



## Fake News Detection Using MultiChannel Deep Neural Networks

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### ABSTRACT

Fake news has become a pervasive issue in today's digital age, posing significant challenges to information integrity and trustworthiness. In this study, we propose a novel approach for the detection of fake news using MultiChannel Deep Neural Networks (MC-DNNs). Our research aims to address the limitations of traditional fake news detection methods by leveraging the power of deep learning and multiple data sources.

## INTRODUCTION

The advent of deep learning has revolutionized the field of natural language processing and computer vision, offering powerful tools for analyzing and understanding complex data. In recent years, researchers have turned to deep neural networks as a promising avenue for fake news detection, harnessing their capacity to process vast amounts of information and discern intricate patterns that might elude traditional methods. However, while these approaches have shown promise, they often focus on single-source data, such as textual content alone, which can be limiting given the multifaceted nature of fake news.

This paper presents a novel approach to fake news detection, leveraging the capabilities of MultiChannel Deep Neural Networks (MC-DNNs). Unlike single-channel models, MC-DNNs incorporate multiple data sources, including text, images, and temporal features, to create a comprehensive and robust framework for discerning fake news. By amalgamating these disparate channels of information, we aim to enhance the accuracy and reliability of fake news detection models while capturing a more holistic understanding of the complex dynamics that underlie the dissemination of misinformation.

## THEORETICAL REVIEW

### 2.1 Application

The application of Fake News Detection Using Multi-Channel Deep Neural Networks is of significant importance in addressing the proliferation of false or misleading information in the digital age. Multi-channel deep neural networks leverage various data sources and techniques to enhance the accuracy and robustness of fake news detection. Here are some practical applications of this technology:

#### 1. Social Media Monitoring:

##### **Methods for Detecting and Identifying Fake News**

The rising global adoption and use of social media platforms has created an environment that is conducive to the spread of online false news in a more efficient manner. There is a flood of information on social media platforms that is large, diversified, and heterogeneous (it includes both genuine and incorrect information), and this information travels fast, having a tremendous influence on the whole community. The outcome has been the collaboration of a large number of academics and technology behemoths in the identification of false news on the internet. Because of the advent of big data and the availability of a large number of user-generated data, deep-level features have started to take the role of feature extractors in traditional automated rumor detection systems. This is due to the availability of vast amounts of user-generated data. This section presents several cutting-edge research on fake news detection, all of which come under the larger umbrella of the content and social context of the news item under investigation.

Figure 4 shows the detail of fake news detection techniques.

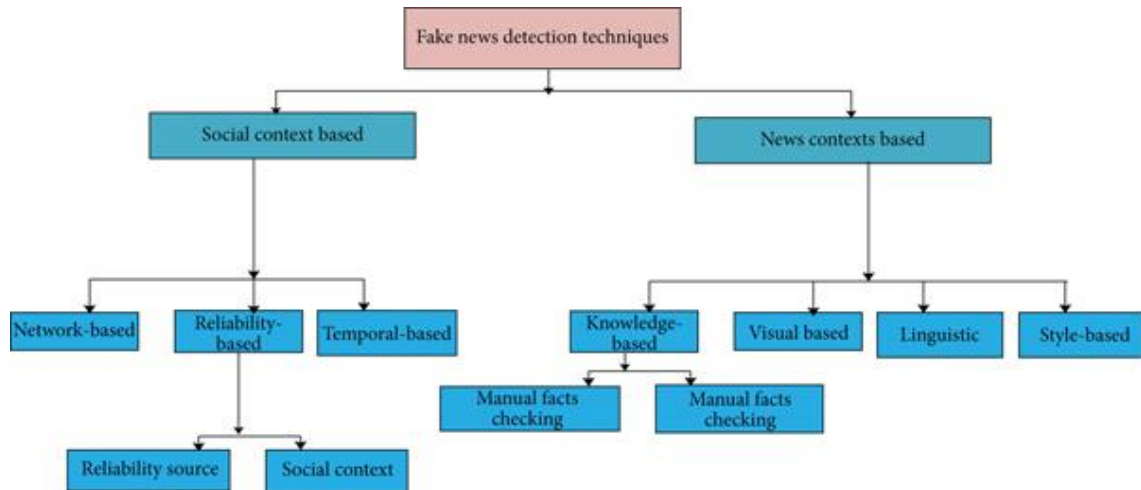


Figure 4.  
Fake news detection techniques

Social media platforms are a primary source of fake news dissemination. Multi-channel deep neural networks can be used to continuously monitor social media feeds and identify potentially false information in real-time.

