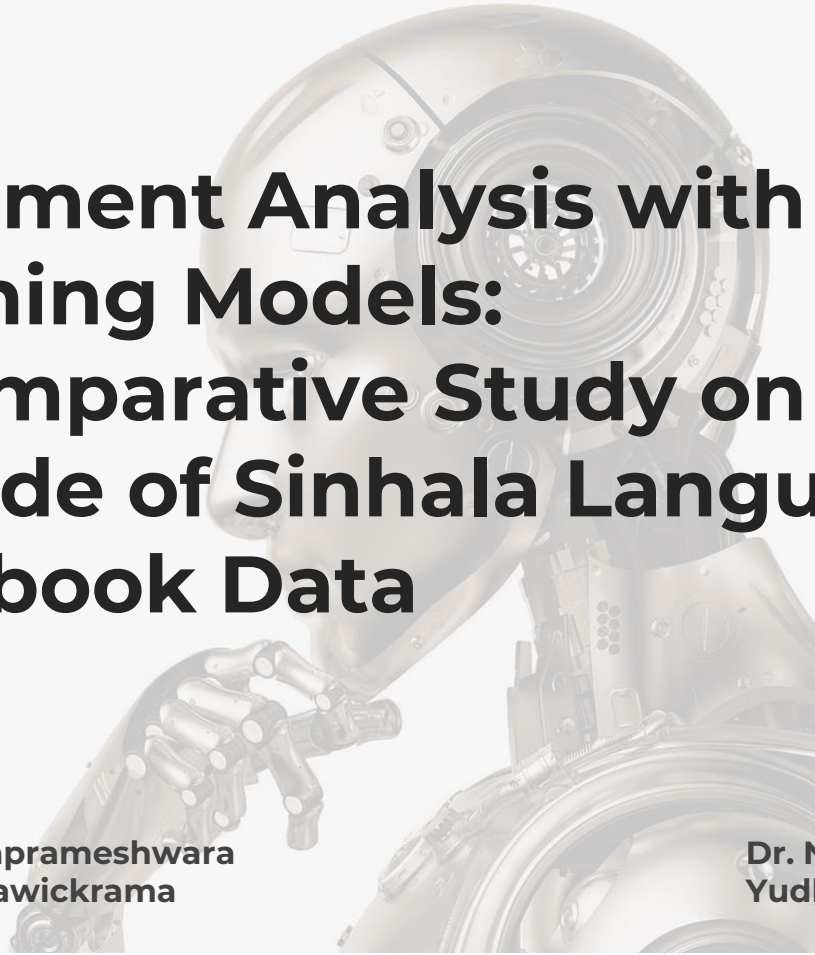
Sentiment Analysis with Deep Learning Models: A Comparative Study on a Decade of Sinhala Language Facebook Data



