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HYBRID DEEP LEARNING FRAMEWORK FOR EARLY DETECTION OF FAKE NEWS IN SOCIAL MEDIA PLATFORMS

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Abstract

The rapid growth of social media platforms has significantly accelerated the spread of information across the globe. However, this accessibility has also facilitated the widespread dissemination of misinformation and fake news, which can negatively influence public opinion, political stability, and social harmony. Detecting fake news at an early stage is therefore a critical challenge for modern information systems. Traditional machine learning approaches often struggle to capture complex linguistic patterns and contextual relationships present in social media content. To address this issue, this paper proposes a Hybrid Deep Learning Framework for Early Detection of Fake News in Social Media. The proposed framework integrates semantic feature extraction using Bidirectional Encoder Representations from Transformers, contextual sequence modeling through Long Short-Term Memory, and feature refinement using Convolutional Neural Network layers. This hybrid architecture captures both global contextual semantics and local linguistic patterns present in news content and social media posts. The system performs data preprocessing, feature extraction, hybrid model training, and classification to distinguish between fake and genuine news articles. Experimental evaluation demonstrates that the proposed model achieves improved detection accuracy, reduced false positives, and faster identification of misinformation compared with traditional machine learning approaches. The framework is particularly effective for early-stage detection where limited propagation information is available. The proposed method provides a scalable and efficient solution for combating misinformation in modern social media ecosystems.

1. Introduction

The rapid expansion of social media platforms has transformed the way people access and share information [1]. Platforms such as Twitter, Facebook, and Instagram allow users to disseminate news and opinions instantly to a global audience [2]. While these platforms have enhanced communication and information accessibility, they have also created an environment where misinformation and fake news can spread rapidly [3]. Fake news refers to deliberately fabricated or misleading information that is presented as legitimate news content with the intention of influencing public perception. The proliferation of fake news has become a major societal challenge [4]. Misinformation campaigns can manipulate political opinions, spread panic during crises, damage reputations, and undermine trust in legitimate media sources. Several high-profile events, including elections, public health crises, and geopolitical conflicts, have demonstrated how rapidly misinformation can influence public behavior [5]. Consequently, there is an urgent need for intelligent automated systems capable of identifying fake news at early stages before it spreads widely.

Traditional fake news detection approaches primarily rely on manual fact-checking or rule-based systems [6]. Although these approaches can provide accurate verification, they are not scalable for large-scale social media environments where thousands of posts are generated every second. Machine learning methods such as Support Vector Machine and Random Forest have been applied to classify fake news based on textual features [7]. However, these models often rely heavily on handcrafted features and struggle to capture complex semantic relationships and contextual nuances within news content [8]. Recent advancements in deep learning have significantly improved the capability of automated text analysis systems. Neural network architectures can learn hierarchical representations of textual data, enabling more accurate detection of misleading information [9]. Transformer-based models such as Bidirectional Encoder Representations from Transformers have demonstrated remarkable success in natural language understanding tasks [10]. These models capture contextual relationships between words and sentences, enabling improved semantic interpretation.

Despite these advancements, several challenges remain in fake news detection. First, social media posts are typically short, informal, and noisy, making linguistic analysis more complex. Second, fake news content often mimics legitimate news writing styles, making it difficult to distinguish using simple textual patterns. Third, early detection is particularly challenging because propagation-based features such as user engagement and sharing patterns are not yet available. To overcome these limitations, hybrid deep learning models have gained increasing attention. By combining multiple neural network architectures, hybrid models can leverage the strengths of different approaches. For instance, convolutional networks can effectively capture local textual patterns, while recurrent networks such as Long Short-Term Memory can model sequential dependencies within text [11]. Integrating these techniques with contextual embeddings generated by transformer models enables more robust feature representation.

This paper proposes a Hybrid Deep Learning Framework designed to detect fake news during its early dissemination stages on social media platforms. The proposed framework integrates contextual semantic embeddings, sequential learning, and convolutional feature extraction to capture both global and local patterns in textual data. By combining these components, the model improves detection accuracy while maintaining computational efficiency.

