FOOD QUALITY PREDICTION BASED ON REVIEWS

BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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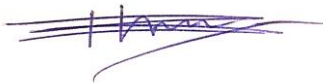
DHAKA, BANGLADESH

SEPTEMBER 2021

APPROVAL

This Project/internship titled **"Food Quality Prediction based on Reviews"**, submitted by Tazrina Haque Mohana, ID No: 172-15-10237 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 09-09-2021.
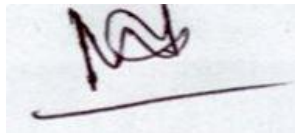
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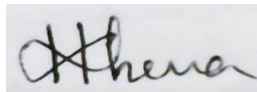
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DECLARATION

I hereby declare that this research has been done by me under the supervision of **Lamia Rukhsara, Lecturer, Department of CSE** Daffodil International University. I also declare that neither this thesis nor any part of this thesis has been submitted elsewhere for award of any degree or diploma.

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ACKNOWLEDGEMENT

First, I express my heartiest thanks and gratefulness to Almighty Allah for His divine blessing makes it possible to complete the final year thesis successfully.

I am really grateful and wish my profound indebtedness to **Lamia Rukhsara**, **Lecturer**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of "*Deep Learning*" to carry out this thesis. Her endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stages have made it possible to complete this thesis.

I would like to express my heartiest gratitude to Almighty Allah and Head**,** Department of CSE, for his kind help to finish my thesis and also to other faculty members and the staff of CSE department of Daffodil International University.

I would like to thank my entire course mate in Daffodil International University, who took part in this discussion while completing the course work.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

Nowadays with the advancement of the internet and technologies people prefer to provide reviews for almost every kind of thing and put them online. It is vital to bring out information from the huge amount of accessible text reviews. This is why consumer's feedback is important. People of almost every age often visit restaurants. In today's world food review is the fundamental requirement for visiting restaurants. But selecting a restaurant based on reviews is not quite an easy task. Deciding whether a food is worth having or not can be difficult. Several factors including the price, quality, taste, quantity can influence the actual worth of a food. From the perspective of a consumer, it is a dilemma to select a food appropriately. Food quality prediction can be a challenging task due to the high number of reviews that should be considered for the accurate prediction. People are keen to find out whether a food is worth having or not before visiting a restaurant. Most people nowadays select restaurants based on their preferred food's review. But the reviews present on the social platforms are mostly broad. People don't find it useful to read the whole review. Therefore, a model which is capable of accepting reviews as input and is able to predict the food quality as output can become a great solution to this problem. During my research, I have proposed a technique to predict consumer feedback from the online reviews given for a food by using Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms. Based on those reviews, the customers will be able to find out the most suited restaurant for their preferred food. This will also help the restaurant owners to improve their food quality based on their customer's review. The purpose of this study is to represent a different view than what has already been done to solve this problem.

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CHAPTER 1
Introduction

1.2 Introduction

Nowadays individuals of almost every age tend to visit restaurants quite often. Before visiting any restaurant, most people are keen to find out the quality of food. Reading food reviews to find out the quality of a food before visiting a restaurant can be a great approach. In today's world, sharing text reviews of numerous products and services including food reviews via blogs, websites and social media especially Facebook groups are a very common trade. Reviews represent consumer's feedback and preferences about a food. By expressing their sentiment through their own words, consumers actually rate a restaurant's food and the services provided by them. That's the reason why these reviews can be the source for the analysis of feedback of consumers about a specific food. Recent time shows that the amount of internet as well as social media users are increasing enormously in Bangladesh. The owners of the restaurants also allow their customers to put their feedback on social platforms so that they can find out the customer's interest and preference about their foods as well as services. This collection of data in the form of text reviews is analyzed to find out consumer's feedback as well as preferences. Text reviews represent nothing but a consumer's feedback about a food's quality, quantity, price and taste. Visitors before visiting a restaurant can get useful information from the consumer's feedback about specific foods. By training the machine learned through Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms about the reviews and the class levels that are bad, good and best, the model would be able to categorize the reviews provided by the consumers. To predict the rating of a food review I have collected the reviews from two of the Bangladeshi Facebook food review groups named Food Bank and Food Bloggers. In my research, I have collected text reviews that are provided by the consumers in Bengali. This model will be able to predict the food reviews written in Bengali only. Receiving reviews as input, the model will be able to predict the food quality as output. The output will be bad, good, best based on the review.

1.2 Motivation

Text analysis, which is the process of obtaining valuable insights from data in the form of texts, is fairly an old area of research. It is vital to bring out information from the huge amount of accessible text reviews. In this area any researcher can find the different types of smart tools for achieving solutions of almost any prominent problem. Food Quality Prediction isn't quite an old topic in the field of research. But Food Quality Prediction based on Reviews is almost new. In today's world, sharing text reviews of numerous products and services including food reviews via blogs, websites and social media especially Facebook groups are a very common trade. Online reviews reflect consumer's opinion about a food. Nowadays people of almost every age tend to visit restaurants quite often. Before visiting any restaurant, most people are curious to find out the quality of food. Reading food reviews to find out the quality of a food before visiting any restaurant is a great approach. Nowadays most people select what they want to eat by reading reviews before even selecting a restaurant. Most people nowadays select restaurants based on their preferred food's review. But the reviews available in social media are mostly broad. Most of the reviews contain many irrelevant words and sentences. But people just want to know the quality of food. This motivated me to train a model which will be capable of accepting reviews as input and will be able to predict the food quality as output. Based on the reviews, the customers will be able to find out the most suited restaurant for their preferred food. This will also help the restaurant owners to improve their food quality based on their customer's review. The most vital thing that honestly has motivated me is that, almost no research has been accomplished based on food review dataset that are written in Bengali so far. This is the thing that inspired me highly. Hence, I have started this research.

