*Grenze International Journal of Engineering and Technology, January Issue*

# Neural Network based Fake News Detection using NLP Technique

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***Abstract*— Although social media platforms let us consume news much more quickly and allow for less controlled editing, fake news is spreading incredible pace and faster. The world has been greatly impacted by fake news since it aims to impact crowd opinion and impact decisions in a specific direction.**

**The work and cost of manually confirming the legitimacy of news have attracted a lot of interest from researchers.**

**Therefore this paper presents, Neural network based Fake News detection using NLP technique. The suggested method is predicated on a Romanian news corpus that includes 13,064 fake and 25,841 real news items. NLP, or Natural language processing, is utilized in the data preparation process.**

**In this study uses the Domain Adversarial Neural Network (DANN) model for the detection of fake news. According to experimental data, the suggested model outperforms other deep learning models in terms of Precision, F1-Score, Recall and Accuracy.**

**By effectively identifying fake news, the negative impact of fake news on communities can be reduced by these achievements.**

***Keywords*— Fake news detection, Natural language processing, Domain Adversarial Neural Network (DANN).**

*Grenze ID: 01.GIJET.12.1.173_1*
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## I. INTRODUCTION

Due to the internet, news is now available in more quality and quantity than ever before, and consumer's accesses for managing their daily online information have changed. Young people, particularly those with limited experience, frequently use social media sites, mobile applications, or simple, dynamic websites to quickly and easily find the information they require [1].

Everyone has the chance to get involved in democratic elections and even change their opinions, mentalities due to the diversity of online news sources [2]. Personalized information can be created and misinformation campaigns can become more successful with the use of new technology and features that are available through social media platforms for spreading fake news on a large scale [3]. So that the public can be avoided by those want to change reality, reliable and credible sources of information are required [4].

Although fake news may be utilized as propaganda or misinformation, it always plays on people's emotions and seeks to provide logical responses, analyses, and comparisons of data from multiple sources. It also frequently inspires inflammation can readily give increase in partisan bias and conspiracy theories that have a negative effect on social security [5]. Fake news is a threat to democracy worldwide, which has damaged public trust in governments, media, and civil society. Due to the public's popularity on social media as well as other networks, by violent viewpoints, distortions, and conspiracy theories has become more and more prevalent [6].

One of the main issues of the present day is identifying and minimizing the effect of fake news, as well as this topic is receiving a lot of attention [7]. The task of determining the truth of assertions in news is known as automatic fake news identification. Since every member of society is significantly impacted by social media traditional news media on a social and political level, this is a new important NLP problem. For example, Exposure to fake news can result in attitudes toward specific political candidates that are cynicism, alienating, and ineffective [8]. For the NLP community, identifying fake news is critical because it has wider implications for that technologies may help the truth of claims while educating the public [9]. In order to help us to stop spreading fake information, automatic fake news identification aims to retain human time. The challenge of detection of fake news is examined from number of perspectives as computer science subfields including Machine learning (ML), Data mining (DM), and NLP have developed [10]. In computer science, ML help to develop adaptive systems that can learn from training data. ML contains many types, like reinforcement, unsupervised, semi-supervised and supervised learning [11]. Preparing the training and test sets of data is typically initial step in creating ML model. Training data is used to instruct machine learning. Using the test data, the users evaluate ML which has been trained [12].

Information from one domain can be learned and used to learn in another, which is an effective way to create an adaptive model across different media platforms. Out-of-distribution generalization includes domain adaptation, which addresses generalization outside training distribution. Therefore, domain invariant feature representations are learned through the use of Domain Adversaries. In order to generate a similar feature distribution in source as well as target domains, DANN uses the gradient reversal layer [13]. Due to user activity, social media platforms have multiple methods of distributing data; data from different platforms comes from different domains.

The DANN-based framework is known as regular black-box system, this should be noted in addition to the outcome. Considering the numerous attempts to develop ML-based frameworks to identify false news, this limited work has gone into giving more detailed explanations than the decision made in a black-box. In order to make depended on generalized detector for false information on social media, the target labels need to include explanations. Therefore, they use a DANN and utilize it in study to identify fake news.