The system performs several key operations including data preprocessing, contextual embedding generation, hybrid neural network training, and classification. The model is trained on labeled news datasets and evaluated using standard performance metrics such as accuracy, precision, recall, and F1-score. The objective is to develop a scalable and reliable fake news detection mechanism capable of assisting social media platforms in reducing the spread of misinformation.

Overall, the proposed research contributes to the development of intelligent misinformation detection systems and highlights the importance of advanced deep learning techniques in maintaining information integrity in digital communication environments.

This research focuses on the development of an automated deep learning framework for early detection of fake news in social media environments. The study primarily analyzes textual content from social media posts and online news articles using natural language processing techniques. The framework integrates transformer-based embeddings, convolutional neural networks, and recurrent neural networks to capture contextual and semantic patterns in news content. The scope includes dataset preprocessing, model training, and performance evaluation using standard classification metrics. The research does not focus on image-based misinformation detection but concentrates mainly on textual misinformation detection in social media platforms.

The rapid spread of misinformation through social media has become a serious global concern. Fake news can influence public opinion, create social unrest, and undermine trust in legitimate information sources [12]. Manual fact-checking methods are insufficient to handle the massive volume of online content generated every day. Therefore, there is a strong need for automated systems that can detect misleading information quickly and accurately. Advances in deep learning and natural language processing provide powerful tools for analyzing complex textual patterns. This research is motivated by the need to develop intelligent AI-driven frameworks capable of identifying fake news during its early stages of dissemination.

To develop a hybrid deep learning model that accurately detects fake news in social media posts at early stages by integrating contextual semantic embeddings, sequential text modeling, and convolutional feature extraction while improving detection accuracy and reducing misinformation propagation.

2. Review of Related Literature

Ramesh Kumar Ayyasamy.et.l., Concerns regarding the impact of fake news on public opinion, trust, and decision-making have been raised in recent years due to its widespread distribution on social media. This paper presents a hybrid deep learning methodology that improves the detection of fake news, addressing the shortcomings of conventional detection techniques. By merging a Convolutional Gaussian Perceptron Neural Network (CGPNN) for classification with a Long Short-Term Memory (LSTM) network for contextual feature extraction, the goal is to increase detection accuracy and model stability. Authors incorporated a metaheuristic Moth-Flame Whale Optimization (MFWO) algorithm for hyperparameter adjustment in order to further optimize performance. Using standardized preprocessing methods and TF-IDF-based text representation, an experimental evaluation was carried out on four benchmark datasets: ISOT, Fakeddit, BuzzFeedNews, and FakeNewsNet. The suggested model achieves up to 98% accuracy, 95% F1-score, and statistically significant improvements ($p<0.05$) over transformer-based and graph neural network models, according to the results. These results imply that linguistic patterns and textual abnormalities in misleading content are successfully captured by the hybrid framework. The suggested approach provides a scalable and effective way to identify fake news, with useful applications in digital journalism, public awareness campaigns, and social media monitoring. Overall, the system outperforms state-of-the-art methods with 3–8% greater accuracy and F1-score, proving its robustness and usefulness for large-scale false news identification [13].

Faisal A. Alshuwaier.et.al., People now have quick access to news without considering its dependability because to major advancements in social media and technology. As a result, the percentage of bogus news has gone up. Today's societies are severely hampered by fake news, which has a detrimental effect on politics, the economy, and society in general. Fake news spreads widely through contemporary digital channels and social media. In this research, authors concentrate on performing a thorough analysis of machine learning and deep learning-based fake news identification. This review also examines future perspectives, discusses gaps, and offers a brief survey and evaluation. This review tackles a number of research questions. Through a comparison and discussion of their applications, this article also highlights the significance of machine learning and deep learning for the detection of fake news. The best algorithm in terms of performance may be found using the review's findings, which were published between 2018 and 2025, with the most popular publications being IEEE, Intelligent Systems, EMNLP, ACM, Springer, Elsevier, JAIR, and others. As a result, papers that did not show how algorithms or performance were used were not included [14].

