Web Analytics Final Report

Topic: Analysis of Smartphone Reviews

Team members: Dawei Sun, Xueyan Ba, Wenpei Wang

Motivation and Objectives

As soon as Apple launched **iPhone 8** in WWDC this year, it draw people attention to the latest smartphones with the most advanced features. It deployed the most popular camera and the most powerful processor than ever. But it still has to face intense competition from the latest smartphones manufactured by Samsung which are **Galaxy S8** and **Note 8**. There are a lot of reviews for these three smartphones and our group is very interested in analyzing smartphone industry especially by observing people's attitudes toward these three popular products online.

Our analysis can be used to guide customers when they want to purchase appropriate smartphones and give manufacturers feedback about what customers think of their products. For customers, when they want to purchase smartphones, they want to how other people like the products they want to buy. For some features of smartphones they care about, how other people rate them. For manufacturers, they want to what features customers care about so they can allocate more research and development budget into improving those features.

Before our analysis, all relevant reviews regarding to iPhone 8, Samsung S8, and Samsung Note 8 would be scrapped for processing. Then we would try to analyze which features and functions people are most concerned and according to the features we chose, some of our reviews will be labeled for training.

Our objectives is to obtain a good model which we can use customers' reviews as input to make predictions about what their reviews are about. Then, their reviews will be categorized into a few groups for sentiment analysis. At the end, we are able to get people's attitude toward some selected features of smartphones.

Introduction

For our project, our group would like to conduct supervised training by using Convolutional Neural Network (CNN) model to classify reviews into five designated groups. With these techniques, we are going to design a system which can scrape online reviews as well as dig into customers' reviews to find valuable information. Also, this information can be useful to both customers or manufacturers.

Methodology

We designed different web crawlers targeting each smart phone we want to analyze to scrape customers' reviews from the best buy website. Then, reviews for three different phones were saved into three different CSV files (raw_Note8_reviews.csv, raw_S8_reviews.csv, and raw_iphone8_reviews.csv).

We applied natural language processing skills to clean three files by removing punctuations and converting to lower cases and saved as new files for further analysis (clean_Note8_reviews.csv, clean_S8_reviews.csv, and clean_iphone8.csv).

After cleaning data, reviews were randomly selected from three files and labels were assigned to each review. Labels are essential features of smartphones such as battery, camera, processor, and screen. Besides these four features, reviews which are irrelevant to previously mentioned four featured are labeled "others." Our goal is to classify all the reviews into these five groups. 1000 reviews were selected from over 3300 reviews, and we also make sure that there are enough samples for each feature. Reviews are used for training were saved as a file called training_data_set.csv.

Convolutional Neural Network was used for multi-label classification. A list consisted of all labels, and a list consisted of all reviews was created. MultiLabelBinarizer was used to transform the labels into indication matrix. For example, a label regarding battery will be transformed into [1, 0, 0, 0 ,0]. 30% of training data was used for testing, and the rest was used for training. After obtaining our model, it can be used to make predictions. We also can generate classification report to validate our model by comparing Y_pred and Y_test.

We can increase the sample size of training data to obtain a better model with higher precision and recall. After increase the sample size from 600 to 1000, precision and recall were improved to both 0.97.

	precision	recall	f1-score	support
battery	0.97	0.97	0.97	75
camera	0.96	0.99	0.98	100
others	0.98	0.98	0.98	41
processor	0.89	0.89	0.89	19
screen	0.98	0.96	0.97	67
avg / total	0.97	0.97	0.97	302

classification report of our model

After obtaining a relatively good model, it can be used for predicting a specific feature of a review. For each smartphone, its reviews are used as input to our model, and they will be classified into one of five groups. In the end, we can obtain five lists and each list contains each of these features.

For each feature of a smartphone, our group conducted sentiment analysis to get customers' opinions.

One method we used was VADER which is an unsupervised method and based on lexicons of sentiment-related words. SentimentIntensityAnalyzer will be imported from vader and polarity_score will return a dictionary contains positive, neutral, and negative scores. For each review, if positive score is greater than negative score, pos counter is incremented by 1 and vice versa. Lastly, we will calculated the ratio of positive reviews.