1.3 Rationale of the Study

Analysis of texts is fairly an old area of research. The reason is very natural. It is vital to bring out information from the huge amount of accessible text reviews. Obtaining valuable insights from data in the form of texts is the process of text analysis. Food Quality Prediction isn't quite an old topic in the field of research. But Food Quality Prediction which is based on reviews is almost new. In today's world, sharing text reviews of numerous products and services including food reviews via blogs, websites and social media especially Facebook groups are a very common trade. The reviews available in social media are mostly broad. But people just want to know the quality of food. In this sense, predicting the food quality plays a major role. And to predict accurately the machine needs to understand what has been told precisely. Many researchers in the past have worked on predicting the food quality and proposed many viable solutions for the time being. But the complexity of Food Quality Prediction which is based on Bangla text reviews is yet to be learnt by machines to the fullest extent. Moreover, text reviews are not limited to a certain type of words. This makes the problem more appealing yet hard one to crack. Every work done in the past (probably except a few) have been done against English text reviews only. But the text reviews available in Bangladeshi food review platforms, especially Facebook groups, are mostly written in Bengali. Therefore, the problem still exists as to work from the very fundamentals. The most vital thing that honestly has motivated me is that, almost no research has been accomplished based on food review dataset that are written in Bengali so far. This is the thing that inspired me highly. Hence, I have started this research. I believe that it will be a quite unique experiment from others.

1.5 Expected Outcome

This research includes both a proposal to solve the stated problem and a basic implementation to test the hypothesis. To propose a model that can predict the food quality based on text reviews is the objective of my research. That is to propose a Deep Learning Model using Artificial Neural Network and Long Short-Term Memory algorithms for this problem. The model's performance will be tested by training the model through Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms. It would be tested how good algorithms respond to the data set by calculating and analyzing the review dataset specially categorizing the total number of Bad, Good and Best reviews. The research will deliver an awesome result from the reviews by using the model. This problem includes many sub objectives. Among the sub objectives, it is expected to solve the below stated ones:

• Ability to work on Bangla food review dataset.

• Detecting the subjectivity of the text reviews.

• Analyzing the sentiment of the text reviews.

• Ability to identify how well the model responds to the dataset.

• Ability to detect the review whether it is positively or negatively explained.

• Ability to predict the food quality based on text reviews.

• Ability to deliver an awesome result from the reviews.

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CHAPTER 2
Background

2.1 Introduction

Extraction of data from texts efficiently as well as easily has always been a great priority in the research field. The more accurately people can extract data the more possibilities open up. Features extraction is an essential process in Textual Content Documentation. Evaluating the emotion category like Bad, Good, Best is a way that is categorically based upon the consumer's emotion from those plenty of text documents available on the internet. I have trained the machine using Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms. The model is capable of identifying totally new text documents whether it is Bad, Good or Best. Nowadays, the use of AI to detect emotion in the text documentation is a very good way because it's the combination of several built-in functions and libraries which has been developed by different types of programming languages. To train my model, I have used the Python programming language. The model has been trained using Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms to identify the pattern of information and categorize the data computationally from a piece of text and to determine the data whether it is Bad, Good or Best. We all know that the success of products or services directly depends on the customer's choice. If the customer likes the product or service, then it is considered a success but if not, then the company certainly needs to analyze the situation where data mining comes on. Data mining is very much important to determine the opinion of a customer about a specific business. Like I said earlier, my research goal is to make a system which can detect text emotions and make a comparison of the attributes of information.

2.2 Related Works

Reviews available on social platforms are frequently accessed by the users to purchase products or services, watch movies, go to restaurants and so on. Text reviews available on

social platforms are however quite a beneficial resource for the analysis of human emotion and hence it becomes easy to work with it for classification related problems. The problem can be identified in two different ways. Many works that have been done simply with predicting the positive, negative and neutral or bad, good and best class levels, some other with star or numeric ratings. Some of the related works had gone through both.

Reviews available on social platforms are progressing day by day with the advancement of the internet and technologies. Based on text documents, many works have been already done for sentiment analysis by Ghose, Socher, Zhang et al. [1, 6, 11]. It is vital to find out a user's emotion for the prediction of text reviews that are available on social platforms. Wu, Jean Y et al. Stated that collection of human sentiment is quite difficult and the reason is that it provides insight into how the emotion of the entire excerpt is formed from its constituents [8]. Ganu, Gayatree et al. stated that working with text documents results much better than the star or numeric ratings [4]. Lee, Moontae et al. Stated that, ratings of score from textual analysis has been mentioned for the further improvement of the quality of the classifier [5]. Working with the user's opinion is always worth applauding because the users are the one who actually deals with the reviewing on the internet. Pang, Hu, Zhang stated that, by using the text reviews coming only with the conclusion of either positive or negative is a text mining for properly understanding the user's sentiment [1, 2, 7]. Some also say that, classifying text reviews as positive or negative sentiment using the supervised learning algorithm might have a tendency of negative classification accuracy approximately 10% less than the positive one. In order to solve this problem, Kang, Hanhoon et al. proposed an advanced Naïve Bayes algorithm that can definitely express the average value of the two accuracies [9]. Again, Khairnar, Jayashri et al. came with neutral value that was a good one also because the class levels were three there [10]

Ghose, Anindya et al. proposed two ranking mechanisms for ranking product or service reviews: one is consumer-oriented ranking mechanism that ranks the reviews according to their expected helpfulness and another is manufacturer oriented ranking mechanism which ranks the reviews according to their expected effect on sales [3]. Zhang, Yongfeng et al. stated in a paper that was published in 2014 attempted to bridge the gap between phrase-

level and review/document-level sentiment analysis by leveraging the results given by reviews [11].

