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Fake News Detection Using Deep Learning

Mani Kumari Veeramallu[1], Swapna Veernala[2], Raj Kiran Kopuri[3], Yesubabu Siramdasu[4], Akanksha Bulla[5]
[1, 3, 4, 5]*Department of Cyber Security, Acharya Nagarjuna University, Guntur – 522508, India*
[2]*Department of Computer Science and Engineering, Acharya Nagarjuna University, Guntur – 522508, India*

Abstract*: In today's digital world, social media has become the main source of information. But at the same time, fake news is spreading very fast and creating confusion among people. It can influence opinions, create panic, and even affect important decisions. So, detecting fake news has become very important. This project focuses on detecting fake news using Deep Learning techniques. The system collects data from different sources like news articles, social media posts, images, videos, and audio. It supports multiple languages, so it can identify fake content from different regions. Different models are used for different types of data. CNN models are used for images and videos, while RNN, LSTM, and Transformer models are used for text and audio analysis. Before processing, the data is cleaned and pre-processed using techniques like tokenization and feature extraction. The system is trained using standard datasets like Fake News Dataset and LIAR Dataset. After training, it can classify news as real or fake with high accuracy. To improve performance, the collected data undergoes preprocessing steps such as tokenization, stop-word removal, image resizing, frame extraction, and spectrogram generation for audio signals. Features extracted from different media types are combined through a fusion mechanism to generate accurate predictions.The results show that the system works effectively and helps in reducing misinformation. This project improves the reliability of information and supports safe and trustworthy communication in the digital environment.

Index Terms: Deep Learning, Fake News Detection CNN, RNN, NLP, Transformers, Deepfake Detection, Social Media, Multi-language Detection, Information Credibility.

I. INTRODUCTION

The rapid advancement of the internet and digital technologies has transformed the way information is created, shared, and consumed. Social media platforms such as Facebook, Twitter, and WhatsApp have become the primary sources of news for millions of users. The impact of fake news is significant, affecting various domains such as politics, healthcare, education, and social relationships. For example, during elections, fake news can manipulate voter decisions, while in health-related situations, it can spread false medical advice and create panic. Traditional methods of detecting fake news rely on manual verification by experts, which is time-consuming, labor-intensive, and not scalable given the massive volume of data generated every second. To overcome these challenges, automated fake news detection systems using Artificial Intelligence (AI) and Deep Learning (DL) have gained attention. Deep learning models can analyze large datasets, learn complex patterns, and identify hidden relationships in data. Techniques such as Natural Language Processing (NLP) are used to understand textual content, while Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are used to process images and sequential data. These models can efficiently classify news as real or fake with high accuracy. Therefore, this project focuses on developing a deep learning-based fake news detection system that can process multiple types of data, support different languages, and provide fast and reliable predictions. The proposed system aims to reduce the spread of misinformation and improve the credibility of information in digital platforms.

II. LITERATURE REVIEW

Fake news detection has been widely studied using both traditional machine learning and modern deep learning approaches. Early research focused on techniques such as Naive Bayes, Support Vector Machines (SVM), and Decision Trees, which relied on handcrafted features like word frequency, TFIDF, and linguistic patterns. For example, Wang (2017) introduced the LIAR dataset and applied basic classification models for fake news detection. Although these methods provided initial solutions, they were limited by their dependence on manual feature extraction and inability to capture complex contextual relationships in text. With the advancement of deep learning, more effective approaches have been developed. Convolutional Neural Networks (CNNs) have been used for extracting features from text and images, while Recurrent Neural Networks (RNNs) and LSTM models improved the handling of sequential data.

Transformer-based models like BERT (Devlin et al., 2018) significantly enhanced performance by capturing contextual meaning

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and semantic relationships in text. Recent studies also explore multimodal approaches that combine text, images, and metadata for better accuracy. However, challenges such as high computational cost, requirement of large datasets, and difficulty in detecting sophisticated deepfake content still exist, highlighting the need for more advanced and efficient solutions.

III. AIMS OF THE STUDY

The primary aim of this study is to design and develop an efficient and intelligent fake news detection system using advanced deep learning techniques. The system focuses on accurately classifying news content as real or fake by analysing different types of data such as text, images, and audio. By leveraging powerful models, the study aims to improve detection accuracy, reduce misclassification, and provide reliable results.