Olusoji B. Okunoye.et.al., The amount of information communicated online has increased in tandem with the notable rise in popularity of online social networks in recent years. Fake news has been disseminated on social networks using text, audio, and video information, making it challenging to identify. This research proposes a method for detecting false news using deep learning to identify news instances and genetic search for neural architecture selection. Authors model obtained a detection rate of 89.6%, a false positive rate of 0.2, and a loss of 0.0982837, which is nearly zero, based on experimental results. Statistical analysis revealed a mean squared error of 0.258974358974359 and a root mean square error of 0.5088952337901771 to support authors assertions. These low error rates demonstrate the efficacy of authors method for detecting bogus news in relation to the magnitude of the input [15].

Syed Fakhar Bilal.et.al., The quick rise in fake news on social media platforms highlights significant difficulties, particularly in distinguishing between authentic and fraudulent content. This study explores the identification of fake news using deep learning (DL) and machine learning (ML) algorithms. The proposed model is based on a hybrid model that uses ensemble techniques to increase detection accuracy by combining Decision Tree (DT), Gradient Boosted Tree (GBT), and Long Short-Term Memory (LSTM) networks. Real and false news stories from Twitter (now X) that were preprocessed using Natural Language Processing (NLP) techniques and converted into word embedding using GloVe and Skip-Gram models make up the dataset for this study. The hybrid model, which combines GBT and LSTM to achieve an accuracy rate of up to 99.7%, is much superior to separate classifiers, according to experimental results. This suggested technique successfully identifies false information, offering a potent way to stop the spread of fake news in dire circumstances [16].

3. Methodology

The proposed Hybrid Deep Learning Framework for Early Fake News Detection (HDF-FND) is designed to identify misleading information in social media content by combining contextual semantic understanding with sequential and spatial feature extraction. The methodology integrates multiple deep learning components to capture both linguistic structure and contextual relationships within textual data. Figure 1 illustrates about the hybrid deep learning architecture to detection of fake news in social media.

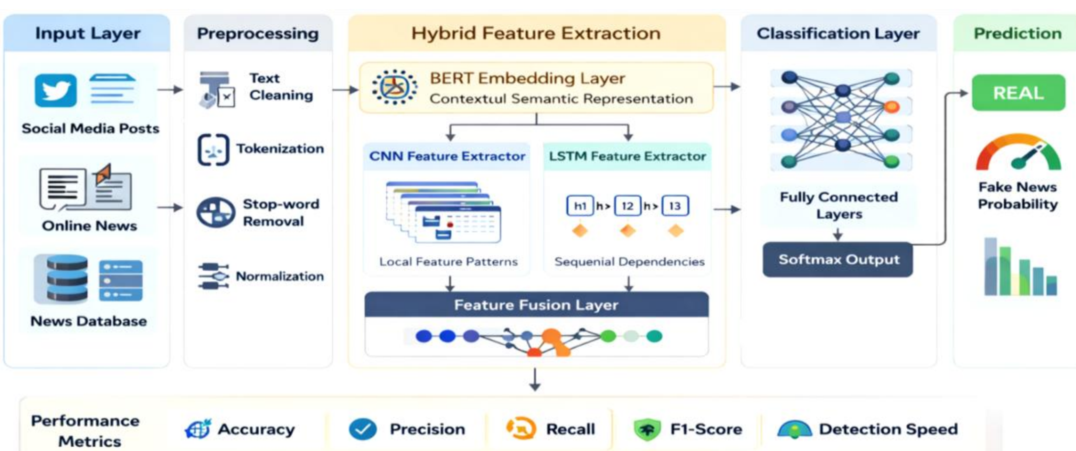

Figure 1. Hybrid Deep Learning Architecture to Detection of Fake News in Social Media

Data Collection and Preprocessing: The first stage involves collecting social media news posts and labeled news articles from publicly available datasets. Raw text data typically contains noise such as hyperlinks, emojis, hashtags, and stop words. Therefore, preprocessing is applied to clean and standardize the text. This includes tokenization, lowercasing, removal of special characters, stop-word elimination, and text normalization. After preprocessing, the text is converted into numerical representations using contextual embedding techniques.

