

**AN ATTENTION BASED BiLSTM APPROACH FOR DETECTING ABUSIVE  
COMMENTS IN BANGLA DISCUSSION THREADS**

**BY**

**TANVIRUL ISLAM  
ID: 213-25-071**

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

Supervised By

**Dr. Sheak Rashed Haider Noori**  
Professor & Associate Head  
Department of CSE  
Daffodil International University



**DAFFODIL INTERNATIONAL UNIVERSITY**  
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## APPROVAL

This Project/Thesis titled "An Attention based BiLSTM Approach for Detecting Abusive Comments in Bangla Discussion Threads", submitted by Tanvirul Islam, ID No: 213-25-071 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 M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 28/09/22.

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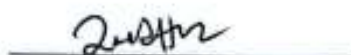
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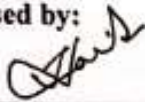
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## DECLARATION

I hereby declare that, this work has been done by me under the supervision of **Dr. Sheak Rashed Haider Noori, Professor and Associate Head, Department of CSE** Daffodil International University. Except as acknowledged in the text and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

Supervised by:



---

**Dr. Sheak Rashed Haider Noori**  
Professor and Associate Head  
Department of Computer Science and Engineering,  
Faculty of Science and Information Technology,  
Daffodil International University

Submitted by:



---

**Tanvirul Islam**  
ID: 213-25-071  
Department of CSE  
Daffodil International University

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## **ABSTRACT**

The usage of social networking platforms has accelerated rapidly with technological advancement in the last few decades. Facebook, Twitter, and YouTube are extensively utilized platforms for social communication, interaction, marketing, and information sharing. So abusive text and comments are widespread on those platforms, negatively impacting the expected user experience. Besides, Bangla is the seventh most widely spoken language worldwide, and a significant number of users use Bangla on those platforms. In this study, I have concentrated on detecting abusive Bangla comments in discussion threads from social platforms, i.e., Facebook and YouTube. After extensive pre-processing, tokenization, sequencing and padding Bidirectional Long Short-Term Memory (BiLSTM) with attention layer is trained utilizing the dataset consisting of a total of 12,022 comments which are labeled into two categories, abusive and non-abusive. In this study, I have estimated the accuracy, precision, recall, and f1-score to assess our models. Our proposed model performed notably with an accuracy of 94%.

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# CHAPTER 1

## INTRODUCTION

### 1.1. Introduction

Nowadays People spend the majority of their time on social media rather than on search engines or playing outside the field. Facebook, Twitter, YouTube, and many other social networking sites serve as simple examples. The purpose of social media pages is for users and admirers to interact with celebrities, public figures, and business icons. Each year, the percentage of Facebook users rises by 6.9% and 1.9 billion access daily[1]. The most widely used social network is Facebook, which has 2.9 billion monthly active users[1]. The most well-known video-sharing website is YouTube, which has 122 million daily active user[2].

Unfortunately, people experience problems as a result of abusive activities on social media. Social networking websites were created to make connections and message sharing easier. Consequently, people rely heavily on internet communication for communication. According to a recent study of UNICEF entitled “Online Safety of Children in Bangladesh” shows that children are more exposed to cyberbullying than younger ones, children are not immune from harmful content, sexual exploitation and abuse, and cyberbullying[3]. The situation worsens after numerous people commit suicide as a result of online harassment and abusive speech[4].

According to statistics, 3.3% of Facebook users, or 71 million people, utilize the Bangla language[5]. As UNESCO declared Bangla as an international mother language Bangla becomes the 7th largest language approximately 265 million users speaking or using Bangla to communicate[5]. In this circumstances, the abusive content, online harassment, oppression and blackmailing in social networking services are growing rapidly. Therefore, detecting abusive Bangla texts from social media needs a lot of attention. In this paper, I have introduced a bidirectional LSTM with an attention mechanism based on (RNN) Recurrent Neural Network to detect abusive Bangla texts or comments.

## **1.2. Motivation**

Users are now more frequently using Facebook and YouTube to share their views and opinions about what is going on in their immediate environment. This develops into a medium for information exchange that provides everyone on the platform the right to speak freely. Along with its favorable effects, that also has certain drawbacks. People have issues as a result of abusive social media behavior.