All the previous work shows that it is indeed necessary to build such a model and it is actually possible to solve the problem with enough initiatives. The fundamental problem lies in analyzing and predicting the reviews. All the works have shown their unique ways of representing the problem and attempts to solve the problem in their own ways. All the mentioned works have helped me mapping my own way of solving the problem. The most vital thing that honestly has motivated me is that, almost no research has been accomplished based on food reviews that are written in Bengali so far and that is quite a new thinking as well as a new implementation apart from all those that had already been done before. This is the uniqueness of my research.

2.3 Research Summary

I have carefully observed the problem and almost all related works to make a very clear understanding of the problem and what has been done so far. I have also analyzed the text reviews generated by the consumers to make a very clear understanding of the problem. The research included reproducing some of other authors' works partially to get better ideas and mathematical representations of other works. The research shows that the problem still exists specially for the reviews that are written in Bengali and still needs to be accurate to represent better outcomes. My research and proposed work have been tested and proved to be a working solution to the problem for further implementation. My model can generate better accuracy for any given data of food reviews that are written in Bengali. Although my work also has its own limitations, challenges and future scopes of work which is described in detail in the later sections of this report.

2.4 Scope of the Problem

In the present world, the necessity of a model that can predict the quality of a food from text reviews is very appealing. The implementation of a model like this will help many of us. Almost everything around us has become quite review dependent. Reading a full review is very time consuming. For foods, people just want to know the quality from reviews. Therefore, a model that can predict the food quality can be the best solution to this problem. Almost every user will benefit from the model because they will not need to read the full food review to get to know about the food quality. Through this model people can easily find out the food quality. This will both save time for the users and make users more efficient and productive. The working scope of my research will be covering food quality prediction problems. The future of emotion or sentiment analysis is going to go big. Nowadays emotion analysis in social media creates a long effect in terms of determining consumer behavior. As a result of deeper and better understanding of the feelings, emotions and sentiments of a food, consumers will increasingly look for reviews that are personalized and directly related to their wants and needs. In my research I have used the dataset containing consumer reviews. As my dataset is in Bengali and almost no work has been done yet using food reviews that are written in Bengali, so it is a great opportunity to go deeper with the research, and find interesting patterns with the dataset and solve problems. The working scope of my research is absolutely quite broad. I have used Deep Learning, Artificial Neural Network and Long Short-Term Memory algorithms for my model to predict the review or food quality. It can be the future food recommendation system.

2.5 Challenges

As there are many aspects mixed with the problem, it is quite complex in nature. Many subproblems are there that need to be solved first to get a remarkable solution. Natural language is very complex itself because we cannot bind users to follow any set of rules. The complexity of natural language needs to be handled much more delicately. To handle

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this problem there has been much research and many models are being developed day by day. Properly parsing the natural language is more important than anything in this problem because the same motive can be derived in many forms of words. One word can be in many forms in natural language and handling every form is not easy or a feasible solution. I needed reviews along with that I needed to check whether the information is valid or not in the reviews. Feature selection, word tokenization and word selection are the most important tasks for this research. Converting the reviews into the category of Bad, Good and Best was a critical task for me and also to choose the perfect algorithm and software libraries to work with. There were a lot of similar words in my dataset which needed to be identified. Data cleaning also is not easy for a large number of datasets. Another critical task was to show the mathematical representation of the attributes and compare with the attributes. The main challenge of this research was the accuracy percentage. Good accuracy level can represent the actual emotion and so it was a must needed task to calculate an accurate accuracy. To find out the word and model selection was a massive venture. I wanted a good dataset and this was indeed a good one. Feature choice became additionally a lot crucial for this study. Algorithm application was additionally an important challenge of course. Finding which set of rules could be very suitable was also very difficult. As a beginner when we go for research, basically we need to cope up with new things. So, keeping patience for studying or working was definitely a challenge.