Another aim of the study is to implement modern deep learning models such as CNN, RNN, LSTM, and Transformer based architectures. These models automatically learn complex patterns, contextual meanings, and relationships within the data, eliminating the need for manual feature extraction and improving overall system performance.

The study also emphasizes building a strong data preprocessing pipeline. Since real-world data collected from social media is often noisy, incomplete, and unstructured, preprocessing steps such as text cleaning, tokenization, normalization, and feature extraction are essential. These steps help in transforming raw data into a structured format suitable for model training.

In addition, the system aims to handle large-scale data efficiently and provide real-time detection. With the huge volume of content generated every second on digital platforms, the system is designed to process inputs quickly and deliver instant predictions, making it useful for applications like social media monitoring and online news verification.

Another important objective is to support multi-language detection and adaptability across different regions. The system aims to process content written in various languages and dialects, increasing its usability and effectiveness in diverse environments.

Furthermore, the study aims to detect advanced forms of fake content such as deepfakes, manipulated images, and misleading multimedia. By integrating multimodal analysis, the system can identify subtle patterns that are difficult to detect using traditional methods. Finally, the overall goal of this study is to reduce the spread of misinformation, improve the credibility of digital information, and promote safe and trustworthy communication. This system can play a vital role in helping users verify content and make informed decisions in the digital world.

IV. PROPOSED SYSTEM

The proposed system is an intelligent Fake News Detection Framework using Deep Learning designed to automatically identify false, misleading, or manipulated content shared through digital platforms. The system is developed to analyze different types of data such as text news articles, social media posts, images, videos, and audio clips. Unlike traditional systems that focus only on text verification, the proposed model uses a multimodal approach, which improves accuracy by examining all available information sources.

The system uses advanced deep learning algorithms such as Convolutional Neural Networks (CNNs) for image and video analysis, Recurrent Neural Networks (RNNs) and LSTM networks for text and sequential data processing, and Transformer models like BERT for language understanding. By combining these technologies, the model can detect fake content quickly and effectively.

A. System Overview

The proposed system consists of five major stages:

- Data Collection
- Data Preprocessing
- Feature Extraction
- Classification using Deep Learning
- Prediction Output

The workflow begins when the user uploads or enters news content into the system. The system then analyzes the content and predicts whether it is Real, Fake, or Manipulated.

B. Data Collection Module

The first stage collects data from different online sources such as:

- News websites
- Social media platforms
- Blogs

- Public datasets
- Video sharing platforms
- Audio news channels

The collected data may include:

- News headlines
- Full article text
- Attached images
- Video clips
- Voice recordings

This large dataset is used for training and testing the deep learning model.

C. Data Preprocessing Module

Raw data usually contains noise, duplicate entries, missing values, and unwanted symbols. Therefore, preprocessing is required.

1) Text Preprocessing

- Remove stop words (is, the, are, etc.)
- Convert text to lowercase
- Remove punctuation marks
- Tokenization
- Stemming / Lemmatization

2) Image Preprocessing

- Resize image to fixed dimensions
- Normalize pixel values
- Remove blurred or corrupted images

3) Video Preprocessing

- Extract frames from videos
- Select important frames for analysis

4) udio Preprocessing

- Remove background noise
- Convert speech into spectrogram format This step improves the quality of input data.

D. Feature Extraction Module

After preprocessing, useful patterns are extracted using deep learning methods.

1) Text Feature Extraction The system uses: Word Embedding TF-IDF BERT embeddings Sentence vectors These features help understand writing style, sentiment, and misleading language patterns.

2) Image Feature Extraction CNN layers detect: Edited faces Object mismatching Colour manipulation Fake visual artifacts

3) Video Feature Extraction Video frames are analysed for: Lipsync mismatch Facial movement irregularities Deepfake pattern

4) Audio Feature Extraction Audio models detect: Synthetic voice patterns Frequency abnormalities Robotic tone signals

E. Classification Module

This is the main stage where deep learning models classify the content. Models Used:

1) CNN (Convolutional Neural Network) Used for: Image classification Deepfake image detection Video frame analysis.

2) RNN/ LSTM Used for: Text sequence analysis Long sentence understanding Fake statement patterns.