Due to the increasingly hostile climate on social media, there is a significant desire on these platforms to identify problematic content and take the necessary steps to stop the issue from getting worse. The process of identifying inappropriate information can be done manually by human moderators, but due to the volume of data produced on these social media sites, it is both practically impractical and time-consuming. Therefore, this gap needs to be closed. I, therefore, hope to make a difference in this particular area.

## **1.3. Expected Outcome**

This study used a dataset that contained 12,022 comments from various social media postings. The following datasets are labeled 0 and 1: 0 for non-abusive text or comments and 1 for abusive text or comments. It is advisable to use clean corpora when applying a classification algorithm. Our dataset is divided into two halves, abusive and non-abusive, following preprocessing, sequencing, and padding. 80% of the data for testing were collected on the train set, whereas only 20% was collected on the test set will use a class of neural networks called recurrent neural networks (RNN) algorithm to train the data set to determine whether a sentence, comment, or piece of text is abusive or not, and then determine whether it is through analysis.

## **1.4. Report layout**

There are five sections in the paper. After this introduction, Chapter 2 gives a background of the abusive text detection field from the perspective of information systems, a survey of text analysis articles that have been published in various information system journals and discussed or posted on various social media, as well as the problem's scope and its difficulties. Chapter 3 provides a thorough explanation of the research technique, including the steps involved in data collecting, pre-processing, and feature extraction.

The experimental results of the employed methodology are presented in Chapter 4. The summary of the empirical research, conclusion, recommendation, and implications for further study are all covered in Chapter 5.

## CHAPTER 2

### BACKGROUND

#### 2.1. Related Works

The interest of researchers in abusive text detection increased in the past few years with the increase in abusive text, cyberbullying and cybercrime. People are becoming more and more reliant on social media sites like Facebook, Twitter, YouTube, and Instagram as online technology advances. The rapid expansion of social networking sites has also increased cyberbullying such as online harassment, hate speech, oppression online, a nuisance online, and blackmail. Multinomial Nave Bayes classifiers are used[6] to detect malicious text after considerable pre-processing with an accuracy of 82.44%, where the dataset is imbalanced and around 70% of data are from “ham” class which lead to a bias toward ham class. The effectiveness for classification of abusive text using 8 traditional machine learning algorithms are compared in[7], where svm achieves the highest accuracy 0.88. The authors find that, stemming the dataset negatively impact accuracy, because rule based stemmer has an accuracy of around 83%. In the rest of the 17% case, stemmer is producing many meaningless, invalid word as like, তার (his/her) →ত, মেয়ে (daughter) →মা, ভাই (Brother) →ভা, আছে(have) →আ, তেরা(you) →তো. Multinomial Naïve Bayes(MNB) for classification, Random Forest(RF) for creating decision trees during training time, Support vector Machine(SVM) for using different kernels to build optimal hyper plane and some types of string features Unigram, Bigram, Trigram use for extracting features[8]. For detecting abusive speech one of the methods is Bidirectional Recurrent Neural Network (BiRNN) which focuses to detect is the speech abusive or not and the results come out compared with Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN) methods[9].

Paper [5] utilized two transformer based learning model BERT and ELECTRA on a dataset of size 44,001 to detect abusive bangla comments from facebook. Using an ensemble technique after a neural network for multi-class classification, they are able to achieve an accuracy of 0.85 which couldn't outperform the traditional machine learning

model of papers [7] discussed previously. Emonet. *al.*[10] compared the performance of several machine learning and deep learning based algorithms for classification of bangla abusive text which are Linear Support Vector Classifier (LinearSVC), Logistic Regression (Logit), Multinomial Naïve Bayes (MNB), Random Forest (RF), Artificial Neural Network (ANN), Recurrent Neural Network(RNN) where RNN outperforms other achieving an accuracy 0.82.

BiLSTM are employed to classify bangla news article of 13 category in papers[11], where authors utilized a dataset of size 40,000. In this papers authors achieved an accuracy and f1-score of 98.33% and 98% respectively which indicate that BiLSTM can be utilized in Bangla text classification with an impressive performance. Another paper [12]utilizes BiLSTM model for sentiment analysis from Bangla text using a dataset of 10,000 where they achieved better performance compared to existing model. Author of [13], proposed a Bangla news article categorization system using BiLSTM, where he added an attention mechanism with standard BiLSTM. The standard BiLSTM cannot identify which word is more influential for text analysis. To address this issue, an effective attention mechanism is introduced that can concentrate the important part of a sentence by giving higher weight to more important words and lower weight to less important words. Evaluation shows that this approach can achieve better accuracy compared to standard BiLSTM.