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Outline

1. Introduction
2. Methodology
3. Results
4. Conclusion

1. Introduction

Sentiment Analysis for Sinhala Colloquial Text

Capability of Facebook data for sentiment analysis

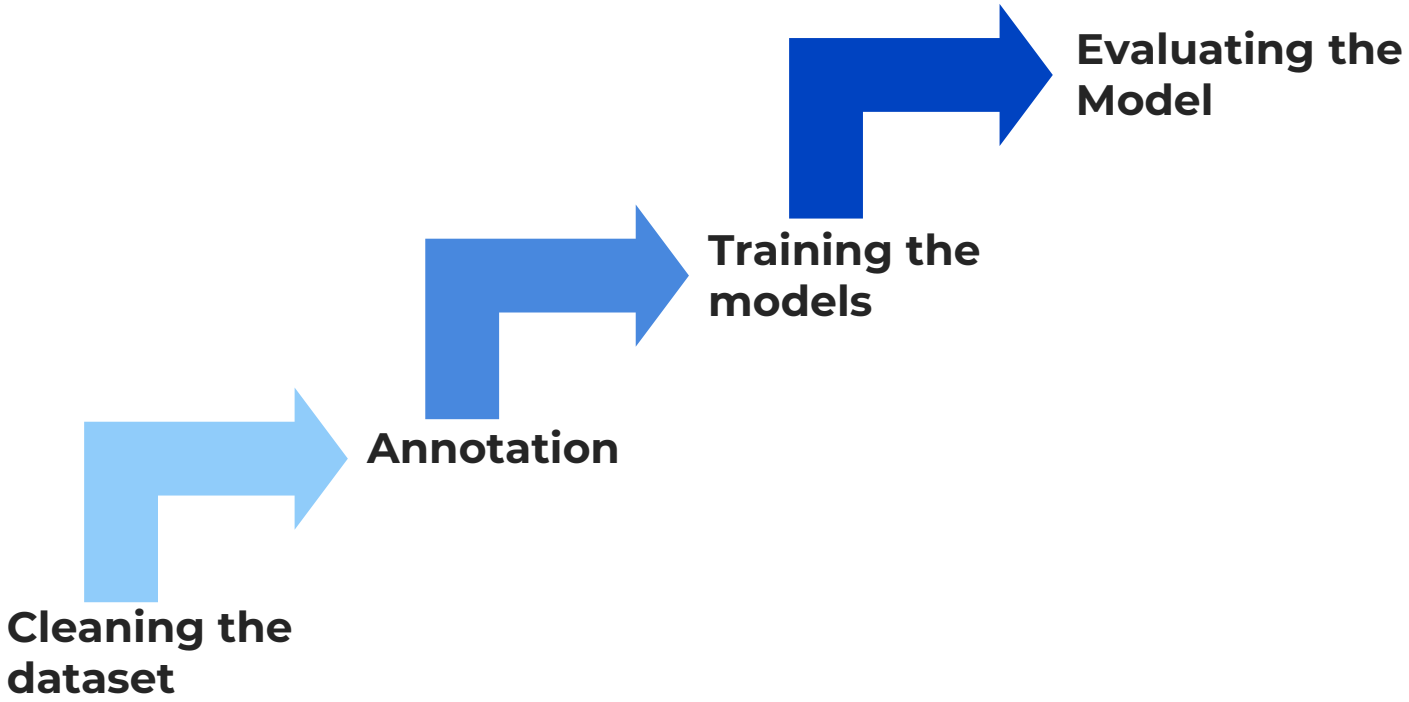
Self annotated dataset of large quantity

State-of-the-art model for Sinhala sentiment analysis

Identify the best model for Sinhala sentiment analysis

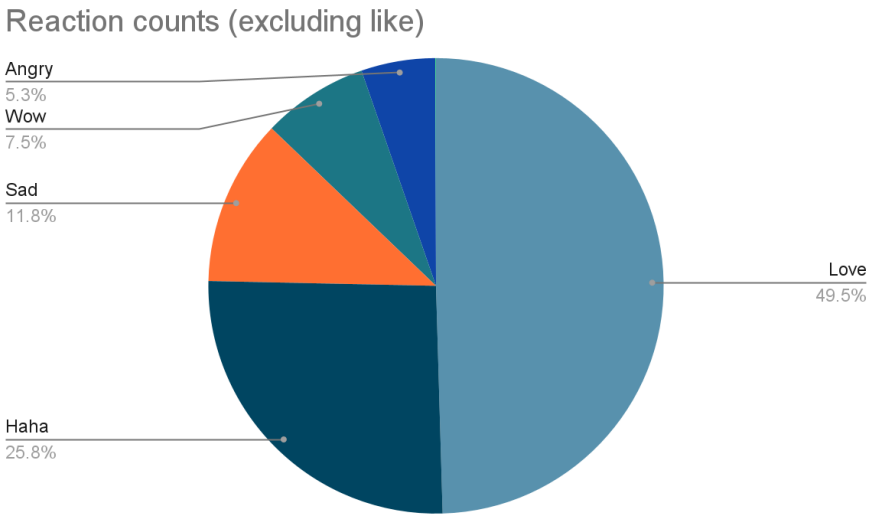
2. Methodology

Walkthrough

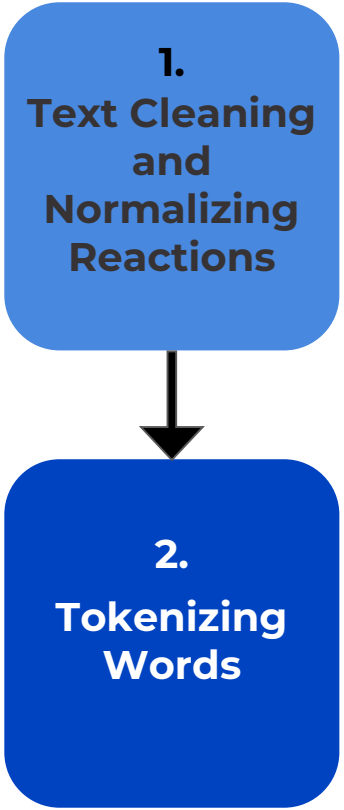


Dataset

- **Developed by Mr. Yudhanjaya Wijeratne and Dr. Nisansa de Silva [1]**
- **Contains 1.8 million Facebook posts spanning over a decade from different sources.**
- **Over 540 million user reactions**
- **526,732 data rows after preprocessing steps**



[1] Y. Wijeratne and N. de Silva, "Sinhala language corpora and stopwords from a decade of sri lankan facebook,"arXiv preprint arXiv:2007.07884, 2020.