CHAPTER 3

Research Methodology

3.1 Introduction

After performing research on almost all current approaches, I have learnt the benefits of the approaches and their limitations and scopes as well. Therefore, my proposed methodology includes an overview of what is done to prevent or extend what capability. This chapter of the report contains every step, data, algorithms and procedures in detail. The entire workflow can be described by figure 1.1
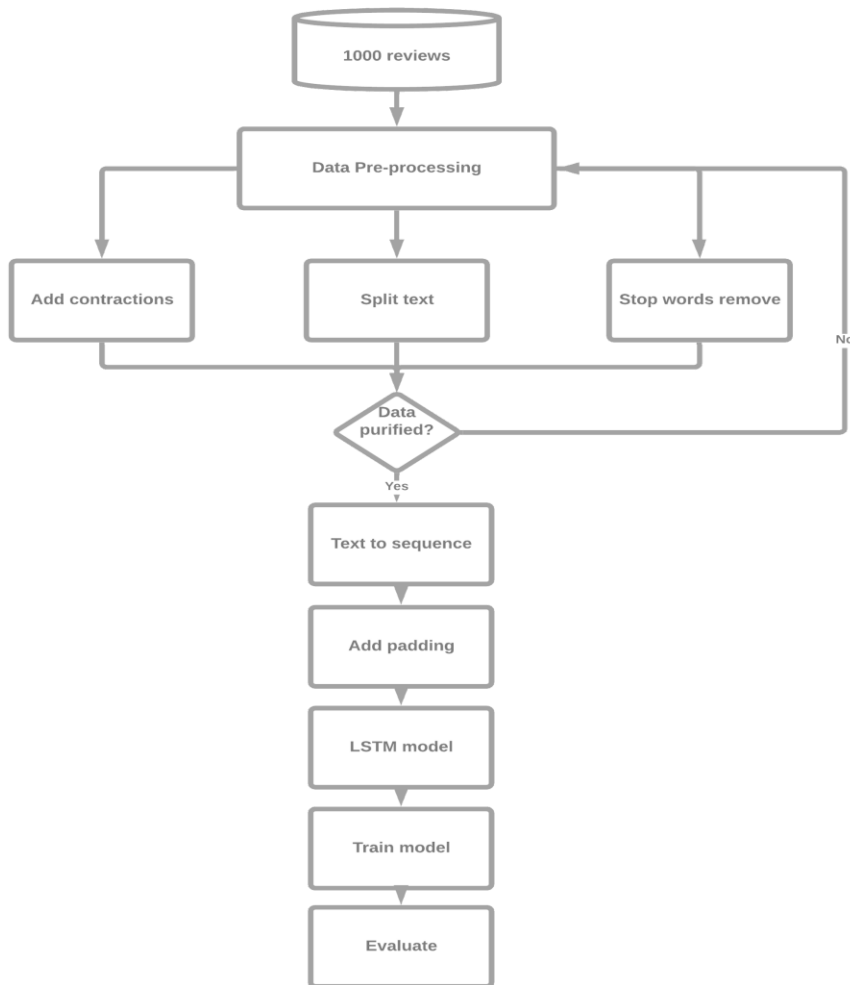

Figure 1.1: Workflow of the Proposed Work

3.2 Implementation Requirements

The detailed system information is given below:

Hardware Requirements (minimum):

Processor:

Over 3.0 Ghz and 3 core CPU and multithreading enabled.

Memory:

At least 4GB of physical RAM.

Storage:

At least 20 GB of HDD space.

Software Requirements:

Operating Systems:

• Linux - Ubuntu 16.04

• Windows - Windows 10 (professional)

Required Environments:

• Python 3.7

• Anaconda

Packages:

• Pandas

• NumPy

• Sklearn

• TensorFlow

• Keras

3.3 Data Collection

For my research I have gathered Bengali food reviews that are in text form. Facebook groups are a source where thousands of food reviews are available. I have basically used the Bangladeshi local Facebook food review groups named "Food Bank" and "Food Bloggers" for collecting data where Bangladeshi people give food reviews both in English and Bengali language. My research work is limited to Bengali language only. Hence, I've

only collected the reviews that are written in Bengali. The features available in the dataset are Review and Quality. My model can predict the food reviews written in Bengali only. I have collected 1000 reviews in total. There are three types of reviews. These are Good, Bad and Best. Food quality prediction is a challenging task due to the high number of reviews that should be considered for the accurate prediction. I am working with Bengali food reviews. There are many food review groups available on Facebook. Hence, I had to select the most trusted ones. There are more than thousands of reviews in those groups. From there I have selected 1000 different Bengali food reviews for my model as a dataset. Collection of different reviews surely provides a better result. Finally, I have a proper dataset. Table 1.1 is the demo of my dataset.

Review	Rating
মিরেরের এরাবিয়ান রাইস (মান্দি)না খেলে জীবন ই বৃথা। কয়লা এর ঘ্রাণ / চারকোল ফ্লেভার এর রাইস অন্য কোনো রেস্টুরেন্টে মনে হয় না আছে। আমি ফার্স্ট টাইম কয়লার স্মেলড রাইস ট্রাই করলাম। ফুড টি খুব টেস্টি ছিল দুই ফ্রেন্ড মিলি হাফ চিকেন উইথ বাসমতি রাইস , এগ আর চাটনি নিমেষেই শেষে করে দিলাম; সফ্ট ড্রিংকস ও ছিল এই কম্বো টি তে।	Best
প্রতিজন ১৫০ টাকা করে ভরপুর কাচ্চি খেয়ে আসলাম #Restora_Bashmoti তে অফিসের ফাকে চরম ক্ষুধা পেটে মনে শুধু কাচ্চি উঁকিঝুঁকি দিচ্ছিলো, তাই দেরি না করে কলিগরা মিলে চলে গেলাম, গিয়েই অর্ডার করলাম ৪ জনের কাচ্চি প্লেটার, যেখানে ছিলোঃ ১) ৪ টি বড় বড় তুলতুলে মাটন পিস ২) ৪ টি জালি কাবাব ৩) সালাদ এবং চাটনি টেস্টঃ কাচ্চির রাইস সুঘ্রান যুক্ত ঝড়ঝড়া ছিলো, অতিরিক্ত তেল বা মশলা যুক্ত ছিলো না, মাটন পিস গুলোতে ভিতর পর্যন্ত মশলা গিয়েছে আর এতো সফট চাপ দিতেই খুলে আসছিলো।জালি কাবাবটা এভারেজ কিন্তু মজা ছিলো খেতে।চাটনী দিয়ে খেতে খুব ভালো লাগবে,পরিমান প্রতি জনের হয়ে যাবে ভালোমতো।আর এক্সট্রা বোরহানী ছিলো। গ্লাস ২৫	Good