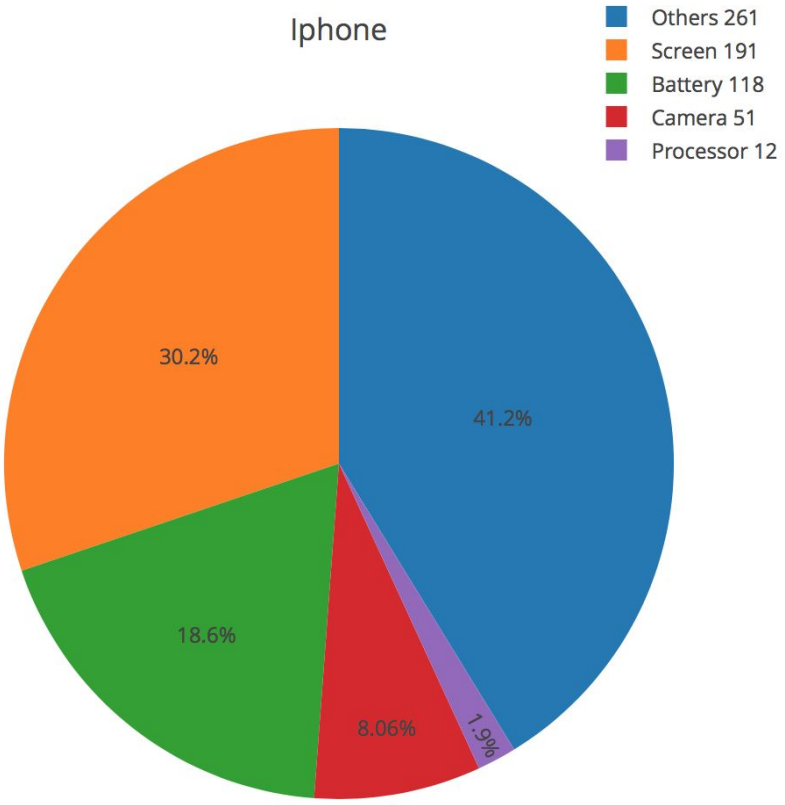
The other way was analyzing reviews by using the positive and negative dictionary. We will group all the reviews regarding to a feature into a large text. Then, count positive and negative words associate to each feature of smartphones.