- Removing text in other languages, numbers, and other text that contains no sentimental value
- Scaling the reaction counts of each row so that their sum is 1
- Removes the bias towards posts with higher reaction counts

- Dividing each message into word tokens and removing stopwords [1]
- Stopwords do not contain a significant sentimental value

[1] Y. Wijeratne and N. de Silva, “Sinhala language corpora and stopwords from a decade of sri lankan facebook,”arXiv preprint arXiv:2007.07884, 2020.

3.

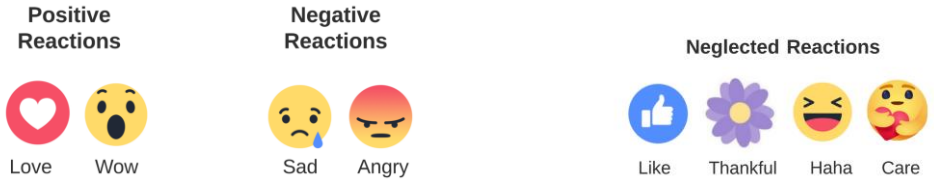
Creating Embeddings

- Using the embeddings developed by the work of Senevirathne et al.[2]
- fastText with 300 dimension

4.

Annotation

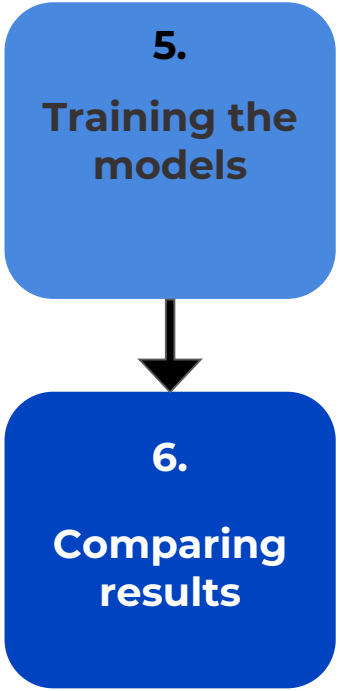
- Binary classification of posts divided into positive and negative classes
- Using the Facebook reactions



[2] L. Senevirathne, P. Demotte, B. Karunanayake, U. Munasinghe, andS. Ranathunga, "Sentiment analysis for sinhala language using deep learning techniques," 2020.

Count of Each Reaction

Model	Reaction count
Like	38889706
Love	2336796
Wow	321178
Haha	1486413
Sad	609597
Angry	349296
Thankful	7



- Core Reaction Set Model, All Reaction Set Model, Star Rating Model[3-4]
- Deep learning models

- Collect performance measures for the selected models
- Compare with the work of Senevirathne et al.[2]

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[3] V. Jayawickrama, G. Weeraprameshwara, N. de Silva, and Y. Wijeratne,"Seeking sinhala sentiment: Predicting facebook reactions of sinhala posts,"arXiv preprint arXiv:2112.00468, 2021.
[4] S. De Silva, H. Indrajee, S. Premarathna et al.,"Sensing the sentiments of the crowd: Looking into subjects," in 2nd International Workshop on Multi-modal Crowd Sensing, 2014.

Models Tested

- **Core Reaction Set model [3], All Reaction set models [3], Star Rating Model [3-4]**
- **Baseline models; GRU [5], LSTM [6] , BiLSTM [7]**
- **Baseline models with CNN layer [8]**
- **stacked 2 and 3 layer LSTM and BiLSTM models [9]**
- **HAHNN [10]**
- **Capsule-A, Capsule-B [11]**

[3] V. Jayawickrama, G. Weeraprameshwara, N. de Silva, and Y. Wijeratne,"Seeking sinhala sentiment: Predicting facebook reactions of sinhala posts,"arXiv preprint arXiv:2112.00468, 2021.
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[7] M. Schuster and K. K. Paliwal, "Bidirectional recurrent neural networks,"IEEE transactions on Signal Processing, vol. 45, no. 11, pp. 2673–2681, 1997.
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[9] J. Zhou, Y. Lu, H.-N. Dai, H. Wang, and H. Xiao, "Sentiment analysis ofchinese microblog based on stacked bidirectional lstm,"IEEE Access, vol. 7,pp. 38856–38866, 2019.
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[11] W. Zhao, J. Ye, M. Yang, Z. Lei, S. Zhang, and Z. Zhao, "Investigating capsule networks with dynamic routing for text classification," 2018.

3. Results

Model	F1 Score (%)	
	News comments [2]	Facebook dataset [1]
Core Reaction [3]	-	49.80
Star Rating Model [3-4]	-	33.77
GRU [5]	54.83	81.33
LSTM [6]	54.50	81.24
BiLSTM [7]	57.71	82.58
CNN [8]+ GRU [5]	54.19	81.37
CNN [8] + BiLSTM [7]	58.53	81.00

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Model	F1 Score (%)	
	News comments [2]	Facebook dataset [1]
Stacked LSTM 2 [9]	53.17	81.58
Stacked LSTM 3 [9]	53.67	81.24
Stacked BiLSTM 2 [9]	57.78	82.56
Stacked BiLSTM 3 [9]	59.42	**84.58**
HAHNN [10]	59.25	77.39
Capsule A [11]	53.55	79.67
Capsule B [11]	59.11	82.04

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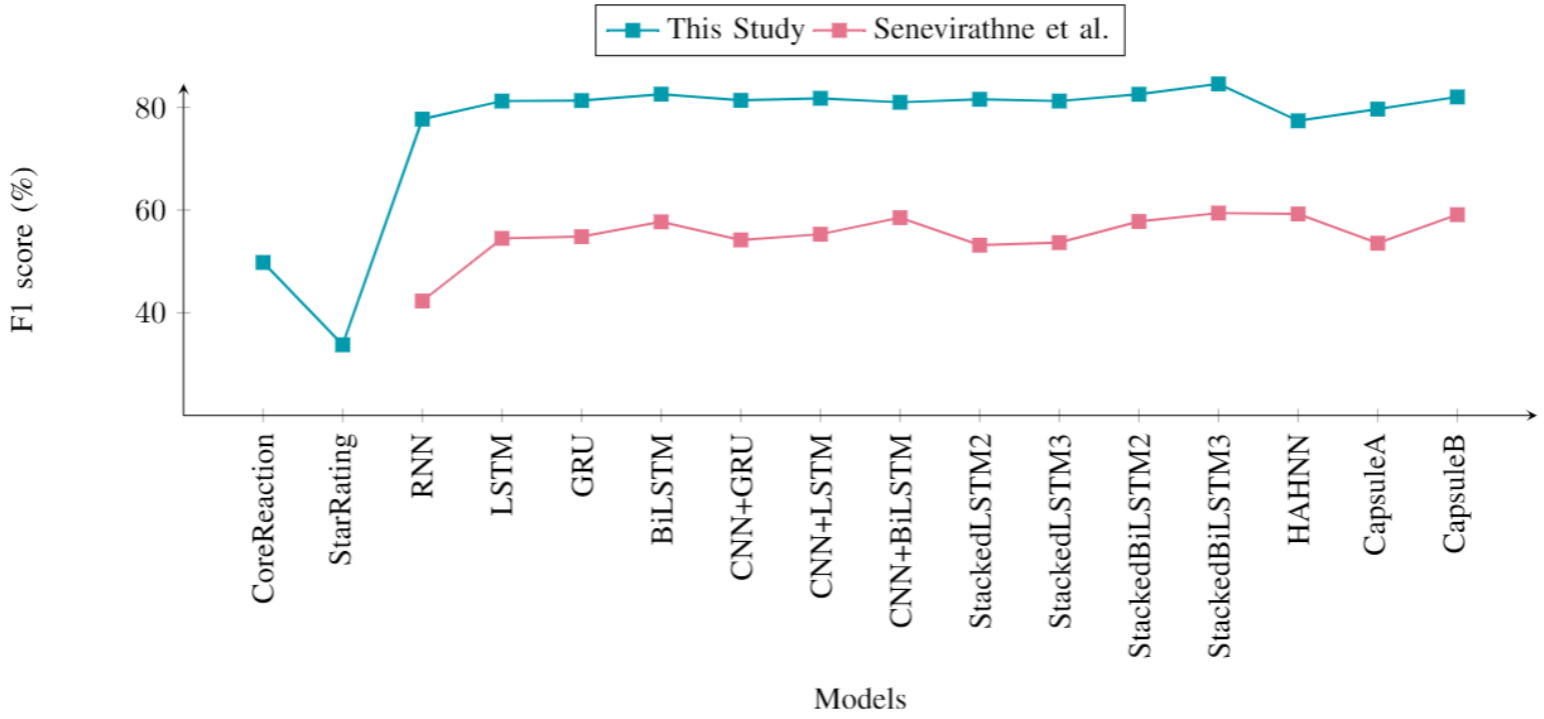

Figure 3. Change of the F1 score of the Models.

4. Conclusion

- **The usage of Facebook dataset[1] significantly improves the performance of models**
- **The state-of-the-model form the results is 3 layer stacked BiLSTM model [9]**
- **The CNN layer [8] used in the work of Senevirathne et al.[2] needs to be improved**
- **The use of attention mechanism introduced in the work of Vaswani et al. [12]**

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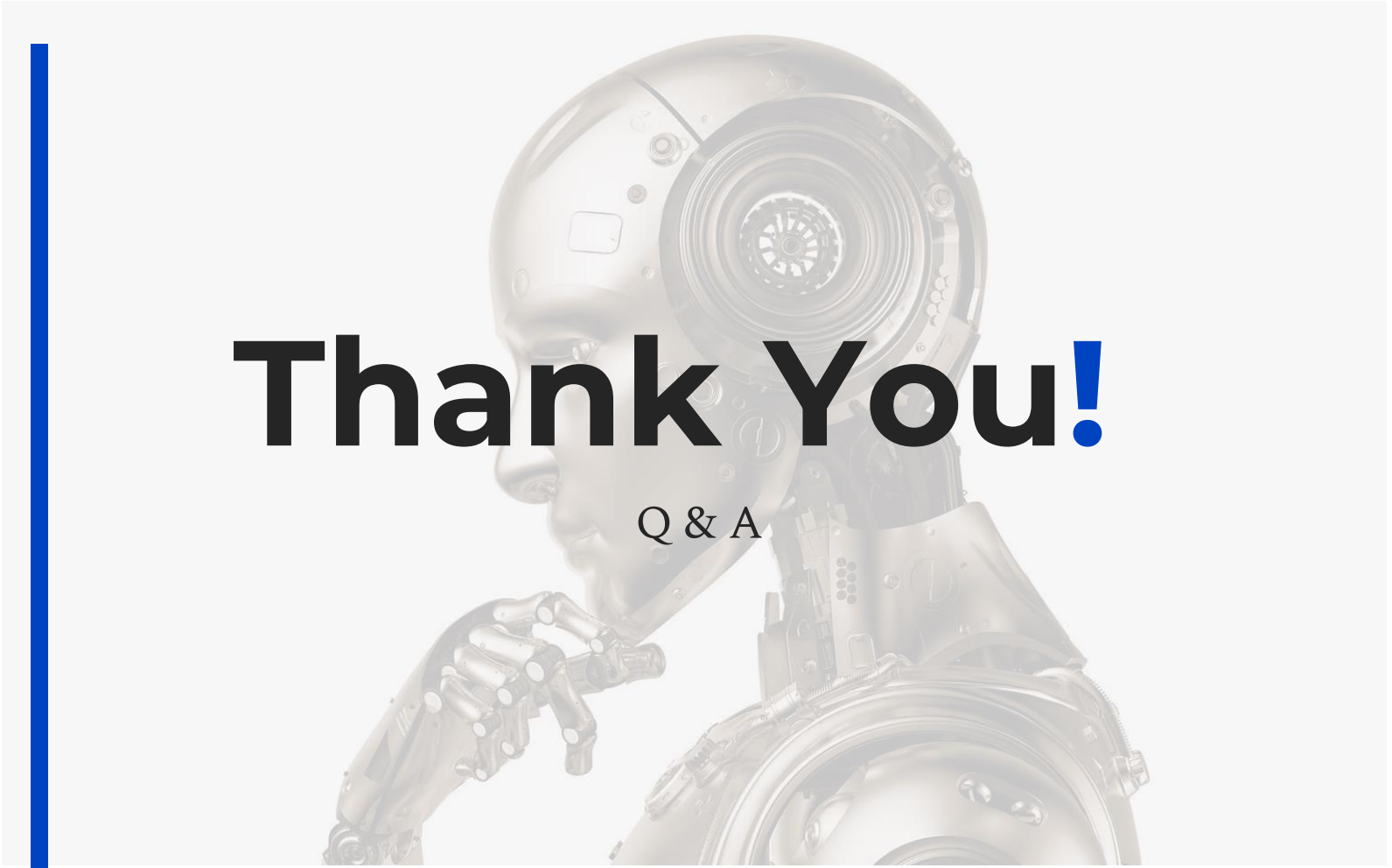

Thank You!

Q & A