টাকা করে, রিফ্রেশিং ছিলো, মিরপুর এর আশেপাশে যারা মাস্ট ট্রাই কিনবা রিকমোন্ডেড, থাকলো,খেয়ে দেখতে পারেন। প্রাইস - ৬১৫ টাকা (ভ্যাট নেই)	
ফতুল্লা, পঞ্চবটি র রেস্টুরেন্ট এটি।নান এবং গ্রিল।টেস্টঃ ১/১০ গ্রীল (. কাচা মাংস) ৫/১০ নান (মোটামুটি টাইপের) সার্ভিসঃ ১/১০ (অর্ডার এর আধাঘন্টা পর খাবার ডেলিভারি)ওদের ডেকে কাচা মাংসের কমপ্লেন করলে বলে গ্রিল এইরকমি হয়।বড় ধরনের গ্রিল খোর যারা আছেন, একবার খেয়ে দেখবেন। জীবনে আর গ্রীল খেতে ইচ্ছা করবে না শিওর।	Bad

Table 1.1: Demo of the Dataset

3.4 Pre-Analysis of the Data

Working with the text data is always a challenging task for large dimensions of the texts. For building a proper and accurate model one needs to analyze the data first. For analyzing the data patterns, I have used Python's matplotlib. After analyzing the data, I have found that the most of the reviews are between 75-125 words. The figure 1.2 represents the data pattern.

Figure 1.2: Patterns of the Data

There are three categories of reviews such as Best, Good and Bad. In numbers there were a total of 327 Best, 333 Good and 330 Bad reviews. The histogram of Figure 1,3 explains in brief.
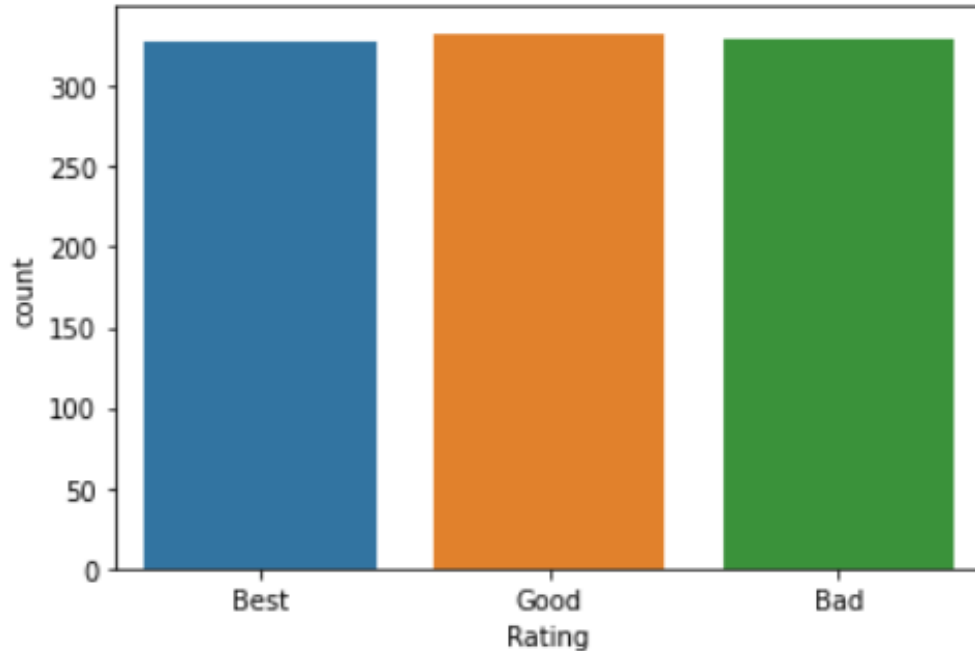

Figure 1.3: Review Categories

3.5 Data Pre-Processing

For building and training the perfect model the dataset needs to be in a perfect, cleaned shape. For cleaning the reviews, I have performed three major steps such as removing stop-words, splitting or tokenizing texts and adding contractions. Stop-words can be ignored without compromising the meaning of the sentence because they do not add much meaning to a sentence. I have removed those words to process my data. For the tasks similar to text classification, where the text document has to be classified into various categories, stop-words simply are taken off in order that much focus can be provided to those words that define the actual meaning of the texts. I added contractions for the words, having similar meaning with different keywords so that the dimension could be reduced a little bit.

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3.6 Text to Sequence

Finally, after cleaning the reviews, I have converted them to sequence and added padding to the last of each review. Now the Ratings should be also converted as they were not in numerical form. For that I have used encoder. The conversion of the labels into numeric machine-readable form is known as Label Encoding. It is an essential preprocessing step for the structured dataset in supervised learning. Sklearn provided efficient tools for my model for encoding the levels of categorical features into numeric values.

3.7 Used Model for the Experiment

To get the accurate model I needed to perform some different experiments with different language models such as Artificial Neural Network followed by Long Short-Term Memory (LSTM).

3.7.1 Artificial Neural Network: Artificial Neural Networks are nothing but computing systems having interconnected nodes that function similar to neurons within the human brains. By using neural networks, a model can identify the patterns that are hidden and the correlations in data. It also can cluster it as well as classify it. Artificial Neural Networks provided my model the ability to process data the same way as the human brains in order that it can make decisions based on the data. In my experiment I have used a simple Neural Network where a single input layer followed by two dropout layers and a final output layer. In the first layer "Relu" and in the output layer "Softmax" activation function was used. Figure 1.4 describes the model.

```
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 16)                80016

dropout (Dropout)            (None, 16)                0

activation (Activation)      (None, 16)                0

dense_1 (Dense)              (None, 3)                 51

dropout_1 (Dropout)          (None, 3)                 0

activation_1 (Activation)    (None, 3)                 0
=================================================================
Total params: 80,067
Trainable params: 80,067
Non-trainable params: 0
```

Figure 1.4: ANN Model

3.7.2 Long Short-Term Memory (LSTM):

LSTM is considered as one of the finest and appropriate language models. In our dataset
the reviews are long and complex so ANN could not solve the complexity of the data. So,
I have used LSTM to solve this issue and it turned out to be a successful one. One input
layer followed by embedding and .3 dropout. I have added a single hidden layer with 128
neurons working on it. "Relu" was applied in this layer. And finally, a dropout layer
followed by the output layer with "Softmax" activation function. The figure 1.5 describes
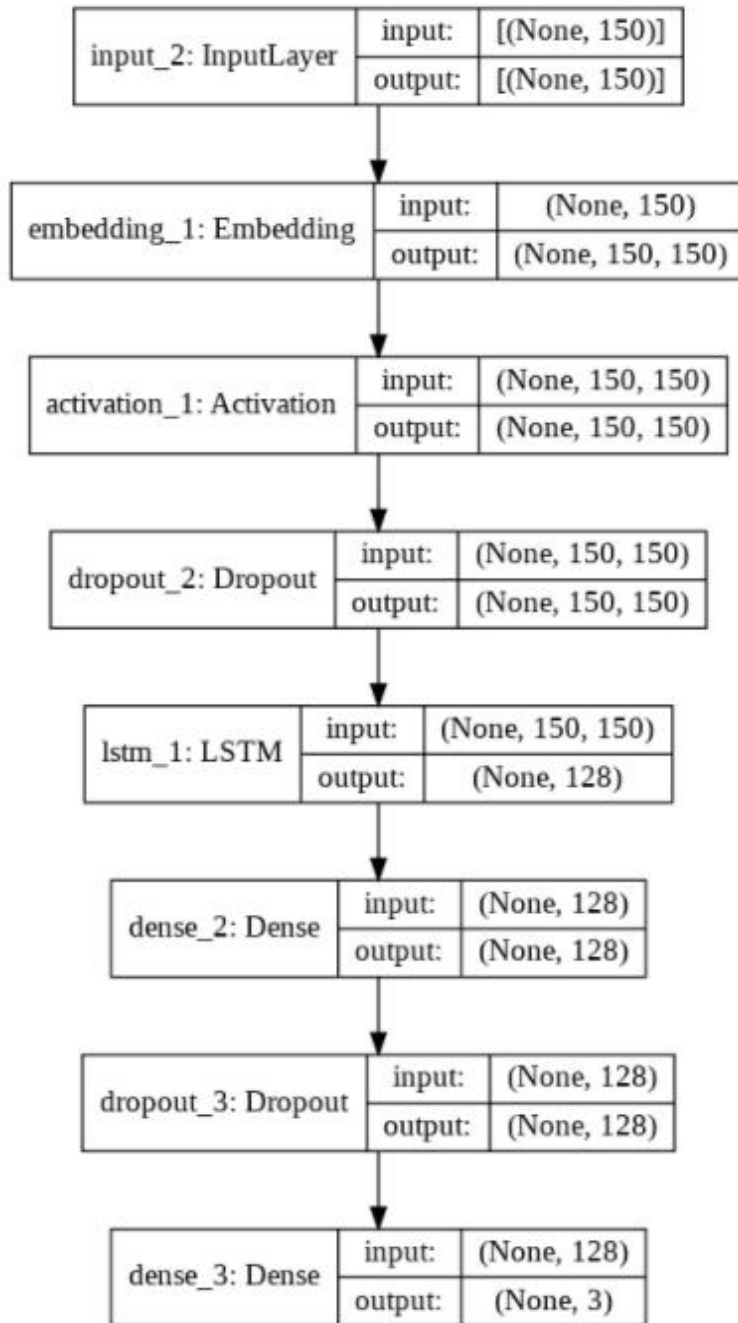this better.

Figure 1.5: LSTM Model

CHAPTER 4

Experiment and Results

The train-test split is simply a technique for evaluating the performance of machine learning or Neural Network approaches. It is used for classification or regression problems and can be used for supervised learning algorithms. Splitting the dataset is important for an unbiased evaluation of prediction performance. The procedure implies taking a dataset and dividing it into two subsets. Therefore, I have trained my model using the training set and then experimented the test set on my model. This is how I have evaluated the performance of my model. To split the data, I have used train_test_split from sklearn. And the ratio for the training and testing was 8:2.

I have trained my models with different parameters several times to achieve better accuracy. Finally, the LSTM model came with a good score with 99% training and 80% validation accuracy. The table 1.2 promises the comparison between two experimental models.