## 2. News Aggregator and Recommender Systems:

- News aggregators and recommender systems can utilize multi-channel deep neural networks to filter out fake news articles and provide users with reliable and trustworthy news sources and recommendations.

## 3. Content Moderation:

- Online platforms can employ these networks to automatically detect and flag fake news content, thereby reducing its spread and impact on users.

### 3.1. Content-Based

Using the content of the article [11], the content-based fake news recognition approach attempts to identify fake news by examining either the text or the images inside the news piece or all of these elements. To automatically identify false news, researchers often depend on either latent [3, 15, 22, 32, 39] or hand-crafted [28] aspects of the material.

#### 3.1.1. Knowledge-Based

To validate the authenticity of a given claim, knowledge-based systems use the fact-checking method, in which the supplied claim is checked against information obtained from external sources. Manual fact-checking approaches (using experts or crowdsourcing) and automated fact-checking techniques (using artificial intelligence) are already available.

(1) Manual Fact-Checking. There are two types of manual fact-checking: (a) expert-based and (b) crowdsourced. Expert-based methods are methods based on experts use an expert-oriented strategy and rely on human professionals who are educated in certain fields to make judgments to be effective. To combat misinformation, "fact-checking websites such as Snopes and PolitiFact use an approach known as fact-checking. Their reliability is certain, but they require a significant amount of time and do not scale well with the tremendous amount of information

available on social media.” The benchmark datasets LIAR and FakeNewsNet, as well as other datasets provided on this page, are used by many academics to generate their research datasets. Crowdsourced is as follows: When using crowdsourced methodologies, the “wisdom of the crowd” may be used to verify the veracity of news items. Fiskkit, which gives a place for individuals to debate key news items and determine their veracity, uses a similar strategy to get their message out. Crowdsourced fact-checking is less reliable than fact-checking conducted by experts, more difficult to administer, and biased and includes inconsistent annotations. In exchange for these time savings, it provides more scalability. CREDBANK is a widely accessible large-scale benchmark fake news dataset that has been annotated by fact-checkers and is intended for use by anybody. Users who are not trustworthy must be screened out of datasets prepared using this method, and conflicting annotations must be addressed before the datasets may be used. The creation of comparable datasets and the annotation of those datasets may also be accomplished via the use of crowdsourcing platforms such as Amazon Mechanical Turk (AMT).

(2) Automatic Fact-Checking. Consequently, automated fact-checking methods have been developed to solve the problem of manual fact-checking not scaling well with a large amount of data, particularly those created via the usage of social media. These techniques depend heavily on natural language processing (NLP), data mining, machine learning (ML), network/graph theory approaches, and many others, rather than on human brains. In general, there are two stages to the automatic fact-checking process: (1) fact extraction, which is concerned with the collection of facts and the creation of a knowledge base, and (2) fact-checking, which is concerned with determining the authenticity of news articles by comparing them to the information contained in the knowledge base. It checks if a given claim is genuine or untrue using open web sources and a knowledge base/graph. Regarding false news identification, real-world datasets are often insufficiently organized, unlabeled, and noisy [29], making automated detection a challenging task.

### 3.1.2. Style-Based

False news may be identified using a style-based technique, which is similar to the approach used for knowledge-based false news identification. The aim of the writer to deceive the audience is assessed using this method, rather than the legitimacy of the news material itself. In most cases, fake news providers are motivated by a desire to exert influence over large groups of people by disseminating inaccurate and misleading information. The names are usually all capitalized to make them catchy, and there are substantially more proper nouns and fewer stop words to make them catchy. To detect fake news, style-based techniques capture the qualities of writing styles that separate genuine users from anomalous ones. As part of the investigation into fake news, Hoy and Koulouri examine the writing style of hyperpartisan news. The most significant contribution of is the detection of stylistic deceit in written materials.