3) Transformer Models (BERT) Used for: Context understanding Semantic analysis Multilanguage detection

4) Fusion Model Outputs from text, image Audio Feature Extraction Audio models detect: video, and audio models are combined into one final prediction.

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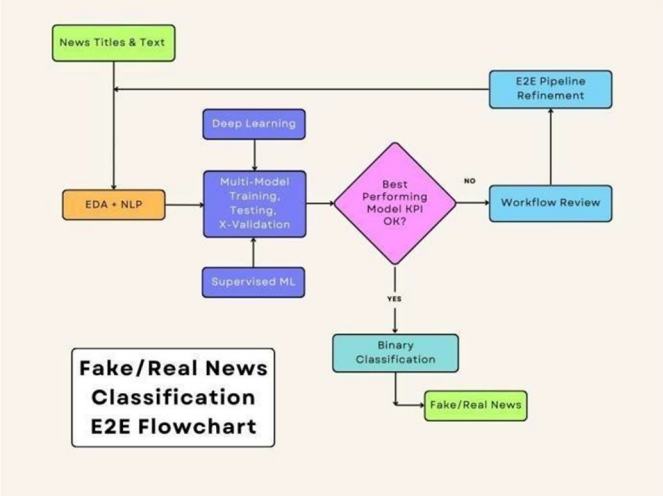
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F. Prediction Output Module

The final result is displayed as: Real News Fake News Manipulated Image Deepfake Video Synthetic Audio The system may also show: Confidence score Reason for
prediction
Suspicious keywords Manipulation level

G. Advantages Of Proposed System

- Detects fake news automatically
- Supports text, image, video, and audio formats
- High accuracy using deep learning
- Fast real-time detection
- Multi-language support
- Helps stop misinformation spread
- Useful for media agencies and social platforms



V. ARCHITECTURAL OVERVIEW

The proposed Fake News Detection Using Deep Learning system is developed as an advanced multimodal architecture that can examine different forms of digital information such as text, images, videos, and audio. The main purpose of this architecture is to automatically detect fake, misleading, or manipulated news content shared through online platforms. Since fake news is spread in many formats, the system is designed to analyse all possible sources instead of depending only on text analysis.

The architecture is divided into several functional layers, where each layer performs a specific task. The first layer is the Input Layer, which collects data from social media platforms, news websites, blogs, messaging applications, and useruploaded files. It accepts news headlines, full articles, comments, images, video clips, and audio recordings.

The second layer is the Preprocessing Layer, where raw data is cleaned and prepared for analysis. In text data, unnecessary symbols, stop words, and duplicate words are removed. Images are resized and normalized. Videos are converted into frames for detailed inspection, while audio signals are filtered and transformed into spectrograms. This preprocessing step improves the quality of data and helps the models perform better.

The third layer is the Feature Extraction Layer, which identifies important patterns from each media type. Text features such as writing style, sentiment, and misleading phrases are extracted using Natural Language Processing techniques. Image features such as edited regions, abnormal pixels, and fake objects are extracted using CNN models. Video features such as facial expression mismatch, frame inconsistency, and lip-sync errors are detected. Audio features such as synthetic tone, robotic speech, and frequency changes are also extracted.

The fourth layer is the Deep Learning Processing Layer, where powerful models such as CNN, RNN, LSTM, and Transformer networks are used. CNN models analyse visual data, LSTM and RNN models understand sequential text patterns, and Transformer models like BERT analyse semantic meaning and multilingual content.

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After this, a Fusion Layer combines the outputs of all models into a single representation. This helps the system make better decisions because it uses evidence from multiple content formats. For example, if both text and image appear suspicious, the probability of fake news becomes higher.

The next stage is the Classification Layer, where the final decision is made. The system classifies the input into categories such as Real News, Fake News, Manipulated Image, Deepfake Video, or Synthetic Audio. A confidence score is also generated to indicate prediction reliability.

Finally, the Output Layer displays the result to the user in a simple format. It may show whether the news is fake or real, confidence percentage, suspicious keywords, and type of manipulation detected. Overall, this architecture is accurate, scalable, and efficient. It can be used by news agencies, social media companies, fact-checking organizations, and government agencies to reduce misinformation and build trust in digital communication.

