

B.Sc. in Computer Science and Engineering Thesis

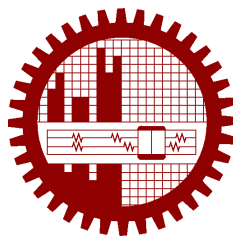
# **Interaction and Natural Language Processing Based Sentiment Analysis of Bangla Food Review in Social Media**

Submitted by

Ataf Fazledin Ahamed  
201705066

Supervised by

Dr. Sadia Sharmin



**Department of Computer Science and Engineering  
Bangladesh University of Engineering and Technology**

Dhaka, Bangladesh

May 2023

# CANDIDATES' DECLARATION

This is to certify that the work presented in this thesis, titled, “Interaction and Natural Language Processing Based Sentiment Analysis of Bangla Food Review in Social Media”, is the outcome of the investigation and research carried out by us under the supervision of Dr. Sadia Sharmin.

It is also declared that neither this thesis nor any part thereof has been submitted anywhere else for the award of any degree, diploma or other qualifications.

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Ataf Fazledin Ahamed  
201705066

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Dhaka  
May 2023

Ataf Fazledin Ahamed

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# ABSTRACT

With the increasing availability of the internet and mobile devices, more and more people are connecting to social media. Social media has evolved from a simple way of connecting with friends and family to a global village. It now presents itself as a medium of entertainment, a news platform, a marketplace, and a place for advertisement. Users are nowadays attracted by social media content. In this study, we have focused on the food review-related contents of social media and performed sentiment analysis. During this study, we collected Bangla food reviews and related comments from popular Facebook pages. We have used CrowdTangle, a social media analytics tool to collect data from social media pages and used a scoring system based on reactions. Later on, we used Natural Language Processing to classify the collected comments and compared the results to the scoring system. Our study shows a high tendency for positive sentiments in food reviews



# Chapter 1

## Introduction

With the technological advancement in the 21st century, more and more people are getting internet access. As of January 2023, around 5.16 billion people in the world have internet access. In Bangladesh, around 38.9% of the population have internet access. [9] Now that internet access has become easier than before, more and more people are joining social media. According to a report from [9, DataReportal], in 2023, around 43.25 million Bangladeshis are Facebook users. Facebook outperforms other social media sites like Twitter, and Instagram by a higher margin.

Nowadays, Facebook is not just a platform to connect with friends and family. Facebook itself has become a global village, for example- it's a place to get the latest news. Due to the newsfeed ranking algorithms, you do not have to manually search for any news by yourself. The news will come to you if you have liked any of the news profiles. In addition to that, Facebook has become an online marketplace where people from different walks of life are buying and selling items, making their livelihood out of this social media site. Furthermore, the rise of mass users on Facebook has given advertisements a new edge in the digital edge. Now anyone can post an advertisement on Facebook and pay the minimum to reach people of any demographic. Day by day, these new additions to the platform are increasing user engagement.

Facebook as a medium of entertainment is just another feature that is taking the world by storm. Every day tons of content are being uploaded to the platform, mostly in video format. Stories, reels, and videos are the main type of entertainment content that has a high engagement rate. Nowadays, content creators are not just limited to YouTube with their content. They are constantly sharing their content on Facebook and generating huge amounts of revenue from Facebook. On the other hand, people from all walks of life are getting easy access to content from their phones. Facebook has become their digital living room. Different types of content such as- Travel vlogs, cooking videos, food review videos, DIY (Do It Yourself) videos, real-life hacks, etc.

## 1.1 Food Review Scenario in Bangladesh

When it comes to creating content on social media, Bangladesh is no different. In recent years, there has been a rise in Bangladeshi social media influencers. Restaurants, food delivery services, catering businesses, etc. have contributed to the food review ecosystem in Bangladesh. Businesses are frequently engaging with influencers to help them generate traffic. On the other hand, customers also give attention to the influencers, while deciding for themselves. They trust the recommendation of the influencers and vloggers when it comes to deciding on a restaurant, a food item, or a food delivery service.

### 1.1.1 Bangladeshi Top Food Vloggers and influencers

The popularity of Bangladeshi food vloggers and influencers is increasing day by day. Mostly, influencers and vloggers rely on social media sites like Facebook and Instagram mainly. However, they have a notable presence on their YouTube channels also. Below, we are going to discuss some of the most popular food vloggers and influencers in this country.

#### **Iftekhar Rafsan**

Iftekhar Rafsan, who is mostly known as **Rafsan The Chotobhai**, is the most popular and well-known food influencer in Bangladesh. He started his food vlogging-related journey in 2017 on YouTube. Currently, he has more than 3.2 million followers on Facebook. Apart from Facebook, he also shares his food review-related content on his YouTube channel. As of 2023, he has around 1.48 million subscribers and 204 videos on his YouTube channel. In 2020, he received the "Top Content Creator of The Year 2019" award from Bangladesh's state ICT Minister, Zunaid Ahmed Palak. [2]

#### **Fahrin Zannat**

Fahrin Zannat, also known as **Khudalagse** is a food vlogger from Dhaka, Bangladesh. She started her journey in July 2019, through her YouTube channel. It is one of the fastest-growing food vlogging-related YouTube channels. Her unique way of presenting and showcasing skills sets her apart from other influencers. As of 2023, she has over 1.5 million followers on Facebook and 609 thousand subscribers on her YouTube channel. Her husband Salman Sadi plays a vital role in her content creation journey. Both of them are among the top influential couples in the content creation industry of Bangladesh.

