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Fake News Identification Using Machine Learning and Artificial Intelligence: A Multimodal Approach for Text and Video Content

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ABSTRACT

The widespread adoption of social media platforms has accelerated the distribution of misleading and fabricated information in textual as well as multimedia formats. Traditional fake news detection techniques mainly focus on textual classification and often fail to recognize misinformation present in multimedia sources such as manipulated videos. This study proposes a multimodal fake news detection framework that integrates Machine Learning (ML) and Artificial Intelligence (AI) techniques to analyze both text and video data. Natural Language Processing (NLP) methods are applied to textual content, while Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks are utilized for analyzing video frames. Experimental evaluation indicates that the multimodal approach provides higher accuracy and improved reliability compared to models that rely on a single type of data.

Keywords: Fake News Detection, Artificial Intelligence, Machine Learning, Multimodal Analysis, Social Media, Video Processing

1. INTRODUCTION

Social media platforms such as Twitter, Facebook, Instagram, and YouTube have become major sources for sharing news and information. While these platforms enable fast communication, they also make it easier for misinformation to spread rapidly in the form of text, images, and videos.

The development of deepfake technology and advanced video editing tools has further complicated the problem by making manipulated media appear authentic. Most traditional fake news detection systems primarily analyze textual information and therefore fail to detect misleading content embedded in multimedia.

To address this limitation, a multimodal detection framework that combines textual and video analysis is necessary. By integrating Natural Language Processing techniques with deep learning models for multimedia processing, it is possible to build a more reliable fake news detection system.

2. RELATED WORK

Early studies in fake news detection mainly relied on conventional machine learning algorithms such as Support Vector Machines (SVM), Naïve Bayes, and Random Forest. These models commonly used textual feature extraction methods such as TF-IDF and n-gram analysis. Recent advancements have introduced deep learning models capable of capturing semantic relationships within text. Transformer-based architectures like BERT have significantly improved contextual language understanding.

Multimodal approaches further enhance detection performance by combining textual and visual features. Convolutional Neural Networks are widely used for visual feature extraction, while feature fusion techniques integrate outputs from different modalities to improve prediction accuracy.

3. DATASET DESCRIPTION

The proposed system is evaluated using widely used benchmark datasets.

FakeNewsNet – A dataset containing news articles, social engagement data, and related images collected from Twitter and verified news sources.
Fakeddit – A multimodal dataset obtained from Reddit that includes text, images, and detailed labels related to misinformation.
FaceForensics++ – A benchmark dataset used for detecting manipulated and deepfake videos.
DeepFake Detection Challenge (DFDC) – A large video dataset designed to support research in deepfake detection.
Text datasets include news articles, titles, and comments, while video datasets contain both authentic and manipulated video samples.

4. PROPOSED METHODOLOGY

Text-Based Fake News Detection::Text data is preprocessed through tokenization, stop-word removal, and lemmatization. Contextual representations are generated using BERT embeddings to capture semantic meaning within the text.
Video-Based Fake News Detection: Video data is divided into frames. Convolutional Neural Networks extract spatial features from each frame, while Long Short-Term Memory networks capture temporal dependencies across frames.
Multimodal Fusion: Predictions from the text and video models are combined using a late fusion strategy: Pfinal = αPtext + βPvideo
This approach allows the system to utilize complementary information from both data sources.

5. IMPLEMENTATION

Text Classification (BERT Model)

```
from transformers import BertTokenizer, BertForSequenceClassification
import torch
tokenizer = BertTokenizer.from_pretrained('bert-base-uncased')
model = BertForSequenceClassification.from_pretrained('bert-base-uncased', num_labels=2)
inputs = tokenizer("Breaking news content", return_tensors="pt")
outputs = model(**inputs)
prediction = torch.argmax(outputs.logits, dim=1)
```

Video Classification (CNN + LSTM)

```
import tensorflow as tf
cnn = tf.keras.applications.ResNet50(weights='imagenet', include_top=False)
model = tf.keras.Sequential([
tf.keras.layers.TimeDistributed(cnn),
tf.keras.layers.LSTM(128),
tf.keras.layers.Dense(2, activation='softmax')
])
```

6. RESULTS AND ANALYSIS

Performance Comparison

Model Type	Accuracy (%)	Precision (%)	Recall (%)	F1 Score (%)
Text Only Model	81.2	79.5	82.8	80.9
Video Only Model	78.9	76.3	80.1	78.1
Multimodal Model	89.5	88.1	90.4	89.2

The results demonstrate that integrating textual and video analysis significantly improves fake news detection performance.

7. CONCLUSION AND FUTURE WORK

This study presented a multimodal fake news detection framework that integrates machine learning and artificial intelligence techniques to analyze both textual and video content. Experimental results indicate that the multimodal system achieves higher accuracy compared to single-modality approaches. Future work will focus on developing real-time detection systems, incorporating deepfake audio analysis, and integrating explainable AI techniques to improve transparency and reliability of the detection process.

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