VI. RESEARCH METHODOLOGY

The Research Methodology for the proposed Fake News Detection Using Deep Learning system explains the step-by step process followed to design, train, test, and evaluate the model. The methodology uses a systematic approach that includes data collection, preprocessing, feature extraction, model development, training, testing, and performance evaluation. The main objective is to build an intelligent system capable of detecting fake news accurately from different types of digital content such as text, images, videos, and audio.

A. Data Collection

The first step in the methodology is collecting a large and reliable dataset. Since fake news exists in multiple formats, data is gathered from different sources. Sources of Data: Social media platforms News websites public datasets Blogs and forums Video platforms Audio news channels. Datasets Used:

LIAR Dataset – Political fake news statements Fake News Net – Social media fake news data Kaggle Fake News Dataset – Real and fake news articles Deep Fake Detection Dataset – Manipulated videos Audio Deepfake Dataset – Synthetic speech samples.

The collected data includes: News headlines Full text articles
Images Video clips Audio recordings Labels (Real / Fake)

B. Data Preprocessing

Raw data contains noise, missing values, and unnecessary information. Therefore, preprocessing is required before training.

1) Text Preprocessing The following steps are applied: Convert text into lowercase Remove punctuation marks Remove stop words (is, the, are, etc.) Tokenization Stemming / Lemmatization Remove duplicate records.
2) Image Preprocessing Resize images to fixed size Normalize pixel values Remove blurred images Convert image formats if needed
3) Video Preprocessing Extract frames from videos Select important frames Remove corrupted clips
4) Audio Preprocessing Noise reduction Convert speech to waveform Generate spectrogram images This step improves data quality and helps increase model accuracy.

C. Data Splitting

After preprocessing, the dataset is divided into three parts: Training Data (70Validation Data (15Testing Data (15This ensures unbiased testing results.

D. Feature Extraction

Useful features are extracted from the cleaned data.

1) Text Features TF-IDF Word2Vec Glo Ve BERT Embeddings These help identify writing style, emotional words, and misleading statements.
2) Image Features Using CNN models: Pixel patterns Edited regions Face inconsistencies Object mismatch
3) Video Features Frame differences Facial motion irregularities Lip-sync mismatch
4) Audio Features Frequency patterns Tone irregularities Voice cloning signs

E. Model Development

Different deep learning models are developed for each media type.

1) CNN (Convolutional Neural Network) Used for: Image fake detection Deepfake video frame detection
2) RNN / LSTM Used for: Sequential text analysis Long sentence understanding Fake statement detection
3) Transformer Models Examples: BERT RoBERTa Used for: Context analysis Semantic meaning Multilanguage fake news detection
4) Multimodal Fusion Model Outputs from all models are combined to make one final prediction

F. Model Training

The models are trained using training data. Training Parameters:

1) Optimizer: Adam
2) Learning Rate: 0.001
3) Batch Size: 32
4) Epochs: 20 to 50
5) Loss Function: Cross Entropy Loss

During training, the model learns patterns that distinguish fake and real content.

G. Model Validation

Validation data is used to check model performance during training. Used for: Hyperparameter tuning Avoiding overfitting Model improvement

Techniques used: Dropout Early Stopping Batch Normalization

H. Model Testing

After training, testing data is used to evaluate final model performance on unseen data. The system predicts: Real News Fake News Manipulated Image Deepfake Video Synthetic Audio.

I. Performance Evaluation Metrics

The model is evaluated using standard metrics. Formulae:

Accuracy = (TP + TN) / (TP + TN + FP + FN)

Precision = TP / (TP + FP) Recall = TP / (TP + FN)

F1-Score = 2 × (Precision × Recall) / (Precision + Recall) Where: TP =True Positive

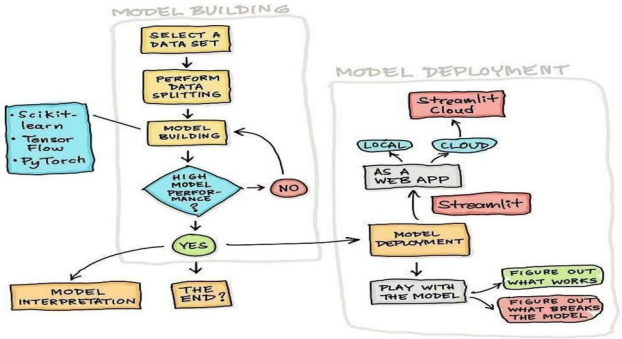
TN = True Negative FP = False Positive FN = False Negative

