



A Secure Framework for Detecting “Fake News in Social Media Networks”

K.S.P. Nonis
(Reg. No.: MS21910418)

A THESIS
SUBMITTED TO
SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE IN INFORMATION TECHNOLOGY
(CYBER SECURITY)

November 2024

I certify that I have read this thesis (draft) and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.



Prof. Anuradha Jayakody

Approved for MSc. Research Project:



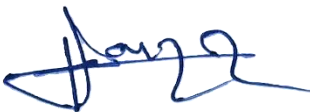
MSc. Programme Co-ordinator, SLIIT

Approved for MSc:

Head of Graduate Studies, FoC, SLIIT

DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Sri Lanka Institute of Information Technology or to any other institution for assessment for any other purpose.

Sign: 

K.S.P. Nonis

Date:11th November 2024...

ABSTRACT

A Secure Framework for Detecting “Fake News in Social Media Networks”

Sanjeeva Nonis

MSc. in Information Technology (Cyber Security)

Supervisor: Prof Anuradha Jayakody

November 2024

In today's digital era, the proliferation of fake news poses significant challenges to societal trust, political stability, and public perception. This study develops a comprehensive framework for enhancing fake news detection, leveraging advanced machine learning techniques, privacy-preserving methods, and dynamic threat modeling. Key objectives include improving detection accuracy, ensuring user data privacy, and adapting to evolving misinformation tactics. By integrating ensemble learning methods such as Random Forests and Gradient Boosting, along with Natural Language Processing (NLP) techniques, the framework offers superior performance in identifying fake news. Additionally, privacy-preserving techniques like differential privacy and federated learning help address growing concerns over user data confidentiality. The research highlights the importance of ensuring compatibility with major social media platforms to maximize effectiveness and scalability. Comprehensive performance evaluations underscore the robustness of the proposed system. Recommendations include fostering collaboration among stakeholders, strengthening user engagement in evaluation processes, and advancing the framework's adaptability to dynamic misinformation tactics. This research contributes significantly to the ongoing fight against misinformation, promoting a more informed and resilient society through an efficient, privacy-focused detection system.

ACKNOWLEDGEMENT

While at Sri Lanka Institute of Information Technology, I have benefited from having great advisors who seem to agree about very little. Prof. Anuradha Jayakody was a great mentor, providing advice, constant constructive criticism of my ideas and writing, access to his web of contacts and friends, and the freedom to work on my own projects on his research account's time.

I would like to express my grateful gratitude to my principal supervisor Prof. Anuradha Jayakody for all his guidance, input, advice, and encouragement throughout the research. Many thanks also to Dr. Prasanna S. Haddella, Dr Harinda Fernando, Mr Amila Senarathne and Mr Kavinga Yapa Abeywardena.

I would like also like to thank Mr Sudharshana Gunawardena – Chairman ITN, Mrs Sanjivani Epa – General Manager ITN and all the staff of the ITN Engineering Division and IET Sri Lanka Network for fullest support, practical information and suggestions.

I also wish to thank all my MSc colleagues; I am grateful for all these unforgettable moments spent with you.

Finally, My Wife Anuradha, Two Sons Sanjula and Anjula and my mother for their never-ending support.

Table of Contents

ABSTRACT.....	4
CHAPTER 1 - INTRODUCTION.....	11
1.1 Background of the Study	11
1.2 Problem Statement	11
1.3. Objectives	12
1.4 Research Question	12
1.5 Significance of the Study	13
1.6 Scope of the Study	13
1.7 Limitations of the Study.....	14
1.8 Structure of the thesis.....	14
CHAPTER 2 – LITERATURE REVIEW	15
2.1 Introduction.....	15
2.2 The Spread of Fake News and Its Impacts.....	15
2.3 Technological Solutions for Fake News Detection	16
2.4 The Role of Social Media Platforms.....	17
2.5 Challenges in Detecting and Preventing Fake News	17
2.6 Theoretical Framework.....	18
2.7 Machine Learning and Fake News Detection.....	19
2.8 Information Systems and Trust Mechanisms.....	20
2.9 Ethical Considerations in Fake News Detection.....	21
2.10 Current Research and Trends in Fake News Detection.	21
2.11 State-of-the-Art Technologies and Methods.....	22
2.12 Emerging Trends and Innovations	24
2.13 Privacy and Ethical Considerations in Research.	26
2.14 Ethical Considerations in Fake News Detection.....	28
2.15 Key Methods and Approaches in the Literature.	30