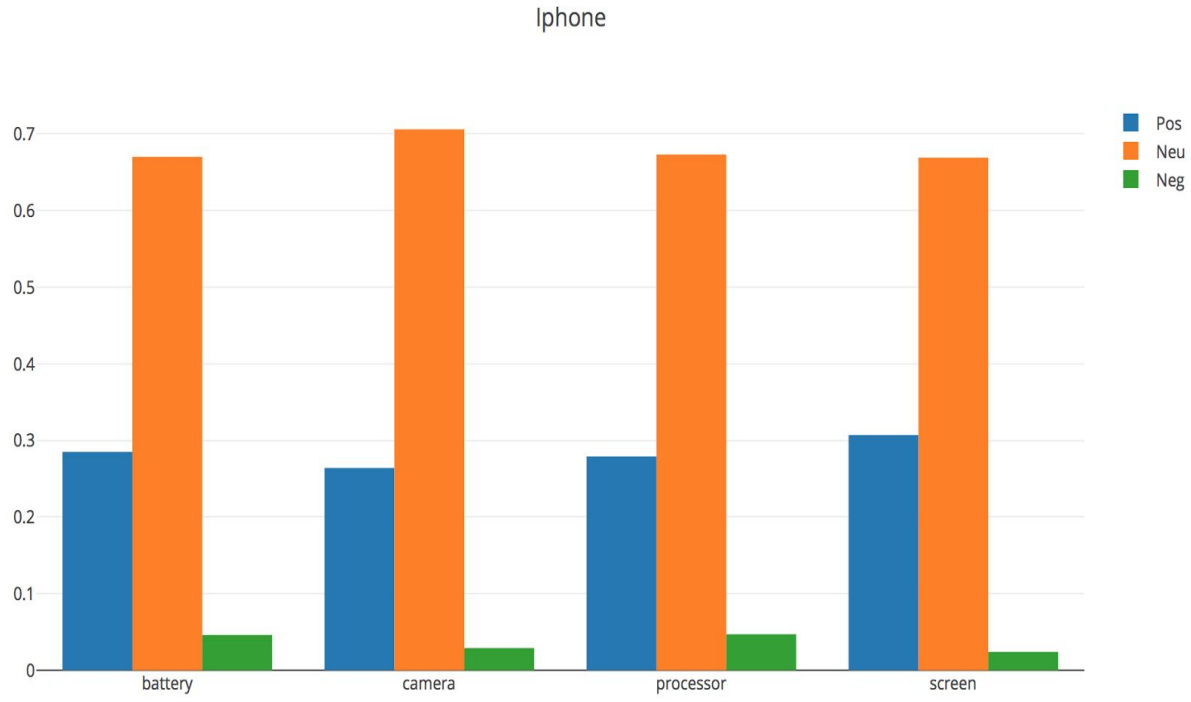
Results

The results of conducting unsupervised sentiment analysis VADER.

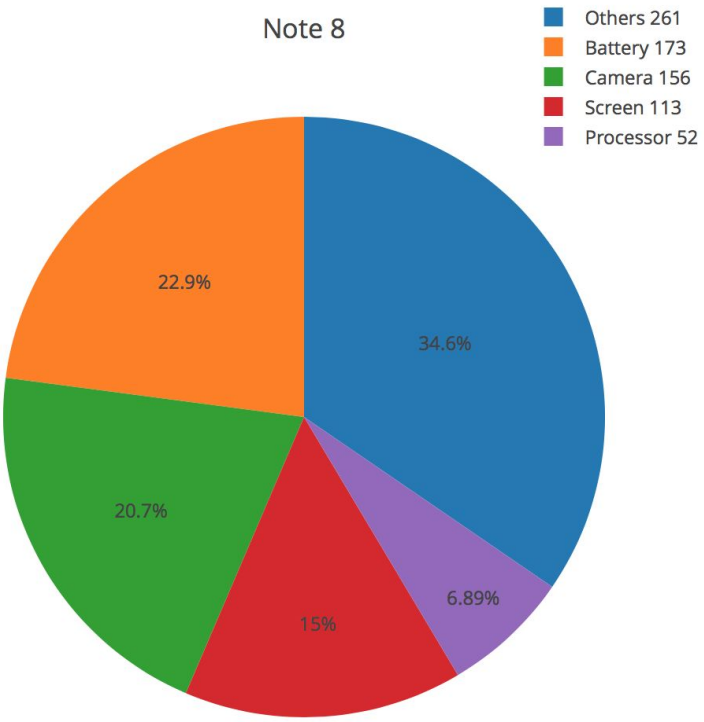
		Note 8	iPhone 8	S 8
battery	positive	167	79	323
	negative	11	11	20
	ratio	93 %	87 %	**94 %**
camera	positive	113	76	254
	negative	21	5	30
	ratio	84 %	**94 %**	89 %
processor	positive	33	42	114
	negative	7	3	5
	ratio	82.5 %	93 %	**96 %**
screen	positive	123	90	269
	negative	3	3	14
	ratio	**97 %**	**97 %**	95 %

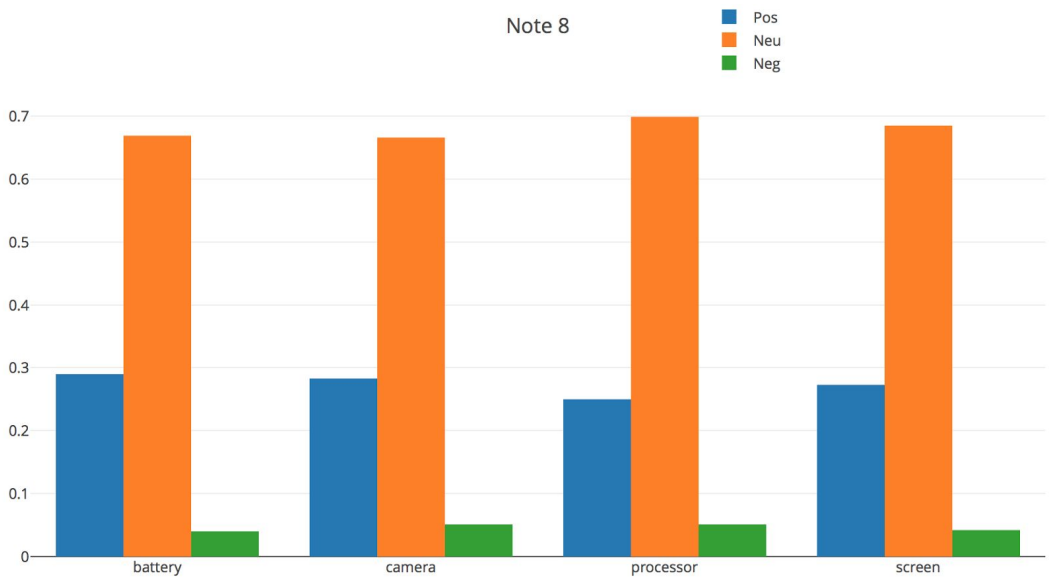
The results of iphone 8 are as following:



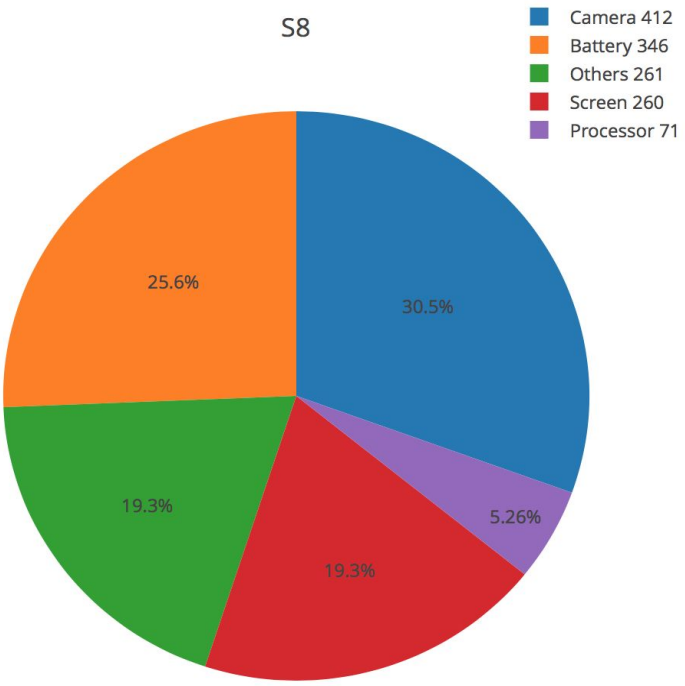


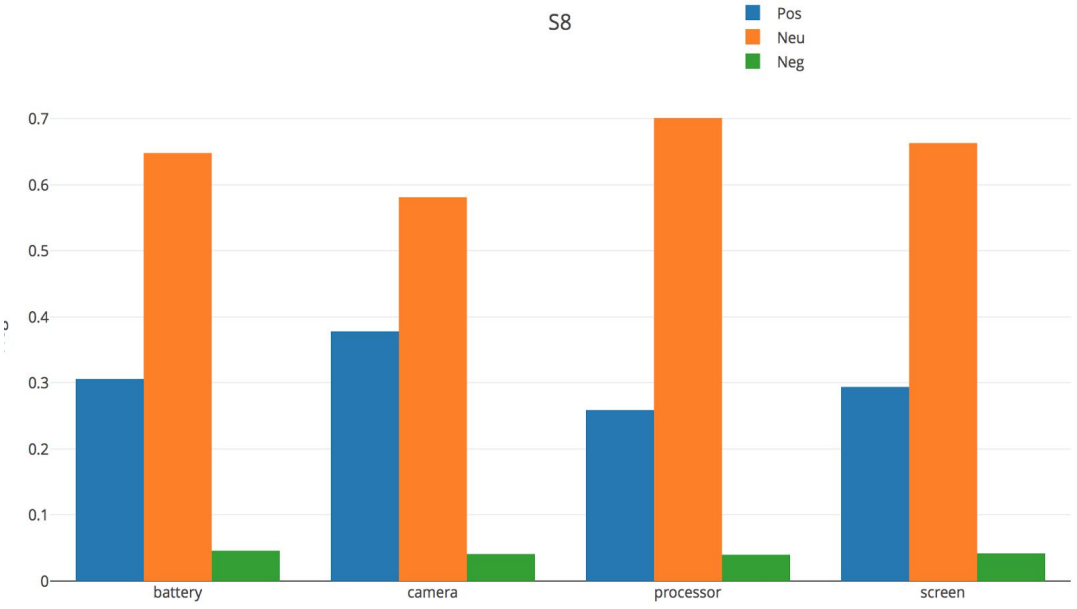
The results of Note 8 are as following:



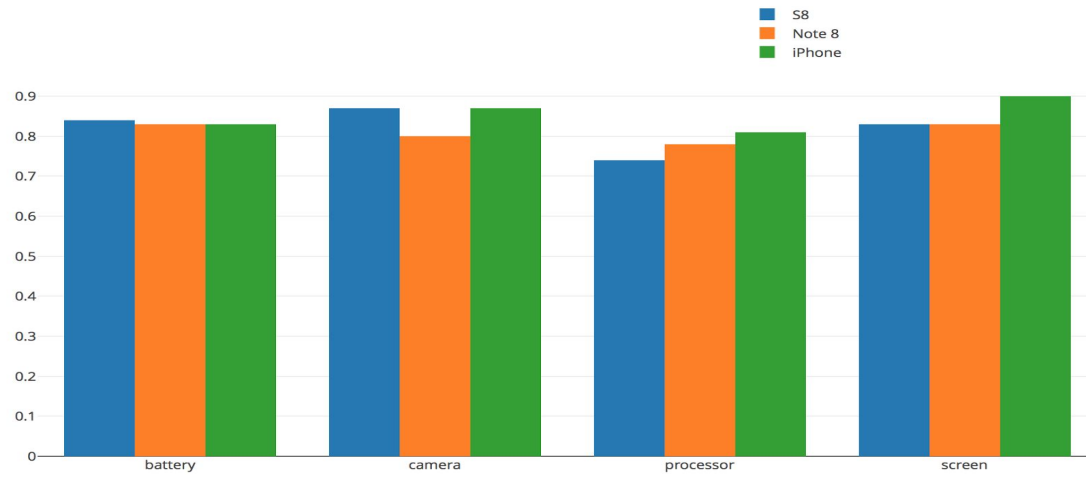


The results of S8 are as following:





Following is the result of alternative sentiment analysis:



Analysis

From the graph, we can see that our model labeled the review data into several features. To test its function, we used 10 sample data for the model to the label. With multiple time test, the test result indicated that our model's precision rate is over 70%. Since the database is relatively small (it's only 2000), we could conclude that our model is working well with the cleaned review data. So the result from our model is relatively credible. If we can train our model with more data, the result can be more accurate.

We also used sentiment analysis to show the attitude of customers. At first, we used Vader which is a sentiment analysis tool to get the result. But the result is not acceptable compared to customers' rating.So we used a simple sentiment analysis method which compares the numbers of positive words and negative words. The result of the alternative method is much more close to customers' rating. The reason our Vader sentiment analysis tool was not working may is that the Vader is focused on sentence analysis. Since we input all review data into it, there were many disturbs in the way of getting the better result.

Since our result is relatively credible, we can get some valuable information from our result that can be derived to business.

From the result, we conclude that S8 and Note8 users have more attention to the camera. This result also proves that our model worked well. Because Samsung always uses the camera as their prime selling point. So the customers of Samsung concerns more on camera. Based on that, we recommend that Samsung needs to focus on camera to attract its core customers.

Secondly, iPhone users have more concern about the screen which is reasonable because iPhone's new screen is a significant improvement of the smartphone display. And that's why iPhone is dominating the smartphone area. It's always seeking challenge and trying to innovating.

We also find that processor is not very often talked about. We guess it is because most of the users are not fully using the calculating power of the smartphone. So most of the users are not considering processor is an important feature of the smartphone. But if the processor is not good enough for daily use, the negative feedback could be huge. So the producer of smartphone needs to find the balance of overpowered and less powered.

Based on the result we can find that all the three products are very popular. The positive ratings are all over 80%. And iPhone has a slight advantage to those two Samsung products.

Conclusion and future work

In conclusion, all three products we analyzed with our model are very successful in gaining customers reputation. The features we are interested in are working so well that almost every customer rate positively.

In the future, we need to improve the performance of our model to get a more accurate result. And we also need to expand the range of our monitoring to get more detailed information from specific features even with the specific type, like 7-inch screen, 9-inch screen, etc. Then we can get more information from customers review that could guide customers behavior also guide the production of manufacturers. Or we could expand our system to all the online selling websites with feedback function to get almost everything customers say to everything that sold online.