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Arabic Fake News Detection Techniques: A Review

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Abstract

People are efficient on websites and social media platforms for news and updates as their popularity has grown. Even official media outlets to publish news use social media networks. However, due to the massive volume of user-generated material, verifying the veracity of the presented information is necessary. To handle the large volume of posts being made, this procedure should be implemented automatically and effectively. Fake news detection (FND) estimates the chance that a certain news story (news report, editorial, expose, and the like) is purposefully misleading. Over the past ten years, there has been an increase in interest in Arabic FND, and several detection techniques have shown some promise in identifying fake news across various datasets. This paper provides an overview of the fake news definition, consequences, detection strategies, and datasets that are utilized for detecting Arabic fake news. The design of Arabic FND systems is mainly based on two methods. The first one uses machine learning (ML) methods that rely on manually produced statistical data extracted from the text and used as a feature to distinguish between real and fake news. In the second strategy, "end-to-end" systems for detection are created using deep learning (DL) approaches. The investigation conducted in this paper may help researchers understand the advantages and uses of Arabic FND systems to develop more efficient algorithms in this field.

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1 Introduction

Due to the vast amount of information, it includes about people, events, and ideas, online news on the Internet or social media platforms is a crucial source of information for individuals when making decisions. However, when consumers use the Internet to get information for making decisions, they will face considerable difficulties due to fake news. This is due to the greatest influence on public beliefs, interests, and even decisions through altering how individuals connect with actual information [1]. Accessing operations for online news sites and social media platforms has become highly simple. It is now quite simple for anyone to write, distribute, and publish news on any subject. Sadly, there are drawbacks to having easy and unrestricted access to social media. Numerous people spread false and misleading news, which harms society [2].

Regardless of how the news is spread, through social media or internet websites, identifying false news is the first step in either preventing or at the very least minimizing its potentially damaging impacts on people, businesses, and governments. Most fake news detection (FND) research relies on machine learning (ML) methods [3]. These methods are of the feature-based type since they require the identification and selection of features that may be used to determine if a piece of information or text is fake. The chosen ML model is then given these attributes to classify the data. Deep learning (DL) models have lately demonstrated effectiveness in text categorization tasks and fake news identification across a variety of languages. They have the benefit of being able to automatically

change their internal settings until they figure out the appropriate features to distinguish between various labels on their own [3,4].

The issue with fake news identification is that both actual news pieces and false news articles must be included in substantial and reliable benchmark datasets for the effort to be successful. Following the creation of these databases, researchers may begin to discover diagnostic characteristics that separate fake news pieces from legitimate news stories [5]. Research in the English-speaking world has gathered swiftly with years of access to reliable datasets and a steady stream of discovering diagnostic traits across a wide range of linguistic factors. Several research works have been published on the FND survey [6,7]. According to our analysis, previous studies do not give a comprehensive overview of DL-based architectures for identifying fake news. The ML tactics for detecting fake news are mostly covered in the survey articles currently available, with less attention being given to DL strategies [8,9].

In the same context, the previous surveys reviewed the recommended solutions. However, this survey offers several factors that must be taken into account before constructing an efficient solution.

The research objectives relating to this paper thereby are:

1. To clarify the problem definition by explaining different types of fake information (e.g., fake news, rumor, clickbait, satire, and hoax)
2. To list the fake news consequences in different fields
3. To provide a comprehensive overview of Arabic FND techniques
4. To list the available Arabic datasets for the FND task

However, due to limited Arabic fake news benchmark datasets and the fact that the Arabic language has several dialects, some of which are extremely distinct from each other, research on this topic has lagged in the Arabic-speaking world. As a result, articles about spotting fake news on Arabic forums are not highly prevalent [6]. To our knowledge, there are no FND survey papers for Arabic language published previously. Table 1 provides a brief overview of some English survey papers and our research contributions. The present study aims to provide a clear definition of the FND problem, clarify its consequences on society, and address the previous research's weaknesses and strengths by conducting a systematic survey on FND.

Table 1: A comparison of existing surveys based on fake news detection

Survey		**Fake News Definition**	**Fake News Consequences**	**ML Approaches**	**DL Approaches**	**Dataset**
Reference	Year					
[6]	2018	✗	✗	✓	✗	✓
[7]	2019	✓	✗	✓	✗	✓
[8]	2018	✗	✗	✓	✗	✓
[9]	2021	✗	✓	✓	✓	✓
Our study	-	✓	✓	✓	✓	✓

Note. ML: Machine learning; DL: Deep learning.