2.16 Application of Machine Learning/AI in the Research Problem.	34
2.17 Comparative Analysis of Studies.....	37
2.18 Gaps in Existing Research.	39
2.19 Practical Implications and Real-World Applications.	41
2.20 Conclusion	44
2.21 Conceptual framework.....	46
CHAPTER 3 METHODOLOGY	49
3.1 Sanderson’s research onion.....	49
3.2 Philosophy.....	51
3.3 Approach.....	52
3.4 Strategy	54
3.5 Choice of Methods.....	55
3.6 Time horizon.....	57
3.7 Sampling	57
3.8 Data Collection and Analysis.....	58
3.10 Hypotheses.....	59
CHAPTER 4 - RESULTS.....	60
4.1 Introduction.....	60
4.2 Data analysis	60
4.3 Correlation analysis	76
4.4 Regression analysis.....	77
4.5 Summary	79
CHAPTER 5 - DISCUSSION	80
5.1 Enhanced Algorithm for Fake News Detection	80
5.2 Privacy-Preserving Techniques	81
5.3 Dynamic Threat Modeling Mechanisms.....	82
5.4 Compatibility with Major Social Media Platforms.....	83

5.5 Comprehensive Performance Evaluations	83
5.6 Conclusion	84
CHAPTER 6 - CONCLUSION AND RECOMMENDATIONS	85
6.1 Conclusion	85
6.2 Recommendations.....	86
6.3 Practical Implications.....	88
6.4 User Engagement Strategies	88
6.5 Future Research Directions.....	89
REFERENCES.....	95
APPENDIX.....	96

List of Figure

Figure 0:1 Conceptual framework	47
Figure 0:2 Flow chart.....	48
Figure 0:3 Pseudocode.....	48
Figure 0:4 Sanderson’s research onion	49
Figure 0:5 Gender	61
Figure 0:6 Age	62
Figure 0:7 Q1 The language used in the news articles I read significantly influences my perception of their credibility.	63
Figure 0:8 Q3 The presence of credible sources in an article enhances its trustworthiness.	64
Figure 0:9 Q5 The readability of an article affects my ability to determine its accuracy.....	65
Figure 0:10 Q7 I believe that articles with a high number of shares are more likely to be true....	66
Figure 0:11 Q9 I often check the comments section of articles to gauge their credibility based on user reactions.	67
Figure 0:12 Q11 believe that algorithms can effectively identify fake news based on textual features.....	68
Figure 0:13 Q13 I trust news platforms that utilize AI and machine learning to filter fake news.	69
Figure 0:14 Q15 I feel confident in the ability of machine learning techniques to accurately classify news articles.....	70
Figure 0:15 Q17 I believe that influential users play a significant role in disseminating misinformation.....	71
Figure 0:16 Q19 I notice that fake news often originates from specific network clusters of users.	72
Figure 0:17 Q21 I believe that current fake news detection systems are generally accurate.	73
Figure 0:18 Q23 I trust the fact-checking mechanisms provided by news platforms.	74
Figure 0:19 Q25 My overall experience with fake news detection systems has been positive.	75

List of Table

Table 1 Gender.....	60
Table 2 Age.....	61
Table 3 Q1 The language used in the news articles I read significantly influences my perception of their credibility.....	63
Table 4 Q3 The presence of credible sources in an article enhances its trustworthiness.	64
Table 5 Q5 The readability of an article affects my ability to determine its accuracy.	65
Table 6 Q7 I believe that articles with a high number of shares are more likely to be true.	66
Table 7 Q9 I often check the comments section of articles to gauge their credibility based on user reactions.	67
Table 8 Q11 believe that algorithms can effectively identify fake news based on textual features.	68
Table 9 Q13 I trust news platforms that utilize AI and machine learning to filter fake news.	69
Table 10 Q15 I feel confident in the ability of machine learning techniques to accurately classify news articles.....	70
Table 11 I believe that influential users play a significant role in disseminating misinformation.	71
Table 12 Q19 I notice that fake news often originates from specific network clusters of users. ..	72
Table 13 Q21 I believe that current fake news detection systems are generally accurate.....	73
Table 14 Q23 I trust the fact-checking mechanisms provided by news platforms.	74
Table 15 Q25 My overall experience with fake news detection systems has been positive.	75
Table 16 Correlations.....	77
Table 17 Regression analysis.....	78
Table 18 Regression analysis.....	78