Brand-Imaging using mining of Brand-related User-Generated content on Social Networking Services using Textual and Visual data inputs

Abstract

This paper revolves around the approach to interpret data from Hashtags, Captions and Images of Social Networking Services to study brand related user generated content in order to gather insights of performance of brand related products using technologies involving emotion-sensing, image-classification, Label-clustering and mathematical indexing of output based on satisfaction levels of different products. product from images is combined with the sentiment calculated from hashtags and captions to find the satisfaction level of various products that the brand wishes to know the performance of.

Keywords: Emotion-sensing, Image Classification, Classification Algorithm

1   Introduction

Social media in today's time can be thought of as the true replication and representation of the ideas and views of all generations. A proper scratching and scraping of selective topics have yielded results that have helped unearth

some underlying interdependencies. An unbiased view or at least views by all kinds of ideologies get a fair share of representation on Social networking services (SNS) making it a relevant platform that can serve the needs of brand interpretation and imaging too. On the other hand, we have been able to detect human emotions from texts and images too using the evolving culture of emotion-sensing using tools of Machine Learning and classification. In this project, we try the combination of these two to deliver brand imaging by using text as well as images to get a hold of what is the true insight that a brand/product needs by knowing the true and unbiased image formed by diving deep into social media. The developing social media insights on the other hand based on social media attributes like reacts and shares and reach are often indicators that a brand looks for with respect to the penetration of these brand-related posts in masses, and thus SNS not only serves as a platform where the brand gets to meet its user base but also the vice versa, whilst the usage of insights to know brand penetration have been heavily built and publicized the other area of Brands knowing the views that its product is carrying through brand imaging is a potency that has been highly underrated as of now and this is the main void that this project aims to fill.

The project deals with the creation of brand imaging and emotion-sensing of products and services of a brand based on posts and reviews uploaded on social media sites such as Instagram, Twitter, and Facebook. Brand-related user-generated content offers an immense plethora of opportunities to learn what consumers currently think and feel about brands. Against this background, we present an automatic approach for collecting, aggregating, and visualizing brand-related user-generated content.
The collected information is classified and mined under different heads which are separately analyzed and then combined to generate a report over user satisfaction level for different domains and products that is related to a brand. The product is identified through the picture that is followed by the text into consideration.

2   Literature Review

A Method for User Sentiment Classification using Instagram Hashtags, by Nam Minji, Lee EunJi, Shin Juhyun, (2015-16)[1], studied on Analyzing emotion-sensing through Social Networking Services mainly

Instagram, Unlike the normal convention of classifying sentiments in Positive/Negative/Neutral sense it went on further to classify emotions on basis of Thayer's Model, which involves Psychological sensing of data. The paper uses hashtags in a post calling it the major ingredient of Instagram posts to collect emotional data.

In this paper, hashtags are used to classify emotions of the post, but ignorance of captions reduces the credibility as modern times use Hashtags for categorization of post and its nature to reach intended groups whereas images and captions actually dedicate the feelings of the post in consideration.

Image sentiment analysis using latent correlations among visual, textual, and sentiment views, by Marie Katsurai and Shin'ichi Satoh, (2016-17)[2], studies the importance of Social Networking sites as the dump yard for all the emotions including angst, ecstasy and everything in between. The Engine built uses vocabulary storage classified into different sentiment levels to extract the emotion of the particular input into consideration. The study also takes into consideration the need to combinedly study the role of image and text together to sense emotions.

Though it aims to solve the novel problem of integration of visual and textual data to perform the sentimental analysis the engine used is somewhat static and renders the process ineffective when vocabulary from different classifiers comes into being.

Sentiment Analysis of a Product based on User Reviews using Random Forests Algorithm by Shailendra Narayan Singh ; Twinkle Sarraf 2019-2020)[3], in their paper studies and analyses the reviews and the ratings of the customers mainly in the e- commerce space. The major problem faced in the online review system is the fact that the text reviews and the star ratings given by the customers often don't go hand in hand. In addition to this, the product rating given by the customers don't have any standard scale to measure them since they are purely based on the customer's point of view. There are times when a product has been given stars but the text review gives a completely different opinion about the customer's thinking of the product . Hence , text reviews provide us a real picture of the product. This paper has efficiently used Sentiment analysis using Random forest classifier and text mining and gives a boolean output as to whether the product is desirable to buy or not and the user does not have to go through all the reviews and ratings by other customers.

Supervised Sentiment Analysis of Twitter Handle of President Trump with Data Visualization Technique by Kalyan Sahu ; Yu Bai ; Yoonsuk Choi (2019-2020)[4], this paper studies and gauges the relationship between the tweets made by the POTUS and the public support for the current administration which is given by the approval ratings. Twitter has been used for the first time by the office of POTUS for directly communicating with the general masses. We see that mass public opinion is much more complex compared to product reviews and it could be difficult to study than normal products.

A quantitative " sentiment - score" measure which is roughly based on the word content of the tweets responses has been defined in this paper to analyze and compare the impact of tweets during various phases of the election (before , between and after the election).The study has successfully found a causative relationship between the tweets and the ratings of the POTUS as it shows an average increase by 60% in the sentiment score over time using sentiment analytics and data visualisation tools.

A New Content-Based Image Retrieval Method Based on the Google Cloud Vision API, by Shih-Hsin Chena, Yi-Hui Chenb (2017)[5], Cloud Vision API is trained by Google; therefore, it saves computational time in obtaining image labels. This study tested whether the Cloud Vision can outperform the existing Machine Learning algorithms in describing the annotations. It illustrates the effectiveness of Google Cloud Vision API for labeling of images.The results(and CBIR performances) of Cloud Vision API on a well-known dataset was compared with the corresponding image annotation algorithms and it was found that Cloud Vision API yields about 43% correctness among around 5000 images. In each dataset, Cloud Vision API is more effective than the ML algorithms. The extensive experimental results showed that the Cloud Vision API came out to be quite competitive as compared with the other image annotation algorithms.

Instasent a framework for sentimental analysis based on Instagram selfies, by Rabia Noureen, Usman Qamar, Farhan Hassan Khan, Iqra Muhammad (2018)[6]: People nowadays post their selfies on social media such as Instagram with food and friends or family whenever they go out, it has become a way of storing memories and sharing them. People are posting huge amounts of pictures everyday on Instagram,this research

study provides a framework to analyze such huge amounts of selfies which are not possible to be analyzed manually. This research framework combines both text and image mining for sentimental predictions. SVM is used for sentiment analysis and to classify text associated with selfies and pictures like captions, hashtags, comments, and emoticons. The deep learning method CNN is used to process image data acquired for sentiment analysis.

Impact of Social Media on Brand Image by Mohd.Sarwar Alam,Dr. Bilal Mustafa Khan (2015)[7]: The rise of social networking sites such as Instagram, facebook, Twitter, etc with the advent of the internet has provided a powerful platform to the people for sharing information related to various products and brands like product quality, satisfaction and dissatisfaction, new arrivals and product or brand success. In this paper, a systematic review of social media and brand equity research is conducted to understand how the dimensions of social media create Word of Mouth i.e. Electronic Word of Mouth (E-WOM) and how this EWOM further influences the equity or image of any brand. It has further tried to identify the key dimensions of social media which creates E-WOM. The dimensions of brand equity are also identified further to see how is E-WOM related to these brand image dimensions as well as how these dimensions contribute to overall brand equity of any brand.

3 Research Gap

While emotion sensing has developed in many ways since the past 2-3 Years we still haven't found some major breakthroughs in the business applicability that it potentially possesses. Upon going through the varied research papers we also found out that while Social Networking services have been found out to be a collection centre for user generated data but a sincere targeted approach on mining of brand-related user-generated content has not been implemented. Also as established from **A Method for User Sentiment Classification using Instagram Hashtags**, by Korean research groups we see dynamic engine for emotion sensing and integration of Captions, Hashtags and Images, the three major pillars of Social networking content have not been understood and studied in collection and only individual emphasis has been given instead. While some relevant works are there in terms of caption and hashtags integration has been done but the choice of SNS has

been limited to Twitter and Facebook, But in today's time we can all comfortably see that user base for instagram has been on an upscale like never before and it also is the most used photo sharing platform, the general way in which daily life SNS users post as is evident from **Supervised Sentiment Analysis of Twitter Handle of President Trump with Data Visualization Technique (2019-20)**, Also currently surveying is majorly done through user bases by use of ratings but as established that stars and reviews generally don't add up making it a less reliable source of information, as in **Sentiment Analysis of a Product based on User Reviews using Random Forests Algorithm (2019-20)**. We therefore emphasize on the use of Social networking data making Brand imaging projections on which some initial studies was done in the paper **Impact of Social Media on Brand Image (2015)**.

4   Problem Statement

Brand Imaging through emotion-sensing and Integration of Textual and Image content of Brand-Related User-generated data on Social Networking Services.

5   Proposed Methodology

1. We can see that Social Networking Services (SNS) are often flooded with Brand Related User Generated content, SNS has also come up to be a platform for Grievance sharing and redressal and therefore mixed views on all products are coming up giving a fair share of representation to all kinds of ideologies.

2. We use this opportunity to find all relevant posts in a given timeframe from Instagram through relevant hashtags making direct association with the brand, for example in our program we use hashtags like McD and McDonaldsIndia and scrap most recent posts with these hashtags. The posts are scrapped using my.apify.com .

3. We then store the Caption, Image, and Hashtags separately to be analyzed together.

4. As explained in the Literature survey about captions presenting the true emotion of statements in given posts, we run dynamic emotional sensing on the caption by finding all hot and relevant keywords. The generated emotion is categorized in polarity points of Positive Neutral and Negative.

5. Once the sentiment pertaining to all the captions has been found out we set on to the next task that is classification and clustering of different labels that the image carries. We run our model to find all the relevant labels that the image contains. We make a broad set of Labels or the main labels that are actually the products on which the brand wants image interpretation, for example in this we have found out all associated labels to main labels like Ice Cream, Crispy Chicken, Coffee, Sandwich, Burger, Salad, mocktail, and Pizza. There are a plethora of association labels that are excavated from the image classification and then clustered or mapped to the relevant label as given.

6. Once the labels have been identified, we project those labels to the field that contains the actual sentiment value associated to the post containing the image from which the labels have been dug out. The labels are then given the index score of Positive, Neutral, or Negative as ascertained from the captions.

7. Once the mapping is complete we find the aggregate resultant of all the labels and posts that were taken as input. The aggregate result through statistical measure is then attributed to map whether the public sentiment relating to the specific target label is positive and what is the associated confidence of the particular product.

8. The final result is shown in a tabulated form with all intermediary and final outputs including positive cases, negative cases, etc. This is further made more visually appealing by fixing the color gradient with respect to the confidence generated.

6   Hardware and Software Requirements

Hardware - Computer System, GPU.
Libraries Used - Pandas, re, string, NumPy, textblob, preprocessor, nltk, stopwords, vaderSentiment, google.cloud, google.cloud.vision, urllib.request
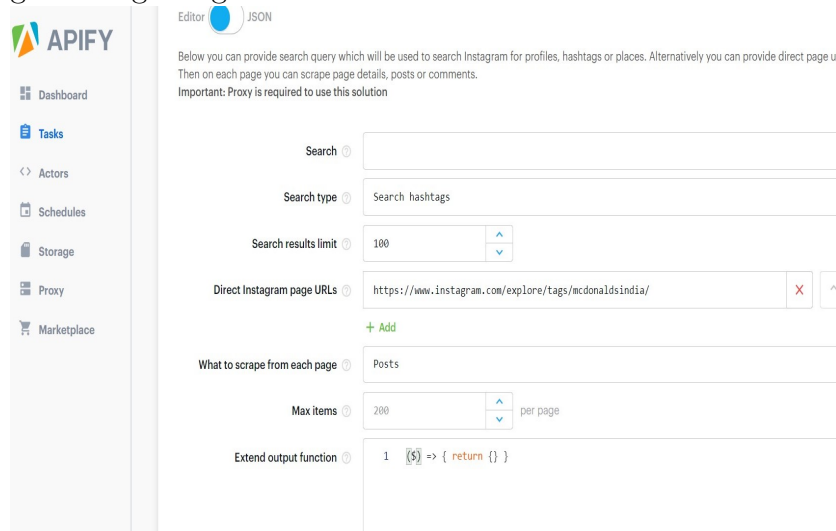**API Required** - Google Cloud Vision API
Software - Spyder (Python 3.7), Anaconda Enviroment.

7   Results

As explained in the proposed methodology about the various tasks that have been in fact taken to generate the desired output of Brand imaging by product satisfaction levels of different products (8, in this case) for the brand McDonald's. We present a therefore result set for the progress to share the way the final results have been derived in a step by step process:

1. In the Fig 1, we can see that this is the window of the APIFY software that we used to scrap relevant posts with required hashtags. Here we are inputting the Tag, the number of photos we want to scrap off, and then we give it a go to get the desired set of results.

2. In the Fig 2 we can see that post the scrapping has been done we have stored the scrapped content in a form where all the captions, Hashtags of the post, Comments on the post and the URL of the image has been stored. This data is then used in sentiment analysis.

3. While in earlier image we saw the image URLs were given, the Image in actuality has been stored in the local drive (as shown in Fig 3), of the workstation where all photos have been sequentially stored for performing the Image label detection.
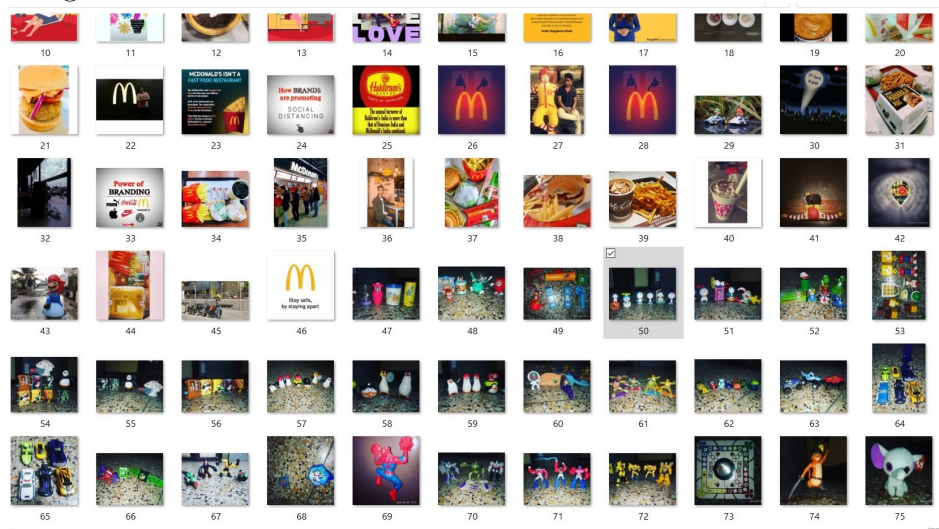
4. From Fig 2, we used the data in that form and performed the sentiment analysis on the caption that included the emojis and all hot-keywords to detect the emotion as shown in in Fig 4.The sentiments have been stored in as Positive Negative or Neutral.

Index	firstComment	sentiment	Hashtags
0	🔥 😊 ❤	positive	['#newpost', '#onfeed', '#feed', '#instagram', '#instagood', '#instafam'…
1	MAJOR MISSING happening On plate *Big Spicy Chicken Wrap Fries*…	negative	['#burger', '#wraps', '#chickenwraprecipe', '#mcdonalds', '#mcdonaldsind…
2	Home great ideas happen Keep cooking masterplans	positive	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
3	Nothing beats work view What ' method	neutral	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
4	means liveliest person Zoom call	positive	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
5	means work time naptime flexible	positive	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
6	No colleagues stealing chair best seat house	positive	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
7	When furry brainstorming partner work home becomes	neutral	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
8	At ' home office ' PUBG breaks unlimited	neutral	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
9	_____	neutral	['#coffeelover', '#cappuccino', '#mccafe', '#mcdonaldsindia', '#coffee']
10	When ' show ' work dress like ' vacation	positive	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
11	My frustrating chotu son requested cronavirus go back miss domi…	negative	['#swiggy', '#mcdonalds', '#mcdonaldsindia', '#dominospizza', '#pizzalov…
12		neutral	['#perfect', '#mcdonaldsindia', '#capachino', '#coffeelover', '#coffeeaddict', '#foodgasm', '#foodie', '#coffeevibes']
13	Nowadays post-work commute involves travelling favourite TV show universe	neutral	['#FunAtHome', '#McDonaldsinIndia', '#McDonalds', '#McDonaldsIndia', '#StaySafe', '#StayHome', '#StayHomeStaySafe']
14	💡 McDonald 's SHOW SOME LOVE ❤ IF YOU LOVE MCDONALD 'S AND MIS…	positive	['#mcdonalds', '#mcdonaldsindia', '#ig_kids', '#adorable', '#cutekids', …

5. While the Sentiments have been recorded we go on to read the labels of the image and use the model involving Google cloud vision to detect the labels and store the count of each as shown in fig 5.

Key	Type	Size	
Green	int	1	1
Green lantern	int	1	0
Hair	int	1	1
Hairstyle	int	1	0
Hamburger	int	1	4
Head	int	1	0
Hero	int	1	0
Hula hoop	int	1	1
Illustration	int	1	5
Infrastructure	int	1	0
Ingredient	int	1	13
Instant coffee	int	1	0
Ipoh white coffee	int	1	1
Jacket	int	1	1
Java coffee	int	1	0

6. While the sentiments were given in textual format of Positive, Negative and Neutral we used the code as shown in snippet in Fig 6 to allot numeric values of +1, 0, -1 as per the sentiment recorded post emotion sensing.

```
121    #Image classification
122
123  ▾ client = vision.ImageAnnotatorClient.from_service_account_file(
124      r'C:\Users\Pratham\Documents\GCV Data Mining Project-92d583df46dc.json')
125      #Please do not use this APIKey for any work other than using it for this project.
126
127      map1 = defaultdict(lambda: 0) #Create a map to store the sentiment value of each label
128
129  ▾ for j in range(200):
130
131          image_to_open = str(j)+'.jpg'
132
133  ▾        with open(image_to_open, 'rb') as image_file:    #Read the image
134              content = image_file.read()
135
136          image = vision.types.Image(content=content)
137          response = client.label_detection(image=image)
138
139
140  ▾        for label in response.label_annotations: #For each label found in image, map them with t
141  ▾            if(label.score > 0.70): #Accept only if the probability of label in image is more th
142  ▾                if(sentiment[j]=='positive'):
143                      map1[label.description]= map1[label.description]+1
144  ▾                elif(sentiment[j]=='neutral'):
145                      map1[label.description]= map1[label.description]+0
146  ▾                elif(sentiment[j]=='negative'):
147                      map1[label.description]= map1[label.description]-1
148                  #print(label.description, label.score*100)
```

