user review API. I focused on the skin care products, which includes 1000 items with a total of 1,000,000+ reviews. A review will be defined as incentivized if it is labelled "*received free sample*" or "*Sephora employee*". In total, 110,000 reviews provide this information and 7% of them are incentivized.

Algorithms

- K means
- Word2vec
- TD-IDF
- Naive Bayes
- Gradient boosting

What would I do next time?

In the future, I can use Keras to further extract useful information from the reviews. I will also add more features from product description and the timing of reviews. Furthermore, I want to analyze reviews of other types of products, for example, make-up products, which may have different topical features. Eventually, I will validate my model with reviews on other beauty products websites.