### 1.3. Linguistic-Based

Varma et al. presented a total of twenty-six lexicon textual characteristics for consideration. Several researchers provided an improved collection of linguistic criteria to distinguish between bogus and legitimate news. A model for social article fusion (SAF) was developed by that includes social engagement factors in addition to linguistic elements. Preston et al. offer a model that incorporates network account features in addition to linguistic features. To discriminate between true and fraudulent news information, the authors have employed linguistic characteristics, as well as

syntactic and semantic elements, to make their determination. Azad et al. provide a model for detecting false news with varying durations of news claims by using several versions of word embedding techniques. Guimarães et al. examine a particular news item's lexicon, syntax, semantics, and discourse levels, as well as its grammatical structure. By conducting dependency parsing at the sentence level, the hierarchical structure learning method proposed by develops a hierarchical structure for a given text. Even though this strategy is effective in a variety of settings, it encounters difficulties in identifying disinformation on popular social media platforms, where messages are brief and, as a result, the linguistic elements collected from them are frequently insufficient for machine learning algorithms to make accurate predictions. These algorithms are also unable to distinguish between fake news that consists only of images or videos, rather than written content and legitimate news that does not include textual content

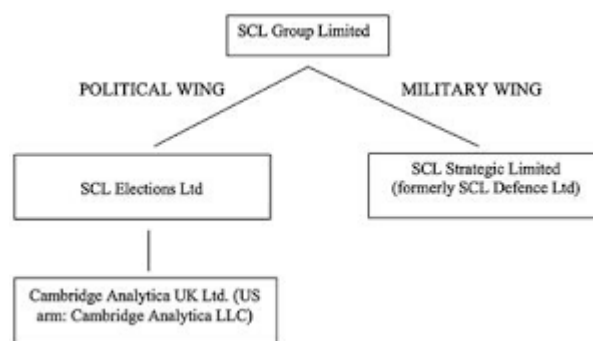
### 3.1.4. Visual-Based

Due to the widespread belief that visual material may increase the credibility of a news article, fake news producers routinely use contentious graphic imagery to attract and mislead visitors. Orabi et al. collect a large number of visual and statistical picture features for news credibility from a range of photographs using a statistical modeling approach. The verifying multimedia use task of the MediaEval-16 benchmark is concerned with the difficulty of distinguishing between images that have been digitally altered and those that have not (tampered with).

#### 4. Fact-Checking Services:

Fact-checking organizations can benefit from multi-channel deep neural networks to automate the process of verifying claims and statements made in news articles and online content.

#### 5. Political Campaigns and Elections:



## METHODS

In this section, we present the methodology employed to develop and implement our MultiChannel Deep Neural Network (MC-DNN) for fake news detection. The methodology encompasses data collection, preprocessing, model architecture, training, and evaluation.

### 1. Data Collection and Preprocessing

#### 1.1. Dataset Selection:

We describe the sources of our dataset, including real news articles and fake news samples. We also specify any criteria used for data selection.

### 1.2. Data Preprocessing:

We outline the steps taken to clean and prepare the dataset, including text cleaning, image processing, and temporal data normalization.

## 2. Multichannel Model Architecture

2.1. Textual Channel: We detail the architecture of the textual processing component, which includes tokenization, word embedding, and recurrent neural networks (RNNs) for sequential data analysis.

2.2. Visual Channel: We describe the architecture used for image analysis, including convolutional neural networks (CNNs) and feature extraction from images.

2.3. Temporal Channel: We explain how temporal features are extracted from the dataset, including timestamps and patterns of news dissemination.

2.4. Feature Fusion: We discuss the methods used to integrate information from the three channels, emphasizing the importance of feature fusion in achieving comprehensive fake news detection.

## 3. Training and Optimization

3.1. Model Training: We provide details about the training process, including loss functions, optimizers, and batch sizes used for each channel.