The following is the paper is structured: The literature survey represented in Section II. Section III explains the described methodology Neural network based Fake News detection using NLP technique. The detailed comparative results and analysis are explored in Section IV. Section V concludes the paper.

## II. LITERATURE SURVEY

M. Umer, Z. Imtiaz, G. S. Choi S. Ullah, B. W. On, and A. Mehmood, et. al. [14] presents hybrid model which integrates Principle Component Analysis (PCA) and neural network architecture as well as Chi-Square, with two different measures minimization techniques, to combine strengths of CNN (Convolutional Neural Network) as well as LSTM (Long Short-Term Memory). So, lower feature dimension vectors sending earlier to the classifier, this work proposes to use dimensionality reduction techniques. According to the experimental data, PCA performs with 97.8% accuracy higher Chi-square and new techniques. L. Sun and H. Wang, et. al. [15], With a focus towards those problems, this study offers a topic-aware, heterogeneous graph-based framework for Fake news detection (FND). It enhances its discriminating ability by examining the news concepts impact FND. The

fake news detector in described model completely utilizes three categories of information: news topics and external knowledge (Wikipedia) by introducing semantically improved topic node information. As such, it enhances the execution of false news identification more effectively.

M. Kang, H. Lim, J. Seo and C. Park et. al. [16] suggested fake news detection algorithm which creates extensive using of the user graphical representation in Korean false news as well as techniques to construct datasets. Furthermore, a training approach based on comparison and ablation studies was presented for user graph in Korean fake news identification. The results of the experiment demonstrated that K-FANG (Korean False News based on Grapgh) performed better at identifying fake news than the baseline. Finally, by increasing its class and resolving the class imbalance problems, the validity of utilizing stance information was also confirmed. The study's conclusions about using user data to identify fake news were useful.

M. R. Talib, M. U. Sarwar, M. K. Hanif and K. Zaheer et. al. [17] the examines a new model known as the Multi-Kernel optimized convolutional neural network (MOCNN) and proposes three-level methodology to determine the ability it is detecting fake news. Using the grid search technique, parameters are optimized in this system. Described suggested model obtains, on Urdu Fake News (UFN) as well as Bend the Truth (BET), 85.8%, 68.2% accuracy 85.8% and 67.7% F1-measure, respectively. A. Bouras, J. Al-Muhtadi, A. Derhab, W. Halboob, M. Belaoued, and N. Seddari, et. al. [18] novel hybrid system for detecting fake news uses two different types of features are to combine the advantages of knowledge-based and linguistic techniques. 94.4% accuracy might be attained by the proposed approach that makes use of both types of features, the results of analysis on a fake news dataset shows that this approach performs better than achieved by using linguistic as well as fact-verification features independently.

O. Ouda, E. El-Daydamony, A. Atwan, M. M. Elmogy, and E. Elsaeed, et. al. [19] presents a framework that uses a set of voting classifiers, feature extraction and selection algorithms, other techniques to FND. The suggested method separates real information from fake news. 94.6% accuracy was achieved by system on Fake-or-Real dataset. The accuracy rate of the method was 92.3% for Media-Eval dataset. The results of the experiment demonstrate that the suggested framework operates more accurately than the previous works. D. Jung, E. Kim and Y. S. Cho, et. al. [20] Through analyzing diffusion patterns for both users and source news in social networks, shows a Topological and Sequential Neural Network (TSNN) model. The results on PolitiFact show 92.15%,92.11% accuracy and F1-score respectively, whereas on GossipCop, the results show 97.91% accuracy as well as 97.88% F1-score. The results confirm described model as a state-of-the-art approach is to fake news identification by showing it to perform significantly better than other baselines.