Rank	Approach type	Algorithm	Accuracy	Loss
01	Recurrent neural network	LSTM	80%	0.4121
02	Simple network	ANN	55%	8.1120

Table 1.2: Comparison of Different Models

I have compiled the model with some specific parameters such as loss = Categorical crossentropy , Optimizer = Adam, Learning rate = 0.0001, batch size = 128 and trained it for 1000 epochs. After training the validation loss was reduced to 0.4121. The figure 1.6 denotes the loss.
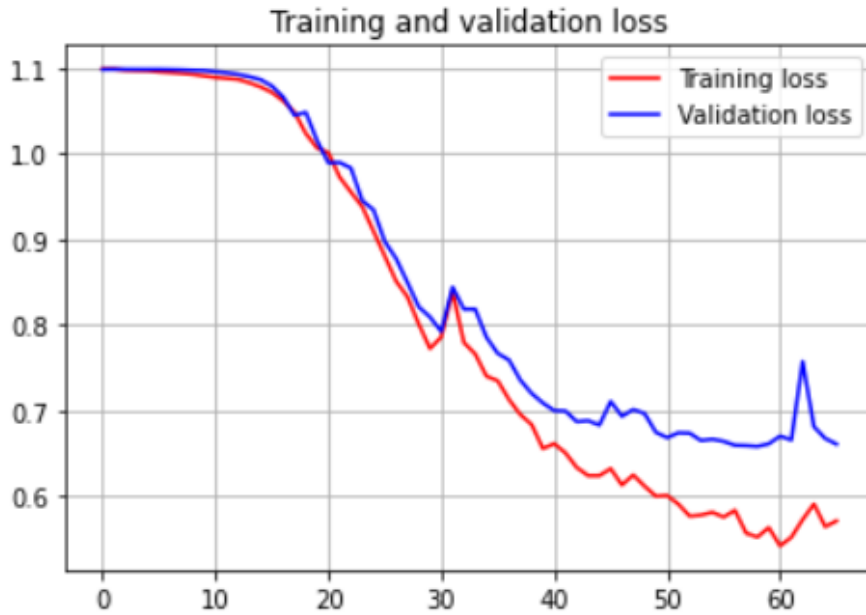
Figure 1.6: Loss during Training

After successful training I have evaluated the models with different matrices such as confusion or contingency matrix. Out of 198 times my model predicted the answer correctly for 159 times and for 39 times it predicted wrong. The figure 1.7 shows the performance of the LSTM model.
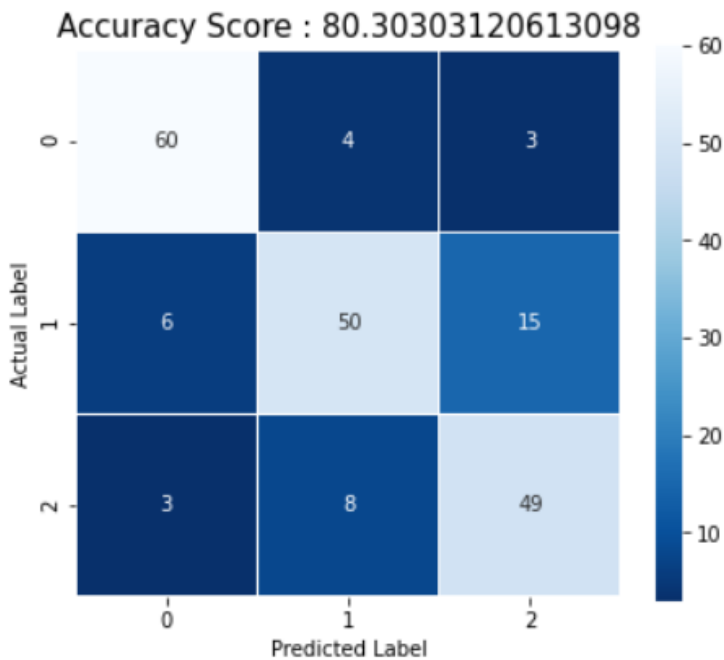

Figure 1.7: Confusion Matrix

The model generated the correct response for most of the times. I have created a pipeline for evaluating the answers and the model was classifying the test data with a good number of accurate answers. The table 1.3 provides a hint of the generated outputs by the model.

Given input	৫০ টাকায় গরুর মাংসের কাচ্চি◉[◌]অনেক রিভিউ দেখার পর আজকে চলে গেলাম বিহারি কেম্পের বোবার বিরিয়ানির টেস্ট করতে☺মোহাম্মদপুরের অন্যতম সেরা কাচ্চি বিরিয়ানি নাকি এইটা।হাফ ৫০ টাকা আমি হাফ নিয়েই ট্রাই করলাম ২ পিস সলিড গরুর মাংস ছিলো মাংস আর রাইস অনেক সফট ছিলো। সব মিলিয়ে ৫০ টাকা হিসাবে আমার কাছে অস্থির লাগছে ৫ খেয়ে ট্রাই করতে পারেন ভালো লাগবে☺
Actual rating	Best
Predicted rating	Best
Given input	আসলাম সুমী আপুর হট কেক খেতে। অনেক দিন পর আসা এখানে। আজ মনে হলো কাপ কেক/ মাফিনগুলো আইটেমওয়াইজ কম ছিলো। আমরা চকলেট মাফিন নিলাম ২ টা আর একটা একলেয়ার। প্লেস: Sumi's Hot cake, Uttara একলেয়ার কেক- জান্নাত বলছে অনেক মজা! :D দামঃ মাফিন- ৪০ টাকা/পিস একলেয়ার- ৫০ টাকা/পিস — at Shumi's Hot Cake,Uttara
Actual rating	Good
Predicted rating	Good

