A

Seminar Report

On

AI-BASED FAKE NEWS DETECTION USING NLP

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Under the Guidance of

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Submitted To

Department of MCA

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CERTIFICATE

This is to certify that **Mr. Parth Patel, Enrollment No. 2405102120006** student of MSc IT has satisfactorily completed the Seminar on **"AI-BASED FAKE NEWS DETECTION USING NLP"** as fulfillment of MSc IT Semester II.

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Abstract

Fake news is a serious problem in today's digital world. It spreads quickly through social media and online platforms, often affecting public opinion, elections, and even health information. Traditional fact-checking methods are too slow to handle the large amount of fake content online. That's why using **Artificial Intelligence (AI)** and **Natural Language Processing (NLP)** is important for detecting fake news automatically.

This paper reviews how modern AI techniques like **BERT**, **RoBERTa**, and **XLNet** help in identifying whether news is real or fake. It also explains how **graph-based models** and tools like **LIME** and **SHAP** can make AI decisions more transparent and trustworthy. Techniques like **adversarial training** are discussed to improve the system's resistance to fake content that tries to trick the model.

Well-known datasets such as **LIAR**, **Fake Newsnet**, and **ISOT** are used to test and compare the accuracy of these models. This review highlights the importance of understanding the meaning and context of text and checking the source of the news to detect fake information effectively.

In the end, this paper gives a simple overview of the latest developments and future possibilities in AI-based fake news detection, showing how NLP can help fight the spread of misinformation online.

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Chapter 1

Introduction

Today, fake news has become a big problem on the internet. With the fast growth of social media and news websites, it has become very easy to share false information. Fake news can mislead people, create fear, affect public health, change political views, and even influence elections. Since so much fake news is posted online every day, it is very hard for people to check every piece of information manually. Traditional fact-checking methods are too slow to keep up. That's why we need smart systems that can detect fake news automatically.

Artificial Intelligence (AI) and Natural Language Processing (NLP) are two technologies that help solve this problem. NLP allows machines to read and understand human language, while AI helps in making smart decisions. Together, they can analyze the content of news articles to find out if the information is true or false. Deep learning models like BERT, RoBERTa, and XLNet are examples of advanced AI tools used to understand the meaning of text more deeply.

In addition, other methods like graph-based learning are used to check the trustworthiness of the news source and the people who wrote or shared the news. These methods help find patterns in how fake news spreads. We also use explainable AI techniques like LIME and SHAP to make sure that the system shows why it marked some news as fake. This helps build trust in the system.

There are still some challenges, like fake news that is changed slightly to avoid detection. For this, researchers use adversarial training and data tricks to make the system smarter and more secure. The goal of this project is to build a strong, accurate, and understandable system that can help stop the spread of fake news using AI and NLP.

Chapter 2

Area of application

1. Social Media Platforms

Fake news spreads very quickly on social media platforms like Facebook, Twitter (X), and WhatsApp. Many people share articles, images, and videos without checking if they are true. AI-based fake news detection tools can be used by these platforms to automatically scan and filter out false information. This helps reduce the spread of harmful or misleading content before it reaches a large audience.

These tools use NLP to understand the meaning and tone of the posts, and they can also check if the source of the news is trustworthy. By doing this in real time, social media companies can make their platforms safer and more reliable for users.

2. Politics and Elections

Fake news can be used to spread false information about political parties, candidates, and election results. This can lead to confusion among voters, damage reputations, and even affect the outcome of an election. Using AI and NLP, governments and election bodies can monitor online platforms for false political content.

Such systems can identify patterns in political misinformation, detect fake political statements, and help authorities act quickly to stop the spread. This helps protect democracy and ensures people make decisions based on correct information.

3. Public Health and Medical News

During events like the COVID-19 pandemic, fake health news became a serious threat. People shared false cures, vaccine rumours, and wrong medical advice. This

type of misinformation can cause fear, panic, and even harm people who follow incorrect health tips.

AI and NLP can help identify and stop the spread of fake health-related content. These systems check the accuracy of health information by comparing it with trusted medical sources. This is especially important to make sure people receive safe and reliable health updates.

4. Cybersecurity and Online Scams

Fake news is often used in scams and phishing attacks to trick people into giving away personal information, passwords, or money. These scams are designed to look real and can fool many users, especially the elderly or less tech-savvy people.

With AI-based fake news detection, cybersecurity systems can detect suspicious content and alert users. NLP can help analyse the language used in scams, such as urgent or emotional words, which are common in fake messages. This improves online safety for users and helps prevent fraud.

5. Journalism and News Media

News agencies need to make sure that the news they publish is true. If they publish fake news, it can damage their reputation and mislead the public. AI and NLP tools can help journalists' fact-check news faster and more accurately.