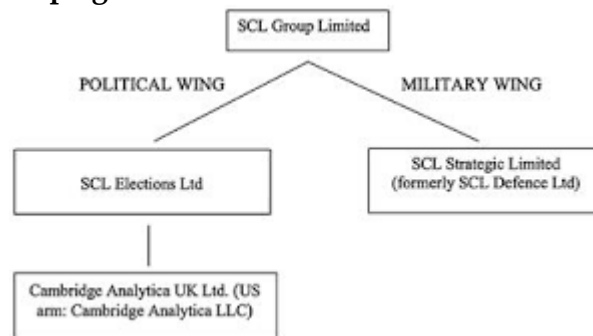
3.2. Hyperparameter Tuning: We discuss the process of hyperparameter optimization, such as learning rates, dropout rates, and batch normalization, to enhance model performance.

## 4. Evaluation Metrics

4.1. Performance Metrics: We specify the metrics used to evaluate the MC-DNN model, including accuracy, precision, recall, F1-score, and ROC-AUC.

4.2. Cross-Validation: We explain how cross-validation was conducted to ensure the robustness of our model's performance.

## 5. Political Campaigns and Elections:



## RESULT & DISCUSSION

### Fake news in the 2018 Italian general election

According to several journalistic<sup>4</sup> and institutional<sup>5</sup> sources, the campaign period leading to the 2018 Italian general election saw a remarkable spread of ‘fake news’. Such misinformation had the common feature of being intentionally fabricated

and published on social media non-institutional outlets. While not all fake news stories had a politically-charged content, those with a clear political target were highly diffused and had the highest reach.

By tracking a set of politically-charged keywords via a content analysis tool, an Italian news channel<sup>6</sup> reported that among the top 100 articles in Italian for social media engagement, five were hoaxes, while another ten were classified as reporting real events but out of context or omitting relevant details. While few in number, these hoaxes had a significant outreach. The second-most shared online news in the database, published on the day before the election, received more than 140,000 interactions, mostly on Facebook. The news consisted of an entirely unsubstantiated report of voter fraud planned by the incumbent Democratic Party in Sicily.

‘Purely false’ news, as the latter example, and non-traditional information sources have a predominantly ‘anti-establishment’ (and, by extension, ‘anti-incumbent’) character. The report by [Giglietto et al. \(2018\)](#) provides a detailed classification of news sources in the lead-up to 2018 general election based on partisanship of their news content and evidences that the vast majority of ‘non-institutional’ websites are biased in favour of Lega and M5s. Crucially, comparable biased sources supporting other parties (including smaller ‘anti-establishment’ ones) captured much less social media attention than pro-M5s and Lega sources. The report stops short of establishing a link between the spread of false information in the electorate and the support for Italian populist parties and their policy stances. Nonetheless, an investigation by [Avaaz<sup>7</sup>](#) provides evidence in support of this link, at least as far as Facebook is concerned.