## **2.2. Scope of the Problem**

Detecting abusive text is a new content-based categorization that expands ideas from natural language processing (NLP) and machine learning. The study of abusive text detection is important because social networks' growing user bases and users' innate faith in their online personas create an atmosphere that is favourable to cyber abusers. In fact, data show that the amount of offensive language on social networks is rising every year. These messages or links pose a significant problem for traditional filtering techniques today since they are typically brief and replete with slang, idioms, symbols, and acronyms that make tokenization challenging. Text mining algorithms that are more accurate and reliable could help solve the current issues. As the upcoming phase of

knowledge discovery, text analysis is currently experiencing significant commercial success. In this study, I'll examine the Bengali language from Facebook statuses, YouTube comments, and other sources to identify any harmful polarities attached to each line, such as positive or negative. After determining the polarity of each statement, I'll try to categorize whether or not the text is abusive.

### **2.3. Challenges**

Bengali is a highly inflectional language with over 160 different inflected forms for verbs, 36 different forms for nouns, and 24 different forms for pronouns[14]. As a result, it has a large number of features that make it difficult to categorize. In addition, a lot of individuals speak informally and locally, which adds to the variety of features. Additionally, there are no standard spelling used during abusive remarks, so numerous spelling variations for the same word increase lexical diversity and complicate classification.

## CHAPTER 3

### RESEARCH METHODOLOGY

#### 3.1. Data Collection Procedure

As Facebook and YouTube are the most used social media platforms, controversial YouTube channels and Facebook pages including comments from the comment thread of posts by actors, social media influencers, singers, politicians, and athletes publicly available are considered the sources of potential abusive text data. Public comments are scrapped by using facebook-scraper(Python Library) and “youtube comments downloader” for Facebook and YouTube, respectively. The dataset contains a total of 12022 comments which are labeled manually into two classes, “abusive” and “non-abusive”. The proportion of abusive and non-abusive data are 40.6% and 59.4% respectively. The dataset contains 12,000 unique vocabulary and the average number of the words in the comment are 10.49. The distribution of the dataset is given below.

TABLE 1: DISTRIBUTION OF DATA

<b>Abusive</b>	<b>4875</b>
<b>Non Abusive</b>	<b>7147</b>
<b>Total</b>	<b>12022</b>

#### 3.2. Data Preprocessing

A proper preprocessing and representation of text corpus are prerequisite for any classification task. I have labeled the collected raw data as abusive and non-abusive manually to feed it to our model. The corpus contains noise like emoji, special character, numeric value and multilingual text that impact negatively on classification tasks, which are removed programmatically. Besides, punctuation, extra whitespace are also removed from the dataset. After preprocessing the dataset, it look like following:

	A		B
1	Status	Comment	
5628	0	সেখানে নটরডেম কলেজের এই অসাধারণ উদ্যোগটা নিঃসন্দেহে প্রশংসার দাবী রাখে	
5629	0	নেট বন্ধ করে প্রম্পত্র ফাঁস ঠেকানো আর ব্যাংকে ক্যাশ নেয়া বন্ধ করে দিয়ে ঘুষ ঠেকানো একই কথা	
5630	0	একজন মানুষের জন্য পুরো দেশকে কষ্ট দিয়ে লাভ নেই	
5631	0	উনাকে সরান সব ঠিক হয়ে যাবে	
5632	0	উনি চশমা পরেও গ্যাপ খুঁজে পাচ্ছেন না কিন্তু উনার অগোচরে ঘটে যাওয়া গ্যাপটা যেন স্প্রেড না করে	

Figure 1: Representation of raw data



'Tokenizer', a properties of tensorflow are employed for tokenizing the corpus which split the sentence into a series of tokens and each word gets an unique value of integer. Sequencing is representing the text comment into a sequence of number, an unique integer for each word utilizing *texts\_to\_sequences* properties from tokenizer object. As comments are different in length, it is required to make them uniform in size before utilizing the corpus for training. Padding is a strategy for dealing with this. The list of comments is padded into a matrix each row having a max length of 15. Following figure illustrate the process of tokenization, sequencing and padding using two example sentence "Hello World!" and "I am here".