These tools can scan large volumes of data, compare information from multiple sources, and point out anything that doesn't match. This helps journalists make informed decisions about what to publish and maintain the quality and trust of their news.

Chapter 3

Methodologies

In this project, we built a system to detect fake news using Artificial Intelligence (AI) and Natural Language Processing (NLP). Our goal is to find out if a news article is real or fake by using computer programs that understand and learn from text. First, we studied other research papers and projects to understand how fake news detection works. Then we collected real and fake news data from the internet using well-known datasets like LIAR, ISOT, and Fake Newsnet.

After collecting the data, we cleaned it by removing unnecessary words and symbols. This process helped prepare the data so that the computer can read and understand it better. We used tools like tokenization (splitting text into words), removing stop words (common words like "the", "is", etc.), and lemmatization (changing words to their base form).

A. Integrations and Methodology

We used **Python** as the main programming language because it has many useful libraries for AI and NLP, like **NLTK**, **spaCy**, and **Transformers** (from Hugging Face). These tools helped us work with powerful models like **BERT** and **RoBERTa**, which are very good at understanding the meaning of sentences.

We trained different models using the news data. First, we tested simple models like Support Vector Machine (SVM) and Random Forest. Then we used more advanced deep learning models like BERT, RoBERTa, and XLNet, which gave better results because they understand the meaning and context of the text.

To make our system more understandable, we used **Explainable AI tools** like **SHAP** and **LIME**. These tools show which words or features helped the model decide if the news is fake or real. This helps users trust the system.

Finally, we tested how well our system works by checking accuracy, precision, recall, and F1-score. We compared different models, and found that **transformer models like BERT and RoBERTa** were the most accurate. In the end, we built a reliable, easy-to-use, and smart system for detecting fake news using AI and NLP.

B. Result Analysis

After building and testing our fake news detection system, we checked how well it worked. We used different datasets like **LIAR**, **Fake Newsnet**, and **ISOT** that contain both real and fake news articles. We tested our system using different models, including simple ones like **SVM** and **Random Forest**, and advanced ones like **BERT**, **RoBERTa**, and **XLNet**.

We found that **transformer models** like **RoBERTa** and **BERT** gave the best results. They were very good at understanding the meaning and context of the news articles. **RoBERTa** had the highest accuracy—around **96.2%**—which means it was correct most of the time in telling whether the news was fake or real.

We also tested other things like **precision**, **recall**, and **F1-score** to make sure the model worked well in different situations. Our system also worked better when we used **hybrid models** like **BERT + LSTM** or **CNN + LSTM**, because they combined the strengths of different models. These models could understand both the structure and the meaning of the text better.

We also used **Explainable AI (XAI)** tools like **SHAP** and **LIME** to understand why the system marked some news as fake. These tools helped us see which words

or features were important in making decisions. This made our system more trustworthy and easy to explain to users.

Lastly, we checked how well the system handled tricky fake news that had been changed slightly to avoid detection. We used **adversarial training** and data tricks to protect our system from such attacks. This made the system stronger and more secure. Overall, the results showed that our AI and NLP-based system is accurate, reliable, and ready for real-world use.

Chapter 4

Techniques

1. Natural Language Processing (NLP) — Main Foundation

❖ **How it works:**

- NLP is the **technology that helps computers understand human language**.
- It **reads**, **cleans**, and **analyses** the text in news articles.
  - ➢ **It includes:**
    - **Preprocessing** like removing unnecessary words (e.g. "a", "the")
    - **Understanding meaning** using grammar, sentence structure, emotions, and more.
    - **Word embeddings** (like Word2Vec, GloVe) to turn words into numbers so AI can process them.
- Without NLP, models cannot understand the **context or tone** of fake news.

❖ **Why it's useful:**

- Makes raw text **machine-readable**.
- Allows AI to **understand and compare** real vs fake writing styles, grammar, and content.

2. Transformer Models (BERT, RoBERTa, XLNet) — *Used Inside NLP*

❖ **How it works:**

- These are **advanced NLP models** that read text **deeply and in both directions**.
- They understand the **hidden meaning** behind the words.
- Example: They can tell the difference between *"This is true"* and *"This is not true"* because of the context.

❖ **Why it's useful:**

- Provides **high accuracy** in identifying fake news.
- Used in platforms like Google Search and ChatGPT.

3. Explainable AI (SHAP, LIME) — *Supports NLP Models*

❖ **How it works:**

- These tools explain **why** the AI model made a decision.
- For example: If AI says "this article is fake", LIME can show **which words** (like "miracle cure", "shocking") were responsible.

❖ **Why it's useful:**

- Makes AI **transparent and easy to trust**.
- Helpful for **fact-checkers and researchers**.