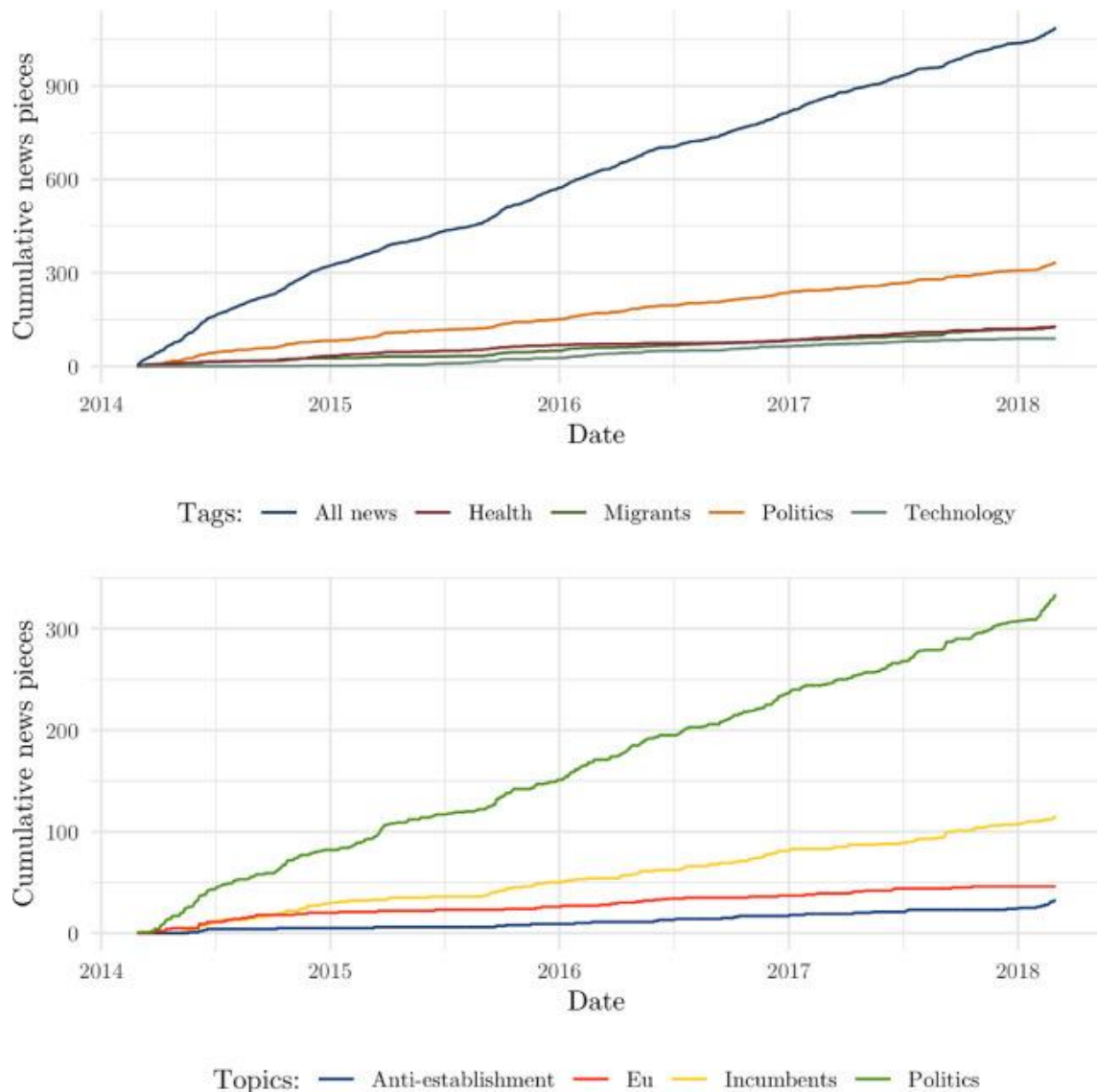


Fig. 1. Cumulative growth of fake news pieces reported by debunking websites between 2013 and 2018 by tags and topic.

During election campaigns, multi-channel deep neural networks can help identify and combat the spread of fake news and misinformation targeting candidates or political issues.

### CONCLUSIONS AND RECOMMENDATIONS

As industrial development increases, automation and processes generate more data and information and require analysis, interpretation and communication. Therefore, this study has demonstrated the application of machine learning techniques in the analysis of real data and the development of predictive models. As a result of the study, it has been shown that it is possible to predict the photovoltaic power of the three systems studied by means of regression models established with an excellent approximation.

The importance of monitoring the variables by means of the measurement sensors has allowed us to obtain adequate control of the photovoltaic system. The application of a fault detection strategy has been demonstrated through predictive model techniques in PV systems, in such a way that it allows us to monitor PV systems by comparing the PV power generated in real time with the calculated values

based on the meteorological variables of radiation and temperature. Correlation coefficients of 83.27%, 82.36% and 85.76% have been obtained in the model results for the PVS1, PVS2 and PVS3 systems, respectively. With which a range of 20% has been established that allows the comparison of the calculation values with the values measured in real time.

The equations of the temperature measurement model and radiation measurement limit also allow us to monitor the behavior of the sensors and rule out possible measurement errors as a function of time. In this way, an additional means of monitoring and control of the equations using these parameters is obtained. The implementation of the prediction models of the PV systems in the SCADA allows the monitoring of the electrical system operator in an optimal way. Finally, the importance of the application of machine learning techniques and its wide variety in development in the field of energy management and its importance in smart grids was demonstrated

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