### **Rasif Shafiq and Ridhima Khan**

Rasif Shafiq and Ridhima Khan, mostly known as the **Petuk Couple** are among the most famous YouTubers of Bangladesh. Their food vlogging journey started in 2018, mostly through their traveling journeys. As of 2023, they have around 1.8 million followers on Facebook and 772 thousand subscribers on their YouTube channel. Even though they started their vlogging journey through traveling-related videos, soon they became one of the top food vloggers in this country. Both of them as a duo, bring joy to millions through their content and authentic reviews.

### **Nusrat Islam Nikkita**

Nusrat Islam Nikkita, also known as **Zoltan BD** is a food vlogger from Dhaka. She is not just a food vlogger, but also a food enthusiast herself. Her enthusiasm about the other influencers and food vlogging inspired her to embark on this journey. Currently, she has around 688 thousand followers on Facebook and 66 thousand subscribers on her YouTube channel. Her unique way of storytelling sets her apart from other food vloggers.

### **Shahriar Rabbir and Kazi Tahsin**

Shahriar Rabbir and Kazi Tahsin are the names of two friends who started their early days of food vlogging as **Metroman** back in 2017. Both of them are known for their humor and storytelling abilities in the videos. As a duo, they have been creating quality video content regularly. At this moment, they have more than 300 thousand followers on Facebook. Their YouTube channel is home to more than 250 thousand subscribers. They also have a presence on the social media site TikTok where they have more than 3000 active followers.

## **1.2 Thesis Objective**

This thesis aims to study the overall food review ecosystem of social media in Bangladesh. Since no such work has been done before, we aim to conduct the study thoroughly. Even though our thesis is based on the sentimental analysis of the food review in social media, in this paper we have presented more insights regarding the overall situation that will help anyone conducting a study on this domain in the future.

Our thesis performs a sentimental analysis of the food review content shared on social media by the top food vloggers and influencers. In our study, we have applied two basic approaches. The first approach is based on the interactions and reactions of the audience on social media. In the second approach, we have used Natural Language Processing technique to analyze the

sentiments of the food reviews through the comment sections of the contents. Since the food review industry of Bangladesh is based on social media, we have taken two such approaches to get a whole idea about the overall situation.

With the hope of overcoming the limitations, we have emphasized the quality of our dataset as well as the collection process. The objectives of the thesis can be described below-

1. Collect interactions and reactions related to data of the popular food vloggers and influencers' content.
2. Collect the comments of the posts related to the collected interactions and reactions.
3. Clean and pre-process the dataset for further tasks.
4. Apply algorithms and machine learning techniques discussed in the methodology of the thesis to analyze the sentiment of the food reviews.
5. Find notable insights from the data collected throughout the thesis and share the experimental results.

## 1.3 Thesis Organization

The rest of the thesis is organized as follows:

- **Chapter 2** discusses the existing research and works related to the problem definition. It contains a detailed literature review and lists the limitations carried out by the existing research.
- **Chapter 3** explains the methodology of our thesis in detail.
- **Chapter 4** contains the entire process of collecting the data and steps to create the dataset for our study.
- **Chapter 5** gives an elaborated step taken by us to pre-process the dataset for our research.
- **Chapter 6** covers the features of the data that we selected for our training and finding purposes.
- **Chapter 7** describes methods and machine learning models used by us for finding the results.
- **Chapter 8** gives an overview of the different evaluation metrics chosen by us to measure our models' performance and the overall findings.

- **Chapter 9** presents the results obtained from our research in a detailed manner.
- **Chapter 10** concludes the thesis, along with our findings, and suggestions on what can do next on this topic.

# Chapter 2

## Related Works

There have been several works in the social media domain regarding sentiment analysis. Since social media is mainly dependent on user interactions and communications, the scope of sentiment analysis and natural language processing have always been present.

- In "Sentiment Analysis on Bengali Facebook Comments To Predict Fan's Emotions Towards a Celebrity" [10] paper, the authors have performed sentiment analysis on the comments posted by different fans on a celebrity's Facebook page. In this work, they have applied various machine learning algorithms to predict the sentiments of the comments. The algorithms used by the authors are- *Random Forest Classifier*, *Support Vector Machine*, *Neural Network*, *Naive Bayes Classifier*. In this study, the authors categorized the emotions into classes such as: "Surprised", "Abusive", "Angry", "Religious", "Happy", "Excited", "Sad".
- The paper titled "Hateful Speech Detection in Public Facebook Pages for the Bengali Language" [6] describes an approach to hate speech detection using machine learning techniques in the Bengali language. In this paper, some basic classifiers such as *Stochastic Logistic Gradient Classifier*, *Logistic Regression along with Principle Component Analysis* were used along with *Gated Recurrent Unit*, *Long Short Term Memory*, and *Word2Vec* models. The paper shows high performance for neural network-based models with an F1 score of 0.69 and an accuracy of 70%.