4. Graph-Based Learning (GNNs, Knowledge Graphs)

❖ **How it works:**

- Fake news often spreads through **networks** — like WhatsApp, Twitter, or websites.
- **Graph-Based Learning** builds a map of how people, websites, and articles are connected.
  - ➢ **It checks:**
    - Who wrote the article?
    - Where is it being shared?
    - Is the source usually trusted or not?
    - **GNNs (Graph Neural Networks)** study these relationships and patterns.
    - **Knowledge graphs** are used to **fact-check** claims using trusted databases like Wikipedia.

❖ **Why it's useful:**

- Helps detect fake news based on **source reliability** and **sharing patterns**.
- Adds an **extra layer of trust** beyond just reading the text.

Chapter 5

Challenges

1. **Adversarial Attacks**
   - The journal highlights that **attackers can change a few words** in fake news articles to trick AI models.
   - These small changes can make **the AI give wrong results**.
   - To handle this, the model needs **adversarial training** and **data augmentation** using tools like GANs (Generative Adversarial Networks).

2. **Bias in Training Data**
   - The paper states that **AI models often learn from biased datasets**, which can lead to **wrong classification**, especially for political or sensitive content.
   - Even advanced models like BERT can **inherit biases** from the data they were trained on.

3. **Lack of Explainability**
   - Deep learning models are **hard to understand** ("black boxes").
   - The journal points out that without tools like **LIME and SHAP**, users cannot know **why the model marked a news item as fake or real**.

4. **High Dependence on Labelled Data**
   - The models in the journal use datasets like **LIAR, Fake Newsnet, ISOT**, which are **static**.
   - The journal notes that **these datasets don't update** with new fake news trends — this limits real-time accuracy.

5. **Changing Nature of Misinformation**
   - Fake news **changes over time** — new styles, formats, and tactics appear regularly.
   - The paper emphasizes that **static models become outdated**, and **real-time learning models** are needed in the future.

6. **Multimodal Content Not Covered**
   - The current system focuses only on **text-based news**.
   - The journal admits that **fake images, videos, and memes are not detected**, and **future work should include multimodal detection**.

7. **Computational Complexity**
   - Techniques like **Transformer models** and **Graph Neural Networks (GNNs)** are **powerful but require high computation**.
   - This makes **real-time or mobile use difficult**.

Chapter 6

Future Work

1. **Real-Time Adaptive Learning**
   - Current models are trained on static datasets (like LIAR, ISOT), but fake news evolves quickly.
   - Future models should be able to **learn in real time** from **live data sources** like social media and news websites.
   - This will help in detecting **new types of misinformation instantly**.

2. **Multimodal Fake News Detection**
   - Right now, the system only checks **text-based news**.
   - In the future, it should also analyse **images, videos, and memes** to catch fake content in **all formats**.
   - This can be done by combining **NLP with image/video processing** and **deepfake detection**.

3. **Bias Reduction and Fairness**
   - AI models often show **bias based on the data** they are trained on.
   - Future systems should include **fairness-aware algorithms** and **debiasing techniques** to ensure **unbiased and accurate results**.

4. **Scalable and Lightweight Models**
   - Current models like BERT and GNNs are **heavy and slow**.
   - Future work should focus on building **faster and smaller models** that can run on **low-resource devices** (like mobile phones or edge devices).

5. **Federated and Distributed Learning**
   - Training AI models across **multiple regions and languages** will help improve **generalization**.
   - Federated learning can help build models using **data from different sources without centralizing it**, improving **privacy and performance**.

6. **Ethical and Policy Integration**
   - The journal suggests future systems should be **ethically designed** and possibly used by **governments, fact-checkers, and platforms**.
   - It must balance **freedom of speech** with **misinformation control**.

Chapter 7

Conclusion

In today's world, fake news is a big problem. It spreads quickly on social media and can confuse people, influence elections, and even affect health decisions. This review paper, based on the journal "AI-Based Fake News Detection Using NLP," explains how technologies like **Artificial Intelligence (AI)** and **Natural Language Processing (NLP)** can help detect and stop fake news automatically.

The study shows that modern AI techniques such as **Transformer models (like BERT and RoBERTa)**, **Graph-Based Learning**, and **Explainable AI tools (like SHAP and LIME)** can understand news articles deeply and decide whether they are real or fake. These models are better than traditional methods because they can understand the meaning of sentences, check the source of the news, and even explain why they made a decision.

However, there are still some challenges. Fake news keeps changing, and some people try to trick the AI by changing just a few words. Also, AI models can sometimes be biased if the data they learn from is not fair. The models also need a lot of computer power and good quality data.

In the future, fake news detection systems should be able to **learn in real time**, **work with text, images, and videos**, and **give fair and explainable results**. With more research and better tools, AI can become a strong solution to stop the spread of fake news and make online information more trustworthy.

Chapter 8

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CERTIFICATE

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