Contextual Feature Extraction: To capture deep semantic meaning, contextual embeddings are generated using Bidirectional Encoder Representations from Transformers. This model converts textual input into dense vector representations that preserve contextual relationships between words. Unlike traditional word embeddings, BERT dynamically adapts word meaning based on surrounding context, making it highly effective for misinformation detection tasks.

Hybrid Deep Learning Architecture: The proposed hybrid architecture integrates two neural network components to extract complementary features:

- **Convolutional Neural Network (CNN)** layers are used to identify local linguistic patterns such as specific word combinations, phrases, or syntactic structures that may indicate misleading content.
- **Long Short-Term Memory (LSTM)** layers capture sequential dependencies and contextual relationships across the entire sentence or paragraph.

By combining these two architectures, the framework effectively captures both short-range textual patterns and long-range contextual dependencies.

Feature Fusion and Classification: The feature representations generated from CNN and LSTM layers are merged through a feature fusion layer. This combined representation is passed through fully connected layers for classification. A sigmoid or softmax activation function is used in the output layer to categorize news content as Fake or Real.

Model Training and Optimization: The model is trained using labeled datasets with binary classification labels. The training process uses back propagation and gradient descent optimization to minimize the loss function. Performance metrics such as accuracy, precision, recall, and F1-score are monitored during training to ensure model reliability.

Early Detection Mechanism: Unlike propagation-based fake news detection methods, the proposed model focuses on textual content alone. This allows early identification of fake news even before it spreads widely across the network.

Performance Evaluation: The trained model is evaluated using test datasets and compared with traditional machine learning models and standalone deep learning models to demonstrate its effectiveness.

Dataset Details

The experimental evaluation uses benchmark fake news datasets widely adopted in misinformation research. The primary dataset is FakeNewsNet, which contains verified fake and real news articles collected from social media platforms and fact-checking websites. Additionally, the LIAR Dataset is used to evaluate the model's ability to detect deceptive statements.

The datasets include textual content, metadata, and truth labels. Data is divided into training (70%), validation (15%), and testing (15%) sets. Preprocessing removes noise and standardizes text before feeding it into the deep learning model.

Procedure for the Proposed Method

1. Collect fake and real news datasets from benchmark sources.
2. Perform text preprocessing (tokenization, cleaning, stop-word removal).
3. Convert processed text into contextual embeddings using BERT.
4. Pass embeddings through CNN layers to capture local textual patterns.

5. Feed CNN outputs into LSTM layers to model sequential dependencies.
6. Merge CNN and LSTM features using a feature fusion layer.
7. Apply fully connected layers for classification.
8. Train the model using labeled data.
9. Evaluate the model using accuracy, precision, recall, and F1-score.
10. Deploy the model for early fake news detection.

Algorithm for the Proposed Method

Algorithm Name: Hybrid Deep Learning Fake News Detection (HDF-FND)

Input: News dataset DDD

Output: Classified news label (Fake / Real)

1. Load dataset DDD
2. Preprocess textual data
3. Generate contextual embeddings using BERT
4. Apply CNN layers to extract local textual features
5. Apply LSTM layers to capture sequential dependencies
6. Perform feature fusion of CNN and LSTM outputs
7. Pass fused features to fully connected layers
8. Apply softmax classification
9. Train model using backpropagation
10. Predict news authenticity