The remaining sections of this paper are structured as follows:

Section 2 presents a definition of fake news and some of its related concepts. The consequences of fake news in different community fields are discussed in Section 3. Section 4 provides a review of the methodology that has been followed to find data sources and the selection procedure used in this paper. The methods and techniques of the current related studies are presented in Section 5, followed by an overview of which of these works depend on ML or DL techniques to build Arabic FND systems. Section 6 describes and comparatively studies the different available Arabic datasets that are used in Arabic FND. All techniques utilized in Arabic FND are generally discussed in Section 7. Finally, Section 8 presents the conclusion of the work.

2 An Overview of Fake News

The term "fake news" refers to media content that has been created by copying the format of actual information but with a different organization, purpose, or goal. The phrase "fake news" has many related concepts rather than a single meaning. The existing studies often connect fake news to terms and concepts such as deceptive news, false news, satire news, clickbait, and rumors [10]. According to the definitions of these terms and ideas, we may separate one from the others based on authenticity (whether it contains any non-factual statements or not), intention (whether it aims to deceive or amuse the audience), and news (whether the material is news). Based on these traits, Table 2 compiles these connected ideas. For instance, misleading information [news] with the malevolent purpose of misleading the audience is called deceptive news [11].

Table 2: Comparison between concepts related to fake news

Concept	Authenticity	Intention	News
Satire news	Non-unified	Entertain	Yes
Rumors	Undefined	Undefined	Undefined
Hoaxes news	Non-factual	Mislead	Yes
Clickbait	Undefined	Mislead	Undefined
Propaganda	Non-factual	Mislead	Undefined

2.1 Definition of fake news

Fake news has always existed for a very long time but has gone by different names, and there is no agreement on what exactly constitutes fake news. This is true from the invention of the printing press and the appearance of the first newspapers in the 17th century to the internet and the explosion of social media. Fake news, according to Stanford University, is defined as "news articles that are deliberately and demonstrably false and may mislead readers" [12]. This concept has been utilized in this study under the assumption that identifying fake news necessitates demonstrating that it contains inaccurate information that may deceive readers. After discussing a definition of false news, it is important to outline and distinguish between its related ideas.

Table 3 lists the key differences between the FND types.

Table 3: Differences between FND types

Features	Satire News or Parody	Rumors	Hoaxes	Clickbait	Propaganda
Definition	Deliberate comedic or exaggerated content presented as satire or parody	Unverified or false information was circulated without substantial evidence to support it.	False information presented as true, often with malicious intent	Sensational headlines designed to attract attention and clicks on websites or social media.	Misleading or biased information spread to promote a particular viewpoint or agenda.
Purpose	To entertain or make a point	To spread misinformation	To deceive people	To attract clicks	To spread a certain ideology
Accuracy	Not intended to be accurate	Often inaccurate	Always inaccurate	Often inaccurate	Can be accurate or inaccurate
Sources	May use real sources, but often use made-up sources	Often based on real events, but the details are changed	Always made-up	Often uses real sources but takes them out of context	Often uses made-up sources

Intent	To make people laugh or think	To mislead people	To trick people	To persuade people	To get people to click on a link
Legal implication	Protected as free speech and satire	May lead to defamation or harm to reputation.	Can have legal consequences if discovered.	May violate ethical standards but is often not illegal.	Consequences if used for malicious purposes

Note. FND: Fake news detection.

Table 4 presents examples for each type (note that these examples are for illustrative purposes and do not represent real news stories).

Table 4: Examples of FND concepts

Types	Arabic Language	Translate to English Language	Explanation
Satire news or parody	"الصحراء الخضراء تزدهر في العراق بفضل تكنولوجيا الري بالبيرة"	The Green Desert Thrives in Iraq Thanks to Beer Irrigation Technology	This headline humorously suggests that advanced irrigation techniques involving beer are causing deserts to turn green in Iraq. It is clearly intended as satire.
Rumors	"تم اكتشاف عملات ذهبية قديمة في باحة المسجد النبوي"	Ancient Gold Coins Found in the Courtyard of the Prophet's Mosque	This is a baseless rumor suggesting a significant archaeological discovery that has no credible source or evidence.
Hoaxes	"العلاج السحري: مشروب مصنوع من أوراق الشجرة يشفي من سرطان السرة"	Magical Cure: Drink Made from Tree Leaves Cures Navel Cancer	This hoax promotes a fictitious cancer cure using a natural remedy that has no scientific basis and could harm people seeking legitimate medical treatment.
Clickbait	"صورة صادمة لنجمة مشهورة تفضح سرّ جمالها! انقر للمزيد"	Shocking Photos of a Famous Star Expose Her Beauty Secret! Click for More	This is a sensational and misleading headline designed to attract readers with curiosity. Content often fails to deliver on the promised shock or revelation.
Propaganda	"المعلومات الحقيقية: دولة X تدعم الإرهاب وتهدد الأمن الإقليمي"	Real Information: Country X Supports Terrorism and Threatens Regional Security	This headline may present biased or misleading information aimed at demonizing a particular country or group for political purposes.