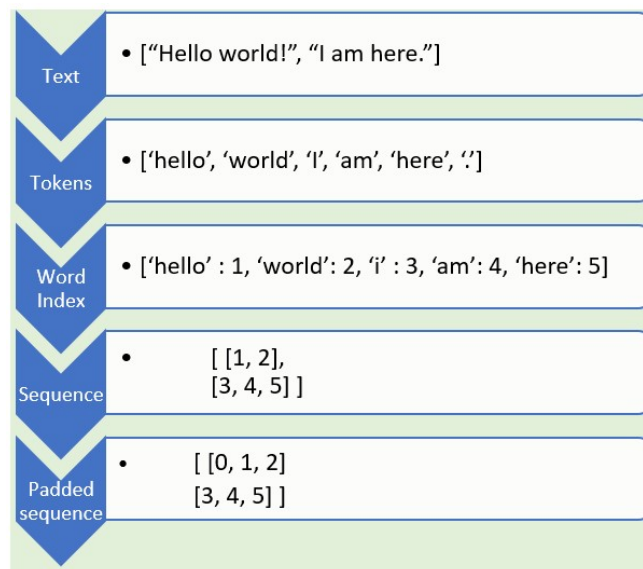


Figure 2: Example of tokenization, sequencing and padding

Now our corpus are ready to feed into our model. The description of my corpus are following:

TABLE 2: PROPERTIES OF DATASET

<b>Total Number of Word</b>	<b>126123</b>
<b>Total Unique Vocabulary</b>	<b>21382</b>
<b>Average Number of word in comment</b>	<b>10.49</b>

### 3.3. Proposed Methodology

Following section describes the architecture of models that are proposed in this study for the classification of abusive Bangla text.

### 3.3.1 Recurrent Neural Networks (RNN)

RNN are the state of the art artificial neural network model for sequential data. Unlike traditional neural networks which assume all input and output are independent, RNN uses feedback loops that can model sequence input by iterating through the features. RNNs pass the outputs from one timestep to their input on the next timestep. So, RNN performs better where the sequence of input features is important like abusive text detection, sentiment analysis, and next word prediction. The block diagram of RNN in following, the output of one timestep is the input for the next timestep.

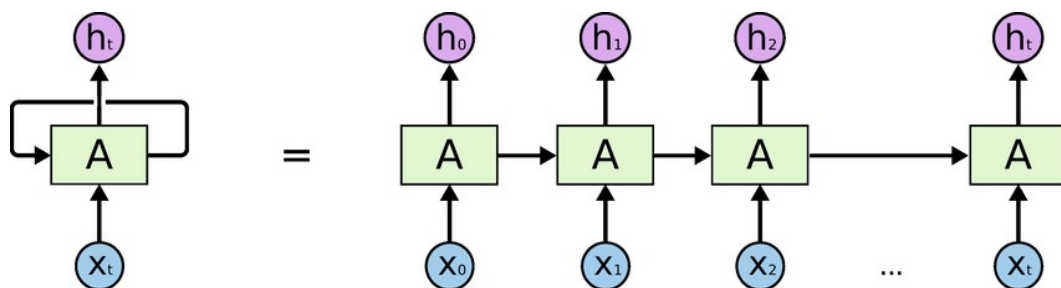


Figure 3: RNN loop

### 3.3.2 Bidirectional long-short term memory (BiLSTM)

Bidirectional long-short term memory (BiLSTM) is a type of RNN that uses special units in addition to standard units. It considers the sequence of features in both directions backward and forward. As a consequence of considering features in both directions, BiLSTM-based classification shows better predictions compared to standard RNN.