In the food review/recommendation domain, there has been noteworthy progress in terms of sentiment analysis. For example, the works mentioned below give an overview of the approaches usually taken by the authors-

- The paper titled "Sentiment Analysis Techniques on Food Reviews Using Machine Learning" [4] employs machine learning techniques such as *Naive Bayes Classifier*, *Support*

*Vector Machine Classifier, Decision Tree, K-Nearest Neighbors*. The paper focuses on the food review collected from Zomato and Amazon Foods. Based on the reviews and ratings submitted by customers, sentiment analysis performed on them gives an idea about the food recommendation ecosystem.

- The paper titled "Sentiment Analysis on Food Review using Machine Learning Approach" [8] uses the famous Yelp review dataset in their research. Sentiment analysis using machine learning algorithms for English text was used for the research.
- The paper titled "Sentiment Analysis of Bengali Texts on Online Restaurant Reviews Using Multinomial Naive Bayes" [14] follows the same approach as the previous paper. However, the Yelp review dataset was translated into Bangla. The paper applies *Multinomial Naive Bayes* algorithm to perform sentiment analysis on the translated Bangla reviews.

Based on a thorough study and a literature review of the existing papers and research, we conclude that no work has been yet performed on the social media domain of food review in the Bangla language context. As a result, our proposed thesis justifies itself as an unexplored topic in the Bangla language domain.

# Chapter 3

## Methodology

To classify the different video contents of the influencers collected from Facebook, we employ two approaches. The first approach depends on the interactions of followers and viewers of the page. The second approach relies on the comments posted on the videos' comment section by the viewers regarding their opinion.

### 3.1 Interaction Based Approach

In this approach, we prioritize different interaction metrics such as the reactions to the videos. Facebook has several reactions such as Likes, Love, Care, Wow, Haha, Angry, and Sad. Each of the reactions conveys different feelings. Since only one type of reaction can be given by an individual, we classify these reactions into two main categories: *positive and negative*.

The approach in this method follows the one employed in this [12] paper. In this paper, the authors performed sentiment analysis of Facebook posts through special reactions. The same approach can also be found discussed in this [3] paper. In this paper, the authors performed a study on understanding Facebook reactions to different articles.

The reaction-based method uses a score-based system to classify the posts/contents posted on Facebook into two categories. In this approach, the reactions are categorized into two classes, and a metric called *polarity* is calculated based on them. The formula for *polarity* is as followed:

$$polarity = \frac{n_{positive} - n_{negative}}{n_{positive} + n_{negative}}$$

$$n_{positive} = \text{Sum of all positive reactions}$$

$$n_{negative} = \text{Sum of all negative reactions}$$



Value	Category
$-1 \leq \text{polarity} < -0.5$	Class 1
$-0.5 \leq \text{polarity} < 0$	Class 2
$0 \leq \text{polarity} < 0.5$	Class 3
$0.5 \leq \text{polarity} \leq 1$	Class 4

Table 3.1: Different classes of polarity based on value

Based on the polarity value, we classify the videos into four different categories. The categories are shown in table 3.1

## 3.2 Natural Language Processing Based Approach

To analyze the sentiment of the comments from the viewers, we propose to use a neural network-based machine learning model. Since we are working on the domain of Bangla food review, most of the comments are expected to be in the Bengali language. As a result, we decided to use the BanglaBERT [1] model from the BUET CSE NLP group. BanglaBERT achieves state-of-the-art performances when it comes to Bangla Natural Language Processing tasks.

In this method, we analyze the sentiment of each comment collected from the food review videos. For each video, we determine the positive and negative sentimental comments with the help of the BanglaBERT model. Now, to classify the text sequence, we must train the pre-trained version of the BanglaBERT model. We used three existing datasets for fine-tuning the model. We used the SentNoB dataset [7] containing Bengali comments from more than 13 different domains. Along with that, we used the ABSA dataset [13] containing different labeled comments on different aspects. In addition to these two, we used an online restaurant review dataset found on GitHub [5].

We merged the three datasets and only kept the positive and negative labeled comments for training. We balanced the dataset into equal portions and split the dataset into train, test, and validation datasets for fine-tuning purposes. After training the model for further classification tasks, we predicted the comments found in each food review-related video. Based on the class having the highest number of comments, we label the post as belonging to that class.

# Chapter 4

## Dataset Creation

For our research purpose, we chose the top five food vloggers and influencers of Bangladesh. Since engagement in social media is higher than any platform for them, we chose Facebook as the platform to conduct our study. We chose video content over other types of content due to its higher interaction rate. In the image 4.1, the comparison between different content types can be seen.

FOOD REVIEW PAGES LAST MONTH - FACEBOOK VIDEOS	FOOD REVIEW PAGES LAST MONTH - PHOTOS	FOOD REVIEW PAGES LAST MONTH - STATUSES
TOTAL INTERACTIONS <b>691,358</b>	TOTAL INTERACTIONS <b>293,167</b>	TOTAL INTERACTIONS <b>26,482</b>
SHARE OF VOICE	SHARE OF VOICE	SHARE OF VOICE
INTERACTIONS + POSTS RATE	INTERACTIONS + POSTS RATE	INTERACTIONS + POSTS RATE
51% Rafsan the Ch... 351,783 4 2.74%	81% Rafsan the Ch... 237,142 4 1.84%	52% Rafsan the Ch... 13,857 2 0.22%
31% Zoltan BD 214,959 11 2.92%	11% Petuk Couple 32,785 1 1.77%	38% Zoltan BD 10,008 3 0.50%
10% Petuk Couple 66,185 4 0.89%	7% Khudalaqse 19,856 1 1.31%	10% MetroMan 2,617 2 0.20%
5% Khudalaqse 33,891 4 0.56%	1% MetroMan 3,384 2 0.25%	0% Khudalaqse 0 0 0.00%
4% MetroMan 24,540 7 0.53%	0% Zoltan BD 0 0 0.00%	0% Petuk Couple 0 0 0.00%

Figure 4.1: Difference between different content types

### 4.1 Interaction Data

We used CrowdTangle <sup>1</sup>, a social media analytics tool from Meta. Using CrowdTangle, we selected the top food vloggers and influencers' pages from the dashboard. During this research, we only used the videos published between 2020 to 2022. After downloading the data from CrowdTangle, we filtered the data based on a few conditions such as:

- Post type must be video

<sup>1</sup>Website: <https://crowdtangle.com/>

Post Created Date	Post Created Time
Post Type	Total Interactions
Total Comments	Shares
Likes	Love
Wow	Haha
Sad	Angry
Care	Haha
Sad	Total Views
Video Length	Message
Link	Score

Table 4.1: Available Information from CrowdTangle

- The content must be posted from their Facebook page/profile
- The downloaded data must be of a food review video

To fulfill the last condition, we had to manually go to each of the links and check whether it was a food review video or not. If it was not one, we simply discarded the data related to it. Some of the notable data collected from CrowdTangle contained the following information:

## 4.2 Comment Data

Since the Natural Language Processing based approach requires Bangla text to analyze the sentiments of the food review videos, we had to download the comments related to the videos mentioned in the previous section. For the filtered data from the previous section, we had to manually download the comments for each post since no public API exists for Facebook. At the beginning of this study, we had to go to the videos' URL and manually copy-paste the comments to a CSV file. However, as our research progressed, we developed a custom plugin for a Chromium-based browser based on an existing one. The plugin helped us to extract the comments from Facebook easily. For each of the videos, we extracted and saved the comments in an individual CSV file and linked the file to the CSV previously downloaded from CrowdTangle. We took caution while performing this operation since a simple mistake may introduce errors to our findings.

Following the steps above, we downloaded around 26,004 comments from 905 Facebook food review-related videos.

# Chapter 5

## Preprocessing

The data downloaded from CrowdTangle and Facebook needs to be preprocessed before we apply it to our proposed methods. The preprocessing steps mainly involve the data collected from the comment section of the food review videos. The comments collected in our research are mainly in three languages- Bangla, English, and Banglish.

To run the BanglaBERT model on the data, we must translate them into Bangla. We follow three basic steps for preprocessing the data. At first, we pass the comment text through 'avro.py', a modern implementation of Avro Phonetic parser <sup>1</sup>. The output of the Avro parser is then passed through Google Translate API <sup>2</sup>. Even after these two steps, some of the comments were not translated into Bangla. As a result, we had to manually translate the text ourselves. The human-level text filtering steps ensure the quality of data for our research.

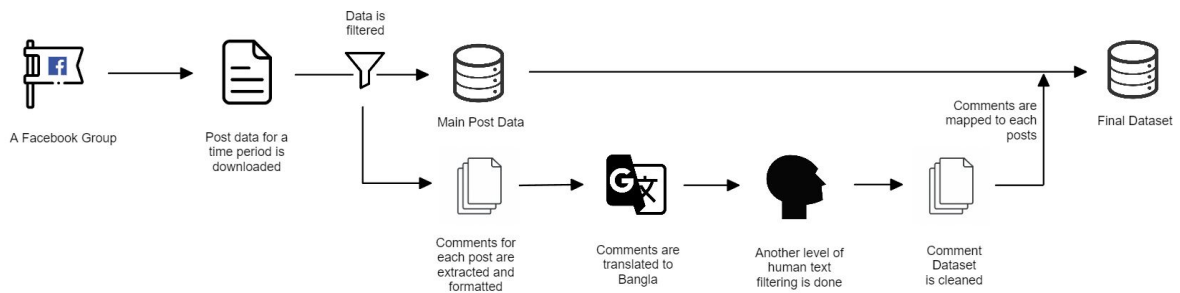


Figure 5.1: Data Collection and Pre-processing Steps

<sup>1</sup>GitHub: <https://github.com/hitblast/avro.py>

<sup>2</sup>Google Translate API: <https://cloud.google.com/translate/>

# Chapter 6

## Feature Selection

Among all the information received from CrowdTangle, the "Likes" information related to a post, which denotes the total number of likes was discarded. It was done due to several reasons-

1. The Facebook News Feed ranking algorithm gives less importance to it. [11]
2. The like count of a post bears no significance. As a reaction, it is treated as a neutral one since it is thought to belong to a lower sentimental reaction.
3. The total like count of our collected data amounted to more than the sum of other reactions. As a result, taking it into calculation would nullify the importance of other reactions by a large margin.

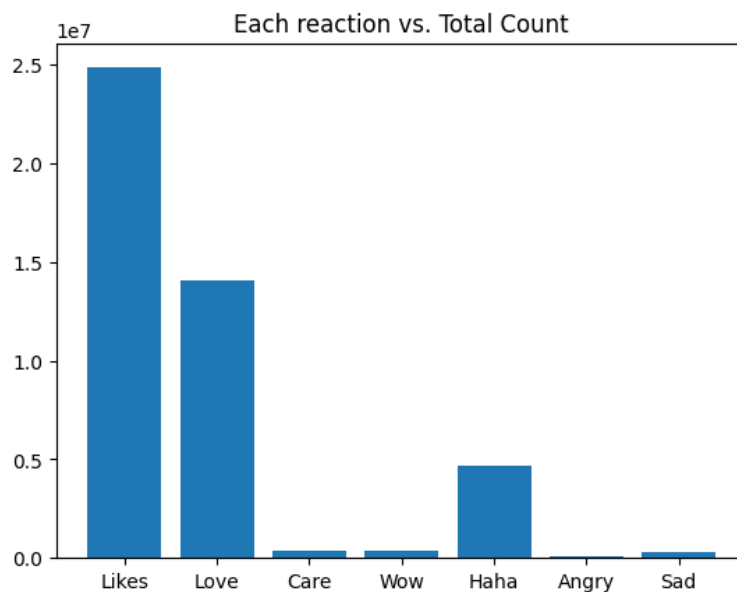


Figure 6.1: Distribution of Different Reactions of Facebook Food Review Posts

In table 6.1, it is quite evident that the total number of likes outperforms all other reactions.