7. As earlier explained in the proposed methodology we have used label clustering from the image to point on some labels that actually relate to specific products. For example P1 Product has L1,L2...Ln labels. Some examples of these labels and corresponding Main products have been shown in Fig 7.

```
154
155    #Labels - Created a set label after mannual clustering of the label
156
157  ▾ ice_cream = frozenset([
158      'Ice cream', 'Dessert', 'Frozen dessert', 'Whipped cream', 'Black-and-white', 'Chocolate brownie',
159      'Cream', 'Sundae', 'Smoothie', 'Frozen yogurt'
160      ])
161  ▾ coffee = frozenset([
162      'Coffee', 'Coffee cup', 'Coffee milk', 'Instant coffee', 'Ipoh white coffee', 'Java coffee',
163      'Espresso', 'Frappé coffee', 'Caffeine', 'Cappuccino', 'White coffee'
164      ])
165  ▾ crispy_chicken = frozenset([
166      'Chicken fried steak', 'Chicken meat', 'Fried meat', 'Crispy fried chicken', 'Deep frying',
167      'Fried chicken', 'Fried food', 'Deep frying'
168      ])
169  ▾ sandwich = frozenset([
170      'Sandwich', 'Taco', 'Bun', 'Breakfast sandwich', 'Breakfast', 'Original chicken sandwich'
171      ])
172  ▾ burger = frozenset([
173      'Burger king premium burgers', 'Cheeseburger', 'Bun', 'Buffalo burger', 'Veggie burger',
174      'Hamburger', 'Salmon burger', 'Big mac', 'Salmon burger'
175      ])
176  ▾ salad = frozenset([
177      'Fruit salad', 'Fruit', 'Orange', 'Cream', 'Syrup', 'Peanut butter'
178      ])
179  ▾ mocktail = frozenset([
180      'Non-alcoholic beverage', 'Drink', 'Red', 'Milkshake', 'Drink'
181      ])
182  ▾ pizza = frozenset([
183      'Pizza', 'Pizza cheese'
184      ])
185
186  ▾ labels = set([
187      ice_cream, coffee, crispy_chicken, sandwich, burger, salad, mocktail, pizza
188      ])
```

8. The entire process has been made to generate the final result that is displayed in the Fig 8.The Result includes index number of the product similar to the product code and has been sorted on the basis of Satisfaction level. The Result has been made visually appealing by using color gradient to show the confidence level or Positivity index of a product. Currently for clarity we are also showing exactly how many positive negative and neutral values are given so as to know how dense is the penetration of the product in the mass.

Index	label_name	positive_values	negative_values	neutral_values	confidence_level
0	ice_cream	5	3	2	20
3	salad	3	0	3	50
7	coffee	7	0	4	63.6364
6	mocktail	3	0	1	75
4	crispy_chicken	6	0	1	85.7143
1	sandwich	6	0	0	100
2	burger	8	0	0	100
5	pizza	2	0	0	100

8 Conclusion

The project can have a far reaching business model applicability and can even be used in multiple socio-political and socio-economic domains to analyse and view the way society is reacting towards any incoming change as SNS are serving as the platform where ideas are being critically discussed and analyzed by all the people of society alike. In the current scenario as we can see the data set taken in consideration was of around 200 recent images posted on instagram it can be further extended to collect data on a regular interval to serve real time data availability and can therefore be a tool of real time actions and governance for management of a company with the major emphasis on reaction from the general public or End users. The project employs the use of multiple technologies like Image classification, Web Scraping, Emotional

sensing and a lot more of normal machine learning tools. This project also aims to create a methodology inspired by an Expert system where we have kept the module like a knowledge engine and with minimal modifications and input parameter changes the same can be extended for different companies and different usage. With adequate usage of new technologies and creation of a proper business usable project, we feel that the project can be extended to multiple domains and serve the purposes of a good business software that can be a tool for Data scientists to examine underlying viewpoints of all class of society with respect to a brand and its products.

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