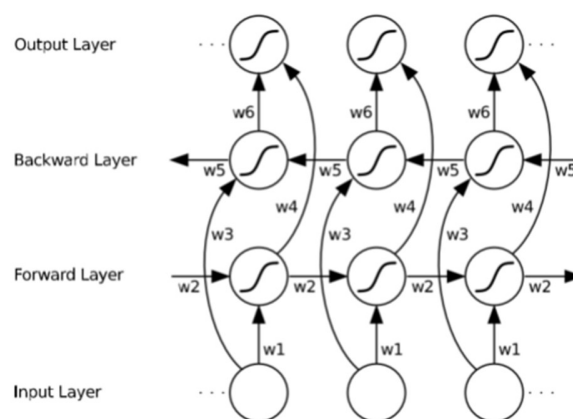


Figure 4: Architecture of Bidirectional LSTM

### 3.3.3 BiLSTM with Attention Mechanism

Besides contextual information, The abusive polarity of a sentence is also highly correlated with the opinion term and the aspect term. All context terms in a given sentence do not have a similar impact to the abusive nature of a sentence. Therefore, concentrating on these aspect-terms is significantly important in the abusive text classification task. The standard BiLSTM cannot identify which word is more influential for abusive text analysis. To address this issue, an effective attention mechanism is introduced that can concentrate the important part of a sentence by giving higher weight to more important words and lower weight to less important words. The architecture of the Attention Based BiLSTM is illustrated in the following figure where the  $\{w_1, w_2, \dots, w_n\}$  denotes the word embedding of a sentence, and the length is  $n$ .  $\{h_1, h_2, \dots, h_n\}$  is a hidden vector.  $\partial$  is an attention weight.  $s$  denotes a sentence vector.

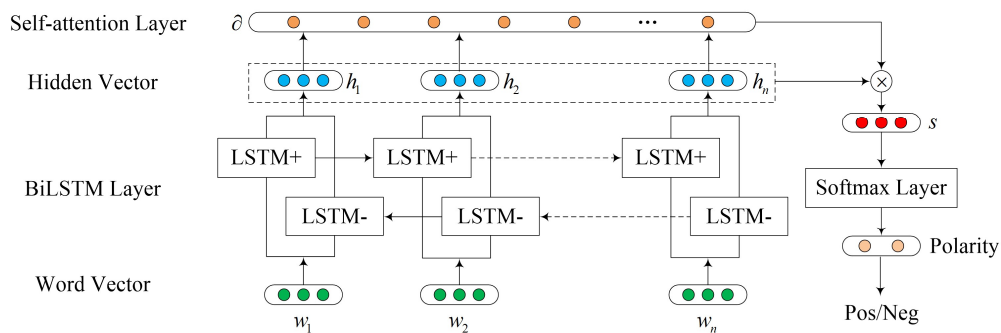


Figure 5: Bidirectional LSTM with Attention Mechanism

### 3.3.5 Model Training

After extensive preprocessing, the corpus is ready to feed into the model. The dataset is split into test and train sets where 20% of data are considered in the test set and 80% in the train set. Bidirectional LSTM with attention layer is considered among the available learning models. Finally performance is evaluated using performance measure like precision, recall, f1-score, and accuracy and confusion matrix. The block diagram of our proposed approach are illustrate bellow.

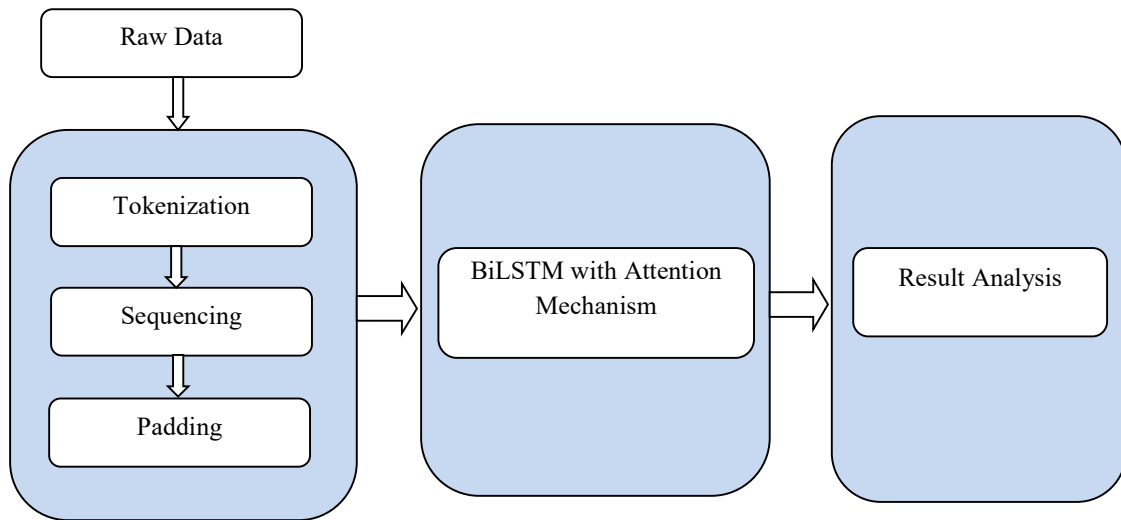


Figure 6: Infrastructure of our proposed model.