## 6.1 Correlation Coefficients

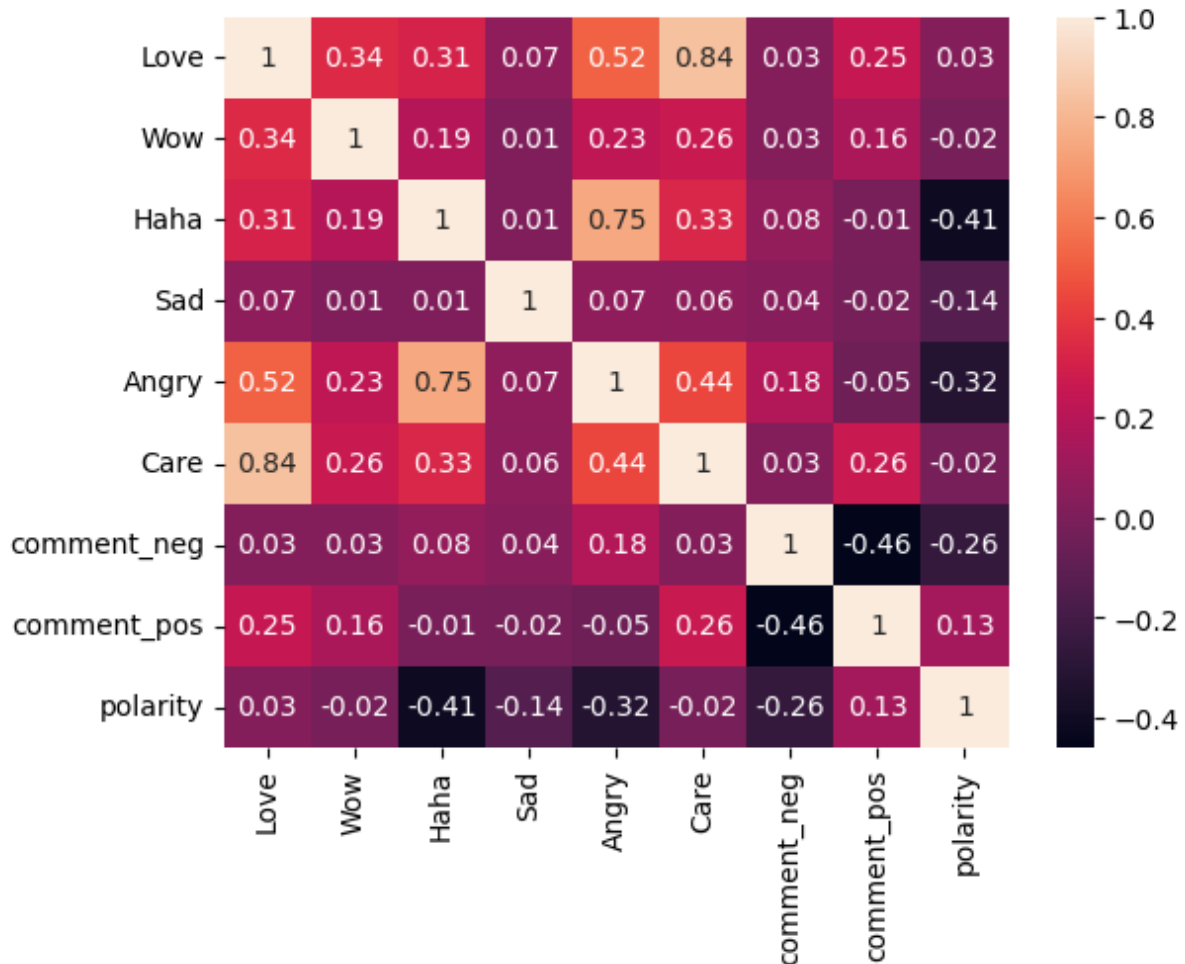


Figure 6.2: Correlation Coefficients of Different Features

Table 6.2 portrays the different correlation coefficients of different features of our dataset. Among them, the value of coefficients between **Love** and **Care**, and **Haha** and **Angry** are higher than others. It goes on to show that there is a strong correlation between these four reactions. Since the correlation value between them are positive, it means a positive correlation.



$$n_{negative} = n_{Haha} + n_{Angry} + n_{Sad}$$

$$n_x = \text{Number of reactions for reaction 'x'}$$

### 6.2.2 Features for Natural Language Processing Method

Similarly, the same approach is followed for quantifying the features of the Natural Language Processing-based method. In this method, the number of comments belonging to positive and negative classes is computed. It leads to two new features called *comment\_positive* and *comment\_negative* which denotes the total number of positive and negative comments predicted by the fine-tuned BanglaBERT model, as stated in Chapter 3.

$$comment_{positive} = \text{Total number of positive comments in a post}$$

$$comment_{negative} = \text{Total number of negative comments in a post}$$

In summary, we can list the features used by our methods as follows:

#### 1. Features for interaction-based approach

- (a) Total number of positive reactions (Love, Care, Wow)
- (b) Total number of negative reactions (Haha, Angry, Sad)

#### 2. Features for Natural Language Processing based approach

- (a) Total number of positive comments
- (b) Total number of negative comments



# Chapter 7

## Model Selection

Since our study involves working with a formula for the interaction-based sentiment analysis, and a pre-trained model for the Natural Language Processing task, we do not use any specific machine learning model. Even though our work involves working with Banglish text, we chose the Bangla text-based model of BanglaBERT due to its higher BLUB Score. From the table 7.1 collected from BanglaBERT paper [1], we can see that the performance of the BanglaBERT model exceeds that of the BanglishBERT one.

Models	[Params.]	SC	NLI	NER	QA	BLUB Score
<i>Zero-shot cross-lingual transfer</i>						
mBERT	180M	27.05	62.22	39.27	59.01/64.18	50.35
XLM-R (base)	270M	42.03	72.18	45.37	55.03/61.83	55.29
XLM-R (large)	550M	49.49	78.13	56.48	71.13/77.70	66.59
<b>BanglishBERT</b>	110M	48.39	75.26	55.56	<b>72.87/78.63</b>	66.14
<i>Supervised fine-tuning</i>						
mBERT	180M	67.59	75.13	68.97	67.12/72.64	70.29
XLM-R (base)	270M	69.54	78.46	73.32	68.09/74.27	72.82
XLM-R (large)	550M	70.97	<b>82.40</b>	<b>78.39</b>	<b>73.15/79.06</b>	76.79
IndicBERT	18M	68.41	77.11	54.13	50.84/57.47	61.59
sahajBERT	18M	71.12	76.92	70.94	65.48/70.69	71.03
<b>BanglishBERT</b>	110M	70.61	80.95	76.28	<b>72.43/78.40</b>	75.73
<b>BanglaBERT</b>	110M	<b>72.89</b>	<b>82.80</b>	<b>77.78</b>	<b>72.63/79.34</b>	<b>77.09</b>

Figure 7.1: Performance Comparison of Different Pretrained NLP Models for Different Downstream Tasks

BanglaBERT offers three pre-trained models for the downstream task of the Bangla language. Due to the limitation of computation hardware and resources, we chose to work with the 'BanglaBERT Base' model. The pre-trained weights of the model were downloaded from HuggingFace model hub <sup>1</sup>. For fine-tuning the model, we used the `sequence_classification.py` script provided with the model's codebase.

<sup>1</sup><https://huggingface.co/csebuetnlp>

# Chapter 8

## Evaluation Metrics

Since our entire Natural Language Processing method depends on the outcome of the BanglaBERT model, we had to train the model for sequence classification tasks and improve the evaluation metrics. To measure the performance of our model, we used several metrics such as accuracy, recall, precision, and F1 score.