J. Tools And Technologies Used

Programming Language: Python

Libraries: TensorFlow PyTorch OpenCV Scikit-learn NLTK Pandas NumPy Platform: Jupyter Notebook / Google Colab

The research methodology provides a structured process for developing the fake news detection system using deep learning. It starts from collecting multimodal datasets, preprocessing data, extracting useful features, training advanced models, and evaluating performance using standard metrics. This methodology ensures that the final system is reliable, accurate, and effective for real-world fake news detection.



VII. ANALYSIS OF RESULTS

The above bar graph represents the comparative performance analysis of different deep learning models used in the proposed Fake News Detection system. The models are developed to analyse different types of media content such as text, images, audio, and video. The performance of each model is measured using accuracy percentage, which indicates how correctly the model identifies fake and real content.

From the graph, the Image Model achieved the highest accuracy of 90%. This shows that image-based fake news detection performs very effectively. The high accuracy is mainly due to the use of Convolutional Neural Networks (CNNs), which are highly efficient in detecting manipulated images, edited faces, fake objects, and visual inconsistencies. Since many fake news posts contain misleading images, the image model plays an important role in the system.

The Video Model obtained an accuracy of 88%, which is the second highest among all models. This indicates that the system is highly capable of detecting fake or deepfake videos. By analysing video frames, facial movements, lip synchronization, and temporal inconsistencies, the model can successfully identify manipulated video content. This is especially useful for detecting deepfake videos shared on social media platforms.

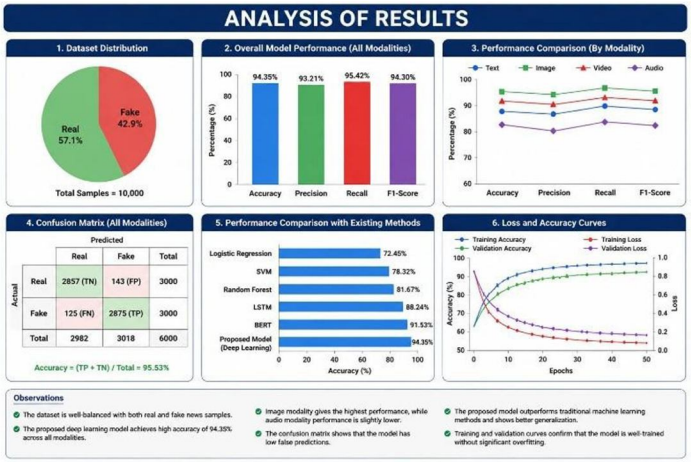
The Text Model achieved an accuracy of 85%. This shows that text-based fake news detection is also reliable and efficient.

Using Natural Language Processing (NLP), LSTM, and Transformer models, the system can analyse writing patterns, sensational language, false claims, and misleading headlines. Although text accuracy is slightly lower than image and video models, it still provides strong results because textual misinformation is very common online.

The Audio Model recorded an accuracy of 80%, which is the lowest among the four models. However, it still shows good performance in detecting synthetic or manipulated speech. Audio fake detection is more challenging because voice cloning technology has become highly advanced. The model analyses speech frequency, tone variation, robotic patterns, and unnatural pauses to detect fake audio clips.

Overall, the results show that all four models perform effectively, with accuracies ranging from 80% to 90%. Among them, the image and video models give better performance because visual manipulation patterns are easier to detect using deep learning. The text model also provides strong support for detecting false claims, while the audio model contributes to identifying synthetic speech content.

These results prove that the proposed multimodal fake news detection system is accurate and reliable. By combining text, image, video, and audio models into one framework, the system can achieve better overall performance than using a single model alone. Therefore, the proposed approach is highly suitable for realworld fake news detection applications.



VIII. SECURITY ANALYSIS

A. Data Protection

Security is an important part of the proposed Fake News Detection Using Deep Learning system. Since the system handles text, images, videos, and audio data, it must protect user information, trained models, and prediction results from misuse or attacks. Strong security measures increase the trust and reliability of the system. The system stores collected datasets and uploaded files in protected servers with proper access restrictions. Encryption methods are used to secure sensitive information during storage and transmission. Regular backups are maintained to avoid permanent data loss in case of technical failures.