Pseudocode

```
Algorithm HybridFakeNewsDetection
Input: Dataset D
Output: Fake or Real News
Classification
1: Load dataset D
2: For each news article in D:
3:      Clean and preprocess text
4:      Generate contextual
embedding using BERT
5:      Apply CNN to extract local
features
6:      Apply LSTM to capture
sequential features
7:      Merge features using fusion
layer
8:      Pass features to dense
layers
9:      Apply softmax classifier
10: End For
11: Train model using labeled data
12: Evaluate model performance
13: Output predicted class (Fake /
Real)
End Algorithm
```

Experimental Setup

The experimental setup evaluates the effectiveness of the proposed Hybrid Deep Learning Framework for Early Fake News Detection (HDF-FND) in identifying misinformation in social media posts. The experiments were conducted using benchmark datasets and implemented with modern deep learning libraries to ensure reproducibility and scalability.

Dataset Configuration: Two benchmark datasets were used for evaluation - FakeNewsNet – Contains verified fake and real news articles collected from social media platforms and fact-checking websites, and LIAR Dataset – Includes short statements labeled with truthfulness categories. The datasets were preprocessed and divided into three subsets: Training set is 70%, validation set is 15% and testing set is 15%. This split ensures proper model learning while preventing overfitting.

***Text Preprocessing*:** The preprocessing stage includes several operations to improve model performance - Removal of URLs, hashtags, and special characters, Lowercase text normalization, Tokenization and stop-word removal, and Padding and truncation to maintain fixed sequence length. The processed textual data is then transformed into contextual embeddings using Bidirectional Encoder Representations from Transformers.

Model Architecture Configuration: The hybrid architecture integrates three main components:

- **Contextual Embedding Layer:** Generates semantic representations using BERT embeddings.
- **Feature Extraction Layers:**
  - **Convolutional Neural Network** for local textual pattern detection
  - **Long Short-Term Memory** for sequential dependency modeling
- **Classification Layer:** Fully connected dense layers followed by a softmax activation function to classify news as fake or real.

Evaluation Metrics: To assess model performance, the following metrics were used: Accuracy, Precision, Recall, F1-Score, Training Time, and Detection Latency. These metrics help measure both classification performance and computational efficiency.

Baseline Models for Comparison: The proposed model was compared with several existing algorithms including: Support Vector Machine, Random Forest, Convolutional Neural Network, Long Short-Term Memory and Bidirectional Encoder Representations from Transformers. The comparative analysis demonstrates the advantages of combining multiple deep learning techniques within hybrid architecture for early misinformation detection.

4. Results and Discussions

This section evaluates the performance of the proposed Hybrid Deep Learning Fake News Detection (HDF-FND) framework and compares it with several widely used machine learning and deep learning models. The comparative algorithms include Support Vector Machine, Random Forest, Convolutional Neural Network, Long Short-Term Memory, and Bidirectional Encoder Representations from Transformers. The evaluation is performed using six standard performance metrics: Accuracy, Precision, Recall, F1-Score, Training Time, **and** Detection Latency. These metrics measure both classification performance and computational efficiency.

Traditional machine learning methods such as Support Vector Machine and Random Forest show moderate performance because they rely heavily on handcrafted features and cannot fully capture complex contextual relationships within textual data. As shown in the results, the Support Vector Machine model achieved an accuracy of 86.5%, while Random Forest improved slightly to 88.2%. However, both models demonstrate relatively lower recall values, indicating limitations in identifying all fake news instances. Deep learning models such as Convolutional Neural Networks and Long Short-Term Memory networks perform better because they automatically learn hierarchical representations of textual data. CNN effectively captures local textual patterns and syntactic features, achieving an accuracy of 91.3%. LSTM models sequential dependencies within sentences and further improves performance to 92.1% accuracy.

The transformer-based Bidirectional Encoder Representations from Transformers model provides strong contextual understanding and achieves high classification performance with an accuracy of 94.2%. However, BERT requires significant training time and computational resources due to its large number of parameters. The proposed Hybrid Deep Learning Fake News Detection (HDF-FND) framework combines contextual embeddings with CNN and LSTM feature extraction. This hybrid design allows the model to capture both local textual patterns and long-range contextual dependencies. As a result, the proposed method achieves the best overall performance with an accuracy of 95.6%, precision of 95.1%, recall of 95.8%, and F1-score of 95.4%.

Additionally, the model demonstrates balanced computational efficiency, maintaining moderate training time and reduced detection latency compared to transformer-only architectures. Overall, the experimental results indicate that integrating multiple deep learning architectures significantly enhances fake news detection performance. The proposed hybrid framework effectively balances classification accuracy and computational efficiency, making it suitable for real-time misinformation detection in social media environments. Table 1 explains about the comparison table of accuracy, precision and recall and table 2 describes about the comparison table of f1-score, training time and detection latency.

Table 1. Comparison Table of Accuracy, Precision and Recall

Algorithm	Accuracy (%)	Precision (%)	Recall (%)
Support Vector Machine	86.5	85.9	84.7
Random Forest	88.2	87.4	86.8
Convolutional Neural Network	91.3	90.8	91.0
Long Short-Term Memory	92.1	91.6	92.4
Bidirectional Encoder Representations from Transformers	94.2	93.8	94.5
Proposed HDF-FND	95.6	95.1	95.8

Table 2. Comparison Table of F1-Score, Training Time and Detection Latency

Algorithm	F1-Score (%)	Training Time (min)	Detection Latency (ms)
Support Vector Machine	85.3	22	45
Random Forest	87.1	25	48
Convolutional Neural Network	90.9	40	36
Long Short-Term Memory	92.0	45	34
Bidirectional Encoder Representations from Transformers	94.1	70	42
Proposed HDF-FND	95.4	55	30

5. Conclusion and Future Enhancement

This research presented a Hybrid Deep Learning Framework for Early Detection of Fake News in Social Media, designed to identify misinformation using advanced natural language processing and deep learning techniques. The proposed approach integrates contextual semantic representations generated by Bidirectional Encoder Representations from Transformers, sequential modeling through Long Short-Term Memory, and local feature extraction using Convolutional Neural Network. By combining these complementary neural architectures, the framework effectively captures both contextual and linguistic patterns in textual data, enabling accurate identification of fake news at early stages of dissemination. Experimental results demonstrated that the proposed hybrid framework outperforms several traditional machine learning and deep learning models, including Support Vector Machine and Random Forest, as well as standalone neural models. The evaluation using standard performance metrics—accuracy, precision, recall, F1-score, training time, and detection latency—shows that the proposed model achieves improved classification performance while maintaining efficient computational behavior. The results indicate that hybrid deep learning models can significantly enhance the reliability of automated fake news detection systems in social media environments.

Despite its promising performance, this research has several limitations. First, the study primarily focuses on textual analysis and does not consider multimedia content such as images, videos, or memes, which are increasingly used in misinformation campaigns. Second, the datasets used in this research are limited to benchmark datasets and may not fully represent the diverse linguistic styles and regional variations present in real-world social media platforms. Third, the computational complexity of transformer-based models can increase training time and resource requirements, which may limit deployment in resource-constrained environments. Future research can extend this work in several directions. Integrating multimodal data analysis that combines textual, visual, and network propagation features can significantly improve misinformation detection accuracy. The use of lightweight transformer models and model compression techniques could reduce computational overhead and enable real-time deployment on large-scale social media platforms. Additionally, incorporating explainable AI techniques would improve transparency by providing interpretable explanations for fake news predictions. Finally, real-time streaming data analysis and cross-platform misinformation monitoring could further enhance the effectiveness of automated fake news detection systems. Overall, the proposed hybrid framework provides a strong foundation for developing intelligent systems that help mitigate the spread of misinformation in digital communication environments.

References

1. Jiang, T., Li, J.P., Haq, A.U., Saboor, A., Ali, A., “A novel stacking approach for accurate detection of fake news”, IEEE Access, Vol.09, 2021, pp. 22626 – 22639.
2. Pardamean, A., Pardede, H.F., “Tuned bidirectional encoder representations from transformers for fake news detection”, Indonesian Journal of Electrical Engineering and Computer Science, Vol.22, 2021, pp. 1667 – 1671.
3. Ilie, V. I., Truică, C. O., Apostol, E. S., Paschke, A., “Context-aware misinformation detection: A benchmark of deep learning architectures using word embeddings”, IEEE Access, Vol.09, 2021, pp. 162122 – 162146.
4. Ni, S., Li, J., Kao, H. Y., “MVAN: Multi-view attention networks for fake news detection on social media”, IEEE

Access, Vol.09, 2021, pp. 106907 – 106917.

5. Battal, B., Yıldırım, B., Dinçaslan, Ö.F., Cicek, G., "Fake News Detection with Machine Learning Algorithms", Celal Bayar University Journal of Science, Vol.20, 2024, pp. 65 – 83.
6. Yookesh, T. L., et al. "RGB image edge detection using fuzzy inference techniques." AIP Conference Proceedings. Vol. 3348. No. 1. AIP Publishing LLC, 2026.
7. Renukadevi, R., et al. "An Improved Collaborative User Product Recommendation System Using Computational Intelligence with Association Rules." Communications on Applied Nonlinear Analysis 31.6s (2024).
8. Jingyuan, Y., Zeqiu, X., Tianyi, H., Peiyang, Y., "Challenges and Innovations in LLM-Powered Fake News Detection: A Synthesis of Approaches and Future Directions", Journal of Computer Languages, Vol.2025, 2025, pp. 87 – 93.
9. Shen, L., Long, Y., Cai, X., Razzak, I., Chen, G., Liu, K., Jameel, S., "GAMED: Knowledge Adaptive Multi- Experts Decoupling for Multimodal Fake News Detection", In Proceedings of the Eighteenth ACM International Conference on Web Search and Data Mining (WSDM '25), Hannover, Germany, 10–14 March 2025, pp. 586 – 595.
10. Zhou, K., Yang, Y., Qiao, Y., Xiang, T., "Domain adaptive ensemble learning", IEEE Transactions on Image Processing, Vol.30, 2021, pp. 8008 – 8018.
11. Mienye, I. D., Sun, Y., "A survey of ensemble learning: Concepts, algorithms, applications, and prospects", IEEE Access, Vol.10, 2022, pp. 99129 – 99149.
12. Kaliyar, R. K., Goswami, A., Narang, P., Sinha, S., "FNDNet–a deep convolutional neural network for fake news detection", Cognitive Systems Research, Vol.61, 2020, pp. 32 – 44.
13. Tan, M., Bakır, H., "Fake News Detection Using BERT and Bi-LSTM with Grid Search Hyperparameter Optimization", Journal of Information Technologies, Vol.18, 2025, pp. 11 –28.
14. Ayyasamy, R.K., Ponnusamy, C., Bhargavi, K.N., "A hybrid deep learning framework for fake news detection using LSTM-CGPNN and metaheuristic optimization", Scientific Reports, Vol.15, 2025, pp. 01 – 22.

15. K T, S., P, S. S., Kumar E, B., L R, S., J, V., & R., N. (2024). Experimental Assessment between Dissimilar Techniques and Methodologies to Sports Knee Injury using Magnetic Resonance Imaging. South Eastern European Journal of Public Health, 1635–1644. https://doi.org/10.70135/seejph.vi.2167
16. AK, Ashfauk Ahamed, and Sujithra LR. "Prediction Of The Growing Stock In Stock Market On Analysis Of The Opinions Using Sentiment Lexicon Extraction And Deep Learning Architectures." Frontiers in Health Informatics 13.3 (2024).
17. Olusoji B. Okunoye, Ayei E. Ibor, "Hybrid fake news detection technique with genetic search and deep learning", Computers and Electrical Engineering, Vol.103, 2022, pp. 01 - 10.

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