S. H. Alsamhi, A. Alharbi and H. Saleh, et. al. [21] provide Optimized Convolutional Neural Network model for FND. The techniques of hyperopt optimization and grid search are applied to optimize different alogrithms. When compared to other models, the results demonstrate that OPCNN-FAKE (Optimized Convolutional Neural Network for Fake News Detection) system shows better results for every dataset. Q. Liao, et. al. [22] Based on the observations, they offer novel fake news detection multi-task learning (FDML) model: 1) There are topics where the percentage of fake news is higher; 2) There are some authors who give more objectives of producing false news. On a dataset of real-world fake news, these systems demonstrate

*A. FDML system works better than novel methods*

M. Narra., et. al. [23] analyzes various subset feature selection methods are affect the false news detection algorithms performance. Feature selection with ML and pre-trained DL system is explored through PCA as well as Chi-square. Comprehensive experiments have demonstrated that the extra tree classifier works better with an accuracy of 0.9474. X. Dong, L. Qian, and U. Victor et. al. [24], Two-path deep Semisupervised learning (SSL) is a novel framework that is suggested, with one path being utilized for supervised and other unsupervised learning. Two paths developed by CNNs are cooperatively improved for SSL. Test results show that that relatively little labeled data, the model based on the suggested framework is capable of accurately identifying fake news. Ying.L, Yu. H, Wang. J, Ji. Y and Qian. S, et. al. [25] obtaining and combine post representations shared by latent topics together with global properties of latent topics are to create a novel end-to-end Multi-Modal topic memory network (MTMN) models intra-modality and inter-modality information in a single framework. MTMN compared with other state-of-the-art algorithms, according to extensive testing on two publicly available real-world datasets.

In [26], the selection of optimal features is done by integrating the 5 different meta-heuristic search methods with correlation-based feature selection (CFS) method. These meta-heuristic methods are Multi-object evolutionary search (MOES), Harmony search (HS), Genetic search (GS), particle swarm optimization search (PSOS) and Evolutionary search (ES). In order to improve the performance of classification, majority voting mechanism based ensemble model proposed and it is named as CFS-MOES (correlation-based feature

selection—multiobject evolutionary search). Results are obtained for breast cancer as 98.83% of accuracy and for cervical cancer as 98.79%.
In [27] presents information about cancer and its related classification model analysis with feature selection and microarray data. Because of its small sample size and large number of attributes, microarray data classification is very difficult which influence the performance. Redundant and irrelevant data is combined in microarray genes, which results the less performance analysis in classification. Machine learning techniques are most recommended models which improves the performance in extracting the important features from gene expression data. In [28] proposes coronary heart disease prediction model named as Accuracy-Based Stacked Ensemble Learning (AB-SEL) Model which reduces the computational time. In order to identify the relevant features, Logistic Regression Recursive Feature Elimination (LR-RFE) method is utilized. Machine-learning Ensemble models are created by utilizing AdaBoost, RF, LR classifiers. Results revealed that, Accuracy of model is 90.16% and computational size as 0.2 seconds.

## III. Neural Network based Fake News Detection using NLP Technique

The block diagram of Neural network based Fake News detection using NLP technique is represented in below Figure 1. Between 2016 and 2021, they gathered a dataset of real and fake news from Romania. 25,841 Real or True news items make up this dataset, which was gathered by hand from official Romanian sources. 13,064 fake news items are also included in the dataset; these were automatically retrieved from Romanian internet platforms.