### 3.4. Implementation Requirements

Python are used as programming language in this study. The implementation requirements are following:

- Google colaboratory
- Python 3
- facebook-scraper (Python Library for scrapping facebook comment)
- YoutubeCommentsDownloader (Web application for scrapping youtube comment)
- Microsoft Office Excel

## CHAPTER 4

### EXPERIMENTAL RESULTS AND DISCUSSION

#### 4.1. Introduction

In this chapter, the results of abusive text classification are presented. In total, I have collected 12,022 comments from Facebook statuses and YouTube comments. After Pre-processing, sequencing and padding, the experiment has been conducted employing attention based BiLSTM approach. Accuracy, precision, recall, f1-score and confusion matrix are considered as performance evaluation matrix.

#### 4.2. Experimental Result

After training our model with Attention-based BiLSTM, different matrices are employed to evaluate the performance of the proposed model. Confusion metrics summarized the count of valid and invalid predictions with the count broken down by each class and evolution metrics confirm the model's performance. True Positive (TP) and True Negative (TN) show the correct prediction of a model. Besides, False Positive (FP) and False Negative (FN) represents wrong predictions. Using these confusion metrics, we can generate numerous evolution metrics. To demonstrate the performance of our model, I have determined the Accuracy, Recall, Precision, and F1 score of the model. The formula of these evolution metrics is given bellow:

$$Accuracy = \frac{TP + TN}{TP + FP + TN + FN} \quad (1)$$

$$Precision = \frac{TP}{TP + FP} \quad (2)$$

$$Recall = \frac{TP}{TP + FN} \quad (3)$$

$$F1\ Score = \frac{2 * Precision * Recall}{Precision + Recall} \quad (4)$$

The accuracy, precision, recall and F1 score are given in the following table.

TABLE 3: PERFORMANCE OF PROPOSED MODEL

	<b>Percentages (%)</b>	<b>Support</b>
Accuracy	94.0	2405
Precision	91.0	2405
Recall	96.0	2405
F1 Score	94.0	2405

The final outcome is an accuracy of 94% which indicate that the model can detect abusive comment in 94 times out of 100 times. Besides it can perform with higher precision, recall and F1 score. Precision indicate that 94% of total positive identification was correct. On the other hand recall indicate that 94% are identified as positive among total positive instance. Confusion matrix are given bellow, which can give a detailed picture of performance.

TABLE 4: CONFUSION MATRIX

		<i>Predicted</i>	
		<b>Positive</b>	<b>Negative</b>
<i>Actual</i>	<b>Positive</b>	929	71
	<b>Negative</b>	77	1328

### 4.3. Discussion

Considerable study has been done for detecting abusive text in a language like English, but insufficient work has been done on Bangla which required more attention. In this study, a dataset of 12,022 samples has been considered from social media discussion threads. After pre-processing, sequencing, and padding, BiLSTM with an attention layer is employed to detect abusive text. Evaluation indicates that Recurrent Neural Networks, especially BiLSTM can achieve state art performance in the classification of Bangla text.

## **CHAPTER 5**

### **SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH**

#### **5.1. Summary of the Study**

In recent times, People pay a lot of attention to text classification since it might help to categorize abusive texts and remarks. To discover the best sequence classifier for text classification, a lot of research is being done in this area. The framework with the Recurrent Neural Networks (RNN) algorithm outperforms other Natural language processing algorithms based on the gathered findings in comparison to the pre-processing technique. RNN was used after considerable pre-processing, and it proved to be 95.00% successful in identifying abusive Bangla Text contents and comments.

#### **5.2. Conclusion**

It was difficult to recognize abusive text in a Bengali sentence since different persons have different interpretations of the same sentence. This text categorization technique enables us to identify the precise expression that the vast majority of people consider. Some study has been conducted in Bangla to detect abusive text detection each having some shortcomings discussed in the literature review, this required more attention. This study is a small step to fill the gap. To extract semantic information from a sentence to identify abuse in Bangla's abusive text content, I have applied the BiLSTM with attention mechanism, the result indicate that it can achieve state of art performance in Bangla abusive text detection.

#### **5.3. Limitations and Suggestions for Future**

Despite being one of the most used languages in the world, Bengali lacks benchmark datasets for the study of abusive text detection. Besides, researchers usually do not publish their datasets. The dataset that was made for this research can be enriched and published for research purposes. Moreover, the dataset was not stemmed in this study. Moreover, the performance of existing rule-based stemmer is not satisfactory which is discussed in the literature review. A sophisticated rule-based stemmer can be developed and utilized in the dataset.

## References

- [1] Brian Dean, “Facebook Demographic Statistics: How Many People Use Facebook in 2022?,” 2022. <https://backlinko.com/facebook-users>
- [2] “YOUTUBE USER STATISTICS 2022.” <https://www.globalmediainsight.com/blog/youtube-users-statistics/>
- [3] “UNICEF calls for concerted action to prevent bullying and harassment for the 32 per cent of children online in Bangladesh.” <https://www.unicef.org/bangladesh/en/press-releases/unicef-calls-concerted-action-prevent-bullying-and-harassment-32-cent-children>
- [4] I. Vojinovic, “Heart-Breaking Cyberbullying Statistics for 2022,” 2022. <https://dataprot.net/statistics/cyberbullying-statistics/>
- [5] A. Tanjim Taharat, S. Rifat, and A. Md Shoaib, “Abusive Bangla Comments Detection on Facebook using Transformer Based Deep Learning Models,” *Soc. Netw. Anal. Min.*, vol. 12, no. 1, p. 24, 2022.
- [6] T. Islam, S. Latif, and N. Ahmed, “Using Social Networks to Detect Malicious Bangla Text Content,” *1st Int. Conf. Adv. Sci. Eng. Robot. Technol. 2019, ICASERT 2019*, 2019, doi: 10.1109/ICASERT.2019.8934841.
- [7] T. Islam, N. Ahmed, and S. Latif, “An evolutionary approach to comparative analysis of detecting bangla abusive text,” *Bull. Electr. Eng. Informatics*, vol. 10, no. 4, pp. 2163–2169, 2021, doi: 10.11591/EEI.V10I4.3107.
- [8] S. C. Eshan and M. S. Hasan, “An application of machine learning to detect abusive Bengali text,” *20th Int. Conf. Comput. Inf. Technol. ICCIT 2017*, vol. 2018-Janua, pp. 1–6, 2018, doi: 10.1109/ICCITECHN.2017.8281787.
- [9] D. Davis, R. Murali, and K. R. Remesh Babu, “Abusive language detection and characterization of twitter behavior,” *arXiv*, vol. 8, no. 7, 2020.
- [10] E. A. Emon, S. Rahman, J. Banarjee, A. K. Das, and T. Mitra, “A Deep Learning Approach to Detect Abusive Bengali Text,” *2019 7th Int. Conf. Smart Comput. Commun. ICSCC 2019*, pp. 1–5, 2019, doi: 10.1109/ICSCC.2019.8843606.
- [11] S. Rahman and P. Chakraborty, “Bangla Document Classification Using Deep Recurrent Neural Network with BiLSTM,” *Proc. Int. Conf. Mach. Intell. Data Sci. Appl.*, pp. 507–519, 2021, doi: 10.1007/978-981-33-4087-9\_43.
- [12] A. Aziz Sharfuddin, M. Nafis Tihami, and M. Saiful Islam, “A Deep Recurrent Neural Network with BiLSTM model for Sentiment Classification,” *2018 Int. Conf. Bangla Speech Lang. Process. ICBSLP 2018*, no. September, 2018, doi: 10.1109/ICBSLP.2018.8554396.
- [13] M. Shopon, “Bidirectional LSTM with Attention Mechanism for Automatic Bangla News Categorization in Terms of News Captions,” *Lect. Notes Electr. Eng.*, vol. 686, pp. 763–773, 2020, doi: 10.1007/978-981-15-7031-5\_72.
- [14] S. Bhattacharya, M. Chhouthury, S. Sarkar, and A. Basu, “Inflectional morphology synthesis for Bengali noun, pronoun and verb systems,” *Proc. Natl. Conf. Comput. Process. Bangla*, no. March, pp. 34–43, 2005.



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