### Accuracy

The most popular criterion for measuring a model's performance is accuracy. The ratio of correctly identified data points to the total number of data points is accurate. Higher accuracy does not guarantee better overall performance because the dataset can be unbalanced. We can express precision in the following way:

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$TP = TruePositive, FP = FalsePositive$$

$$TN = TrueNegative, FN = FalseNegative$$

### Recall

The proportion of correctly identified positive data points to the total number of positive data points is known as recall. Sensitivity is another term for it. The efficiency with which a model classifies relevant data is measured by the recall. The following is how we can express recall:

$$Recall = \frac{TP}{TP + FN}$$

## Precision

The ratio of accurately identified positive data points to the total number of positively classified data points is precision. It indicates a model's ability to predict positive samples. Precision takes precedence over accuracy. Precision can be expressed in the following way:

$$Precision = \frac{TP}{TP + FP}$$

## F1 Score

For unbalanced datasets, the F1 score is useful. It discusses the trade-off between recall and precision. When precision equals recall, the F1-score reaches its maximum value. F1-score uses the harmonic mean of recall and precision rather than the arithmetic mean. The f1-score can be expressed as follows:

$$F1\ Score = \frac{2 \times Precision \times Recall}{Precision + Recall}$$

# Chapter 9

## Results

### 9.1 Fine-tuning Task

The fine-tuning task of the BanglaBERT model is very critical for our research as it was determined to be the ground truth for our Natural Language Processing-based approach to sentiment analysis. Our model yields a better performance on the training dataset. During the training, we used cross-validation to validate the model against a completely unknown dataset so that the model can learn better. The performance achieved by our model is described in the tables below:

Metrics	Value
Evaluation Accuracy	0.744
Evaluation F1 Score	0.699
Evaluation Precision	0.713
Evaluation Recall	0.698
Evaluation Loss	0.64

Table 9.1: Evaluation Performance Results for BanglaBERT

Metrics	Value
Prediction Accuracy	0.8376
Prediction F1 Score	0.8375
Prediction Precision	0.8377
Prediction Recall	0.8375
Train Loss	0.7038

Table 9.2: Test Performance Results for BanglaBERT

## 9.2 Natural Language Processing Approach

The bar graph and the histogram below denote the total number of positive and negative comments received from the viewers. Figure 9.1 shows the total number of comments from each class collected from our dataset. It is quite evident that the positive comments are way more in number than the negative ones. The histogram shown in figure 9.2 denotes the distribution of the comments in terms of the polarity value.

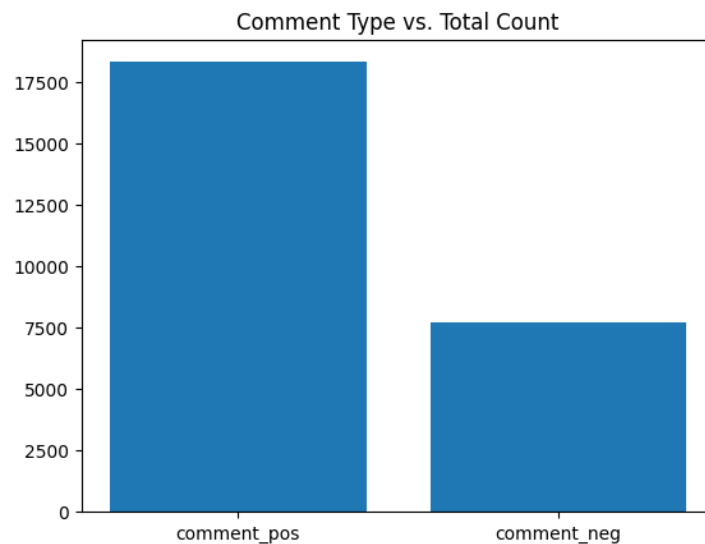


Figure 9.1: Distribution of positive and negative comments

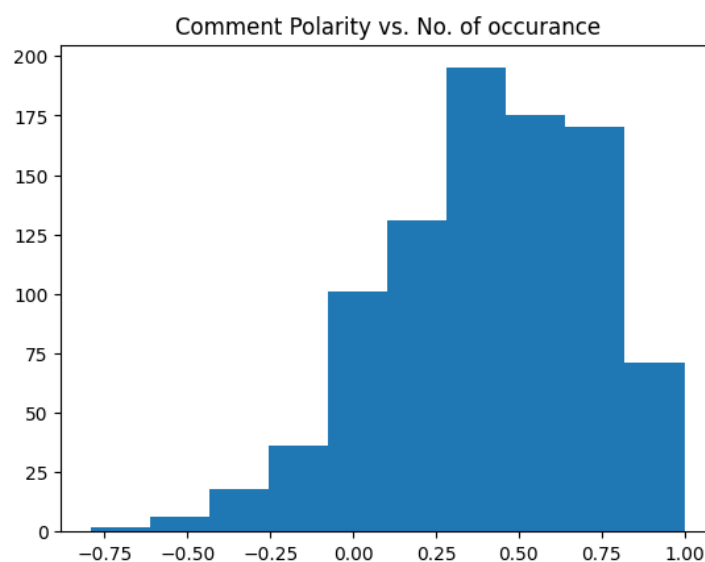


Figure 9.2: Distribution of comments in terms of polarity

## 9.3 Interaction Based Approach

The interaction-based approach proposed in this thesis provides high-level insights into the overall food review situation in social media. The bar graph shown in figure 9.3 shows the total number of videos belonging to each of the polarity classes described in chapter 3. The histogram shown in figure 9.4 denotes the polarity distribution of the food review posts.