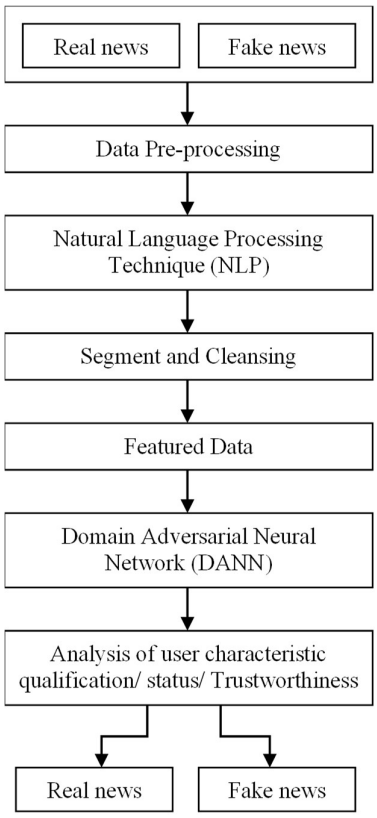


Figure 1. Block diagram of Fake news detection model

Preparing the data is an essential step before using neural network architectures and machine learning techniques. Python packages like Pandas and NumPy were used to remove Hypertext Markup Language (HTML) tags as Romanian stop words and punctuation marks like "!", "?", and "-" from phrases like "acea," "apoi," and "atare". To generate simple, complete, consistent datasets reduce noisy data, pre-processing was used. In order to lower the possibility of under fitting or over fitting, this paper suggests a system that takes pre-processed news as input does several analysis and transformations.

An essential tool for data preparation is NLP, which focuses on human-computer interaction. Large-scale NLP and analysis can be achieved with NLP. Word segmentation, data cleansing, feature extraction, word indexing, word embedding, and word stopping are all achieved through NLP. Word segmentation is the process of removing individual words from words while maintaining their correct meaning by using a dictionary database. The information retrieval method then provides data to the feature extraction by sending each user's query to a web crawler they can find relevant news content on the Internet. The news contents are retrieved by the query process, which then forwards them to the data preparation phase for transformation into featured data vectors. For the Domain Adversarial Neural Network (DANN) model, the featured data will be utilized.

The trained as well as tested data sets are comparable from various distributions in DANN representation learning approaches. The main inspiration behind DANN's operation is that predictions need to be based on overlapping features will ensure effective domain transfer. Therefore, network is unable to differentiate between the domains used for training (source) and testing (target). As a result, while utilizing DANN, a labeled source domain data set is needed rather than a labeled target domain dataset. The domain classifier, label predictor, and feature extractor make up the three main parts of the DANN architecture. A deep neural network is used in feature extractor to carry out feature learning. The training data sample's class label is classified using a standard feed-forward neural architecture. Finally, Gradient Reversal Layer (GRL) connects domain classifier to feature extractor, allowing the unsupervised nature of DANN.

The effectiveness of Domain adaptation method was evaluated by the application of an extensive testing methodology. The "With DANN" and "Without DANN" comparison would enable they to show that the effective approach is compared to normal unsupervised procedures. Metrics like F1 score, Accuracy, Precision, and Recall are utilized in evaluation.

## IV. Result Analysis

In order to build a system for detecting fake news, they must first gather data to train a neural network. To cover the news domain, they require data in a large number. Between 2016 and 2021, they collected news from Romania that was both real and fake. The suggested method is predicated on a Romanian news corpus that comprises 13,064 false and 25,841 real news items. The results are in terms of recall, accuracy, precision, and F1-score. These equations are used to calculate these measures.

### *A. Accuracy*

Correct predictions divided by the total number of samples is the measure of accuracy.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \qquad (1)$$

### *B. Precision*

The proportion of true false news that model identified to all news that it identified as fake. Equation (2) can be used to express precision in terms of TP and FP.

$$Precision = \frac{TP}{TP + FP} \qquad (2)$$

### *C. Recall*

The proportion of actual fake news that model identified to all of the fake news in dataset. Equation (3) can be used to develop recall (r) in terms of True positives (TP) and False negatives (FN).

$$Recall = \frac{TP}{TP + FN} \qquad (3)$$

### *D. F1-Score*

$$F1 - Score = 2 * \frac{Precision * Recall}{Precision + Recall} \qquad (4)$$

Where TN represents True Negative outcomes, FN represents False Negative outcomes, and FP stands for False Positive and TP for True Positive outcomes.

Table 1 compares the performance of the described Neural network-based Fake News detection using NLP (ADNN+NLP) (Domain Adversarial Neural Network+ Natural Language Processing) with that of unsupervised models (Deep Belief Network (DBN), K-means clustering algorithm).