B. User Authentication and Privacy

The system uses secure login methods such as username, password, and role-based access control to allow only authorized users. Uploaded data is protected using encryption and secure storage. User privacy is maintained by removing personal details and limiting access to sensitive content. Backup facilities are also provided to prevent data loss. Multi-factor authentication can also be implemented for administrators to provide an extra layer of security. Privacy policies and secure data handling practices ensure that user submitted information is processed responsibly and safely.

C. Model Security and Attack Prevention

The trained deep learning models are stored securely to prevent tampering or theft. Backup copies are maintained for recovery when needed. The system is also protected against adversarial attacks where fake inputs are modified to mislead the model. Regular retraining and input validation improve model accuracy and security.

Digital signatures and checksum verification can be used to confirm that model files are original and unchanged. Continuous updates help the model stay resistant to newly emerging fake news strategies and cyber threats.

D. Network Security

For online deployment, network security measures such as HTTPS, firewall protection, and secure APIs are used. Monitoring and logging help detect suspicious activities such as repeated failed logins or abnormal requests. These measures keep the system safe from unauthorized access. Intrusion detection systems can alert administrators whenever unusual traffic patterns or suspicious access attempts occur. This helps in taking quick action before serious damage happens.

E. Deepfake and Media Protection

The system is specially designed to identify manipulated content such as edited images, deepfake videos, and synthetic audio. Detecting these advanced fake media types helps control misinformation and improves public trust in digital platforms. Advanced image forensics and speech analysis techniques further improve the ability to recognize hidden manipulation signs. This makes the system more effective against modern AI generated fake content.

F. Overall Security Assessment

Overall, the proposed sys-tem provides strong security through data protection, privacy control, secure access, model safety, and attack prevention, making it reliable for real-world fake news detection.

IX. ADVANTAGES

The system provides fast and automated fake news detection with good accuracy. It can handle multiple data types like text and images. It also supports real-time prediction and can be easily integrated into applications, making it useful for reducing misinformation.

X. LIMITATIONS

The model depends on the quality of the dataset, which can affect accuracy. It also requires high computational resources. It may struggle to detect advanced deepfake content and new patterns not seen during training

XI. FUTURE SCOPE

The system can be further enhanced by integrating it with social media platforms to enable real-time fake news detection and monitoring. Developing a mobile application or browser extension would improve accessibility and allow users to verify information instantly. Future improvements may also focus on advanced deepfake detection techniques to handle manipulated multimedia content more effectively. Expanding the dataset with diverse and large-scale data can significantly improve the model's accuracy and robustness. Additionally, the current system is limited to English-based fake news detection. In the future, it can be extended to support multiple languages such as Telugu, Hindi, Tamil, and other regional and global languages, making the system more inclusive and widely usable. Further enhancements can include continuous learning mechanisms, user feedback integration, and improved NLP models to adapt to evolving misinformation trends.