Table 1.3: Input and Output

CHAPTER 5

Summary, Conclusion, Recommendation
and
Implication for Future Research

5.1 Summary of the Study

Getting to know about the food quality from reviews should be easy. Having to read the complete review makes it time consuming. But having a model that can predict the food quality from textual reviews is a solution to this problem. This will enable researchers, consumers and every other person to learn about the food quality from text reviews properly. Although the result of my research within the limited time is extremely limited, the result remains quite promising. There are many tools, packages, libraries, and algorithms for this field. I have studied hard to search out which is better for my research. Artificial Neural Network and Long Short-Term Memory made my research meaningful. People do write a lot of reviews. Most of the words or sentences are meaningful where the rest are meaningless. I have analyzed those meaningless reviews too. I have studied different kinds of machine learning tools to get rid of those reviews and make a valid dataset. Finally, further investigation of supervised and active learning techniques for classification problems may provide a mechanism for reducing the amount of labeled data required to supply highly accurate outcomes. To complete my research work, I have studied how machine learning and deep learning algorithms are used for getting the answer to various problems. My research is about supervised machine learning and it's also a classification model problem. For this, I have learnt machine learning and deep learning very deeply about the classification model and therefore the related algorithms. As my dataset is about textual content documentation, hence I have studied how the Natural Language Processing is used for processing text content documentation. Many tools and techniques are there that are suitable for this area. I have also discovered which technique is best for the completion of my research work. I have learnt different forms of tools to complete my research. I have got several types of tools and therefore the techniques to

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accomplish my research. I have deeply learnt about Artificial Neural Network, Long Short-Term Memory, Sci-kit learning library and popular Python programming language.

5.2 Conclusion

This undergrad research, although in a very short time, has made the problem and what has been done perfectly clear. I've got focused on making the matter scope clear so it is a platform for an extension model to the current system. This report can be identified as the state-of-the-art literature review as well. The work that has been proposed and done so far shreds a new angle of light with which the problem can be solved more efficiently. The outcome so far is very convincing and can be developed more into a better outcome producing model. The main objective that has been mentioned for the research is achieved and thus that completes the purpose of the research. A true dynamically adaptive model is what the final outcome of this research is. My model being capable of working given any Bengali text review can produce output. Data mining plays an important role here. It helps to understand the public opinion to improve the service. In the same way, the consumer also has to depend on the opinion of others to get a better knowledge about the food quality. Text reviews are the deciding factor here. The review of a food also gives a speedy classification. Through my model a consumer can understand the quality of a food from the text reviews. People are willing to give reviews constantly nowadays, so it is easy to use this enormous data from online. I have tried to describe my working method and how I went through from the very beginning to the end. I had my own way to complete the research. I have experienced a lot of problems as well and some of them were quite hard to understand. For the beginners, machine learning is a very good research area. In the basis of our country, related works like consumer opinion classification from the Bengali food review dataset has not yet been done. I have tried to establish a model which is capable of predicting the textual content data that is given by a consumer. By this, the consumers can decide whether to have the food or not. Basically, I have used all the reviews for Bangladeshi local Facebook food review groups. These reviews are the expressions of what they feel about the foods. I have tried to describe all the operating techniques, working procedure, methods with tables and figures. I have a plan to make this research finished in

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extra requirements additionally. I have additionally confronted loads of hassle to complete this research. All the Procedures have been tremendous so it took a lot of time to understand. I have experienced a lot of problems from the beginning to the end of my research.

5.3 Recommendations

Perfection is nothing but a work in progress. In comparison to that, my proposed model is only at its early stages. Therefore, a lot of work can be done to it. This section of the report contains the limitations of the current model and few possible future works. Current model can serve as the base model that can be extended with more features to solve various other related problems. Though I have mentioned some related works but the amount is very few and directly there is almost no work like this based on Bengali data. I have understood all other research processes and after that I started to fix my research goal. After doing the work step by step finally I am at a stage where it can be said that this is my expected research goal. Working on this research required tremendous hard work and continuous patience which helped me make this research successful.

5.4 Limitations

• I have worked with limited data and that's 1000 to be exact. This is the major limitation my model has. If I could work with more data, the performance of my model would have been far better.
• My research work is limited to Bengali language only. That means my model can only predict the food reviews that are written in Bengali. The model could be extended to predict food reviews in almost every language available.
• Accuracy limited to 80% which could be better.

5.5 Future Works

This research can be considered as the opening of many platforms for emotion or sentiment analysis from food reviews. Although it has some limitations, some future work can be done further in this research. I will train the model in such a way that the consumers will

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be able to relate the actual opinions. I will work with a lot more data to improve the performance of my model. I will extend my model to the extent that it will be able to predict food reviews in almost every language available. The mentioned are the next steps of improving the performance of the model. After implementation of these the model can become a suitable mobile and web application. Optimization of the system is the challenge that comes after the system is capable of solving problems at hand. When it is capable of solving problems then I can think of making it fast and more reliable.

5.6 Implication for Further Study

My research can be expanded to a complete model that can understand any Bengali food review given to it and predict the food quality. The limitations and possible future works mentioned in the report can be a very good starting point. I am still working on the model and will continue to work on the model furthermore for a better and more accurate result. For any researchers that want to follow up the methodology I have proposed can start from where the model currently is. This report is the first step of reproducing the current state of the model.

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