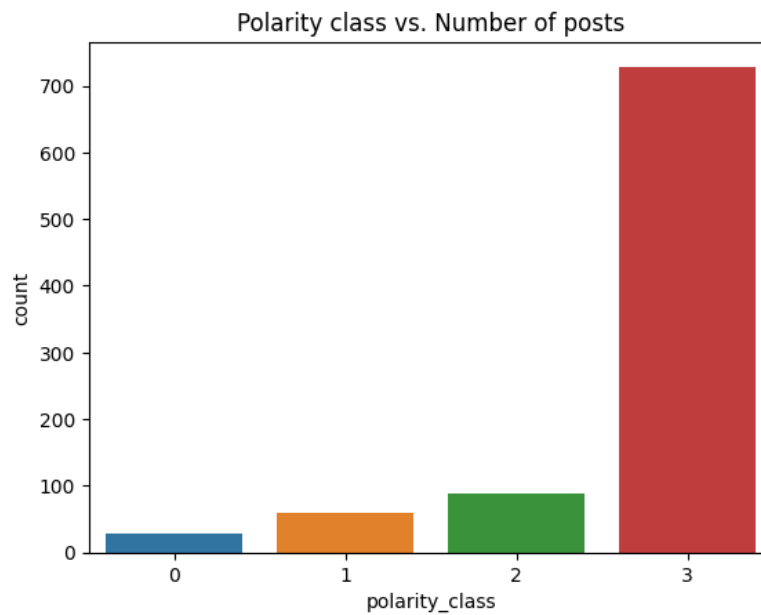


Figure 9.3: Distribution of posts in terms of polarity class

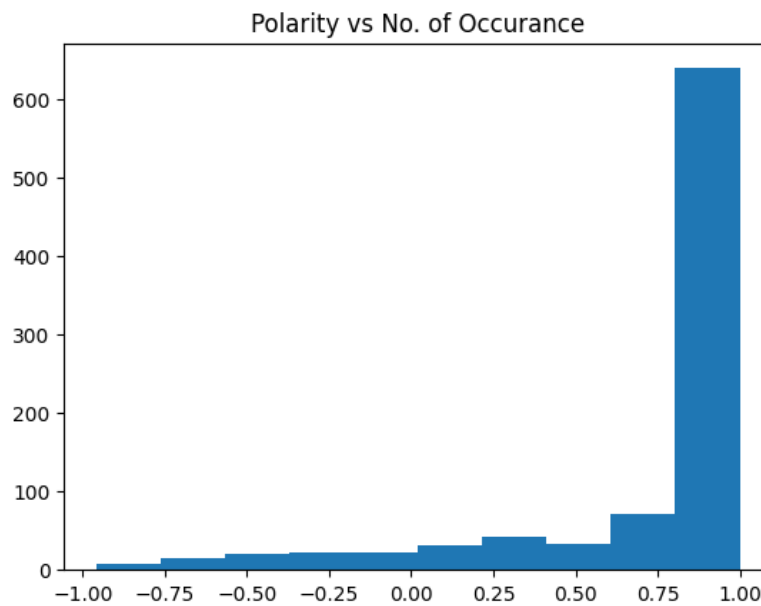


Figure 9.4: Distribution of posts in terms of polarity score

From both approaches, we find significant insights into the sentiment related to food reviews in the social media domain in Bangladesh. From the interaction-based approach, we can see that more than 90% of the food review posts contain positive reactions, indicating a positive sentiment. The number of posts decreases along with a lower polarity score, meaning the minimum number of posts shows negative polarity.

On the other hand, the Natural Language Processing-based approach shows a bit different insights. The maximum number of posts contains a polarity score between 0.25 to 0.5. There exist lower high polarity posts than those of medium polarity. And here also, the number of posts decreases along with the polarity level.

Both of the approaches proposed and implemented in this paper indicate a positive sentiment of the food review ecosystem of social media in Bangladesh. Interaction and comments posted by the viewers of the top food vloggers and influencers indicate that there is positive sentiment regarding the overall food review-related content shared in the social media space of Bangladesh.

# Chapter 10

## Conclusion

We can conclude our research through the results found in chapter 9. The study conducted throughout this research dives into the interaction and other analytical data of social media along with a state-of-the-art Natural Language Processing-based approach. The findings show us that the food reviews shared on social media are taken in positive sentiment by most of the viewers whereas some outliers denote a negative sentiment towards the reviews.

### 10.1 Future Work

Since our study relies heavily on more and more data points, we intended to expand our dataset to get clearer insights. In the future, we hope to expand our work into different food review-related groups where we might find more insights regarding this industry that is increasing day by day. Since the overall process shown throughout our study is data-dependent and lengthy, we plan to incorporate an automated system through our developed plugin. We believe both users and the research community will benefit from the data collected through the plugin.

The interaction-based sentiment analysis introduced in paper [3] and [12] can be applied to other research areas working with social media. The special reactions classified into multiple categories along with a radar chart-based metric might help us look inside the data and provide rich insights. Being a cost and resource-efficient approach, this method needs more and more attention to it which can lead to an initial indication or hypothesis carried out at the initial phase of research.

We also wish to publish the dataset collected throughout this research. We believe it will not only add value to the existing datasets related to sentiment analysis but also will help expand the research of the Bangla language.



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