Note. FND: Fake news detection.

3 Review method

This section includes a list of the sources that served as the foundation for our research, along with the research questions that were developed to support it and the keywords used in the search strings.

3.1 Data sources

Before starting the search procedure, a suitable selection of electronic databases was chosen to find research papers that address our queries (Table 5). Figures 1 and 2 depict the proportions of research effort employed in the study before and after filtering (for articles published solely between 2015 and 2025).

Table 5: Sources considered during the search process

Databases	URL
Google Scholar	https://scholar.google.com/
PubMed	https://pubmed.ncbi.nlm.nih.gov/
Springer	https://link.springer.com
IEEE Xplore	http://ieeexplore.ieee.org

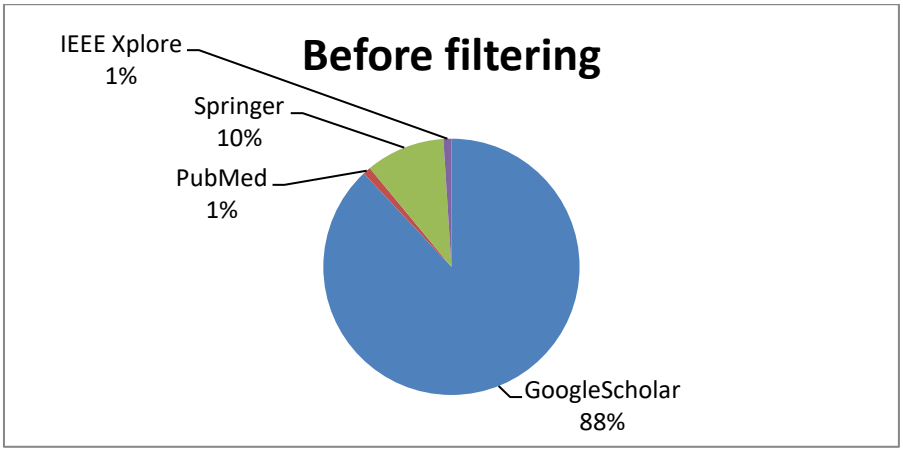

Figure 1. The graph shows item distribution.

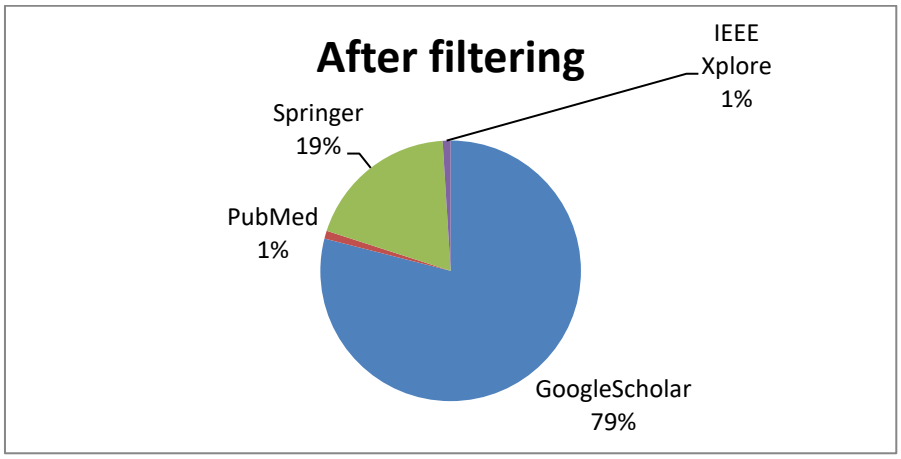

Figure 2. The graph showing the papers after filtering.

3.2 Research questions

This paper reviews the techniques and datasets used in the Arabic FND field. Various ML and DL techniques are applied to solve the Arabic FND problem. Additionally, numerous datasets are utilized in the Arabic FND. Thus, the following sentences provide a summary of the main research questions:

• RQ1: What are the most common techniques used in Arabic FND systems?

• RQ2: What are the various datasets that have been employed in the Arabic FND?

3.3 Screening procedure

To find research articles closely related to our work, a suitable selection of electronic databases was chosen before starting the search process. