

**EARLY DETECTION OF SINHALA LANGUAGE FAKE
NEWS IN SOCIAL MEDIA NETWORKS**

HGHS Hathnapitiya

228049R

Degree of Master of Science by Research

Department of Information Technology

University of Moratuwa

Sri Lanka

2024 April

**EARLY DETECTION OF SINHALA LANGUAGE FAKE
NEWS IN SOCIAL MEDIA NETWORKS**

Hathnapitiya Gamaethiralalage Hansanie Sandunika Hathnapitiya

228049R

Dissertation submitted in partial fulfilment of the requirements for the
degree Master of Science by Research

Department of Information Technology

University of Moratuwa

Sri Lanka

2024 April

Declaration

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature:

Date: 09.04.2024

The above candidate has carried out research for the Masters Dissertation under my supervision.

Name of the Supervisor: Dr. Supunmali Ahangama and Dr. Shalinda Adikari

Signature of the supervisor:

Date: 09/04/2024

Abstract

With human evolution, people invented new technologies to make life easier. In the early twentieth century, people read newspapers, listened to radio, and watched television to gather information. With the refinement of technologies, tech people introduced social media platforms to connect with people. Busy modern people started to browse and rely on these platforms to gather news while losing interest in traditional platforms. Social media is easy to access and cost-effective. These platforms can be effortlessly used for propagating fake news content and misleading people for personal, political, or religious benefits. Society must have a proper mechanism to avoid the spread of false information. The knowledge of human experts can be used to overcome the issue by manually investigating news content. However, it requires many human experts, and it consumes time. The study introduced an automated system to detect Sinhala fake news published on social media when the content is published. The data set was created by gathering news from Facebook, which was proven fake by Sri Lankan fact-checkers or legitimate by Sri Lankan news broadcasting channels. The proposed method considered content-related features with deep learning and machine learning techniques. The deep learning model was implemented by extracting Sinhala POS tags and their TF-IDF values combined with XLM-R embeddings. The introduced deep learning approach achieved 86% accuracy. The machine learning approach used TF-IDF values of Sinhala POS tags, FastText embeddings, and punctuation count. The proposed machine learning approach achieved 85% accuracy. The proposed methods can identify fake news early, preventing its spread. The performance can be further enhanced by increasing the dataset size by collecting more data.

Keywords – Sinhala fake news, social media, content-related features, natural language processing (NLP), deep learning (DL), machine learning (ML)

Acknowledgement

I would like to express my heartfelt gratitude to Dr. Supunmali Ahangama and Dr. Shalinda Adikari, my research supervisors, for their constant support and guidance throughout my research work. Their knowledge, expertise, and continuous support have greatly helped me in every aspect of my work.

I want to express my gratitude to my loved ones and close friends for their unwavering support and encouragement throughout my research. Their support has been instrumental in helping me complete the research.

The research was funded by the Accelerating Higher Education Expansion and Development (AHEAD) Operation of the Ministry of Higher Education funded by the World Bank.

TABLE OF CONTENT

Declaration.....	iii
Abstract.....	iv
Acknowledgement	v
LIST OF FIGURES	vii
LIST OF TABLES	viii
LIST OF ABBREVIATIONS.....	viii
CHAPTER 1: INTRODUCTION.....	1
1.1. Overview.....	1
1.2. Problem Statement.....	4
1.3. Objectives	4
1.4. Summary	5
CHAPTER 2: LITERATURE REVIEW	7
2.1. Introduction.....	7
2.2. Content-based Approaches	8
2.3. Social Context-based Approaches	12
2.4. Hybrid Approaches	13
CHAPTER 3: METHODOLOGY	18
3.1. Introduction.....	18
3.2. Methodology	19
CHAPTER 4: RESULTS AND ANALYSIS.....	40
4.1. Introduction.....	40
4.2. Results.....	40
4.3. Use of Comments.....	46
CHAPTER 5: DISCUSSION.....	53
CHAPTER 6: CONCLUSION AND RECOMMENDATION.....	57
References.....	59

LIST OF FIGURES

Figure 1: Language Tree ([1]).....	1
Figure 2: Internet users over time in Sri Lanka ([6])	3
Figure 3: Fake news detection approaches	7
Figure 4: High Level Architecture	19
Figure 5: Example of Fake News.....	21
Figure 6: Fake News data collection procedure.....	22
Figure 7: Pre-processing steps	23
Figure 8: Example for URL removed text	24
Figure 9: Example of new line removed.....	24
Figure 10: Removing common words.....	25
Figure 11: Translated text.....	25
Figure 12: Translation Steps	27
Figure 13: Punctuation removed text.....	28
Figure 14: Example of Sinhala POS tags.....	29
Figure 15: Sinling POS tag Hierarchy	30
Figure 16: TF-IDF Calculation Process	32
Figure 17: Example of Determiner [33].....	32
Figure 18: Example of NCV [33]	33
Figure 19: Example of NIP [33].....	33
Figure 20: Example of NNJ [33].....	33
Figure 21: Example of PRP [33].....	33
Figure 27: Confusion Matrix of the most accurate model	45
Figure 28: ROC graph of the most accurate model.....	45
Figure 29: Confusion matrix of KNN	47
Figure 35: Time gap between post time and comment time	51
Figure 36: Number of comments before the firstly identified comment.....	52

LIST OF TABLES

Table 1: Summary of Literature Review.....	15
Table 2: Results of ML and Ensemble Models on selected features.....	41
Table 1: Summary of Literature Review.....	15
Table 2: Results of ML and Ensemble Models on selected features.....	41

LIST OF ABBREVIATIONS

Abbreviation	Description
POS	Part-Of-Speech
TF-IDF	Term Frequency - Inverse Document Frequency
XLM	Cross-Lingual Language Model
NLP	Natural Language Processing
DL	Deep Learning
URL	Uniform Resource Locators
NCV	Noun in Compound Verbs
NIP	Nipathana
NNJ	Adjectival Noun
PRP	Pronoun
ROC	Receiver Operating Characteristic
SOV	Subject, Object, Verb
OS	Operating System
ML	Machine Learning
CNN	Convolutional Neural Network
RNN	Recurrent Neural Network
LSTM	Long Short-Term Memory
BERT	Bidirectional Encoder Representations from Transformers
GRU	Gated Recurrent Unit
SVM	Support Vector Machine
NER	Named Entity Recognition
ZSL	Zero-Shot Learning
AI	Artificial Intelligence
LLM	Large Language Model