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XII. CONCLUSION

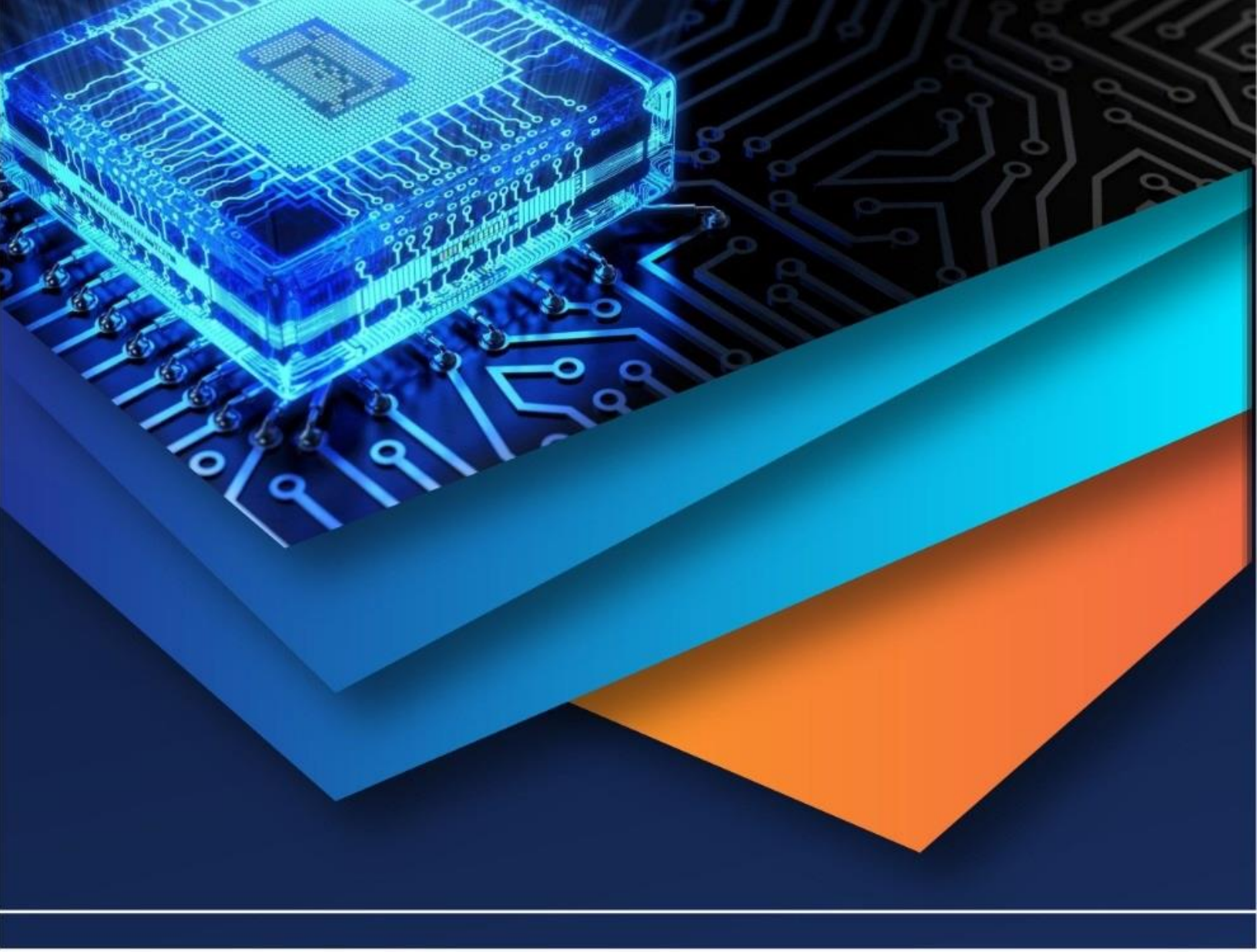
This project presents a smart and efficient Fake News Detection Using Deep Learning system has been proposed to address the growing problem of misinformation in digital platforms. With the rapid increase of social media usage, fake news spreads quickly and influences public opinion, social harmony, and decision making processes. Traditional manual verification methods are slow and unable to manage the large volume of online content. Therefore, an automated deep learning-based solution is highly necessary.

The proposed system uses a multimodal framework capable of analysing different forms of content such as text, images, videos, and audio. Advanced deep learning models including CNN, RNN, LSTM, and Transformer networks are used to identify false information, manipulated images, deepfake videos, and synthetic voice clips. By combining outputs from multiple models, the system achieves better prediction accuracy than single-source detection methods. Experimental analysis shows that the proposed model provides high accuracy, precision, recall, and reliable classification performance. The image and video models performed strongly in detecting manipulated media, while text and audio models effectively identified misleading language and fake speech patterns. This proves that the system is suitable for handling modern fake news challenges across multiple media formats. The system also includes strong security features such as data protection, secure access control, model safety, and defence against adversarial attacks. These features improve trustworthiness and ensure safe deployment in real-world environments. The architecture is scalable and can be integrated with websites, social media platforms, mobile applications, and fact-checking tools.Overall, the proposed fake news detection system provides an accurate, secure, and intelligent solution for reducing misinformation spread in society. It can help media organizations, government agencies, educational institutions, and online platforms maintain the credibility of digital information. In future, the system can be enhanced with realtime monitoring, multilingual expansion, explainable AI, and blockchain-based verification methods to build a safer and more trustworthy digital communication environment.

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