TABLE I. COMPARATIVE PERFORMANCE ANALYSIS

| Models | Accuracy | Precision | Recall | F1-Score |
|---|---|---|---|---|
| Deep Belief Network (DBN) | 89 | 90 | 88 | 90 |
| K-means clustering algorithm | 91 | 90 | 89 | 91 |
| ADNN+NLP | 98 | 97 | 97 | 98 |

Below Fig. 2 represents the comparative analysis of described Neural network based Fake News detection using NLP technique (ADNN+NLP), and fake news detection using DBN and K-means clustering in terms of Accuracy and Precision parameters. In this graph, X-axis represents the models and Y-axis represents the percentage values. Results states that, Accuracy and Precision of described prediction model (ADNN+NLP) are high compared to other models.

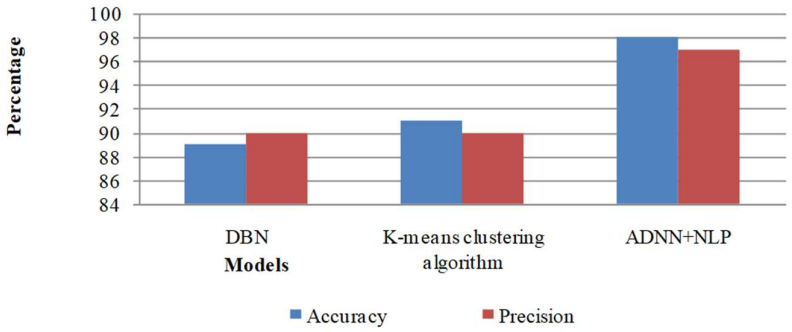


Figure 2. Comparative Accuracy and Precision analysis

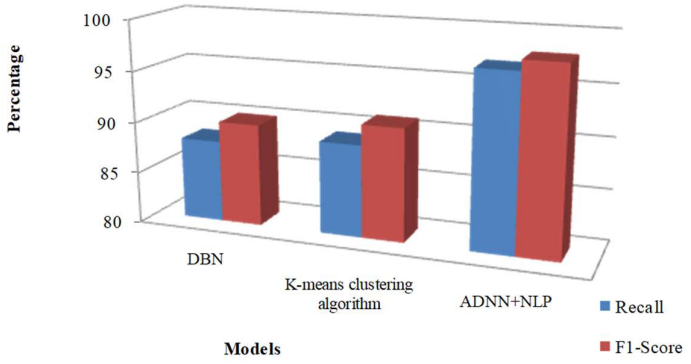


Figure 3. Comparative Recall and F1-Score analysis

Described Neural network based Fake News detection using NLP technique (ADNN+NLP), and fake news detection using DBN and K-means clustering models comparative graphical representation of Recall and F1-Score parameters is shown in above Fig. 3. In this graph, X-axis represents the models and Y-axis represents the percentage values. From graph it is clear that, Recall and F1-Score parameter values are high compared to other models as Deep Belief Network (DBN), K-means clustering algorithm.

From overall results it is clear that, described prediction model of Neural network based Fake News detection using NLP technique (ADNN+NLP) is more efficient than other models. Obtained values are Accuracy as 98%, Precision as 97%, Recall as 97% and F1-Score as 98%.

## V. CONCLUSION

In this paper, Neural network based Fake News detection using NLP technique is described. One major issue facing society is fake news. It is necessary for FND and put an end to its spread before it keeps damaging a country. The suggested method is predicated on a Romanian news corpus that includes 13,064 fake and 25,841 true news items. In the data preparation process, Natural language processing (NLP) is used. Domain Adversarial Neural Network (DANN) model is utilized in this system for fake news detection. The proposed model's result is evaluated using four evaluation metrics: recall, F1-score, precision, as well as accuracy. From

overall results, described prediction model of Neural network based Fake News detection using NLP technique (ADNN+NLP) is more efficient than Deep Belief Network (DBN) and K-means clustering algorithm. Obtained values for proposed system are Accuracy as 98%, Precision as 97%, Recall as 97% and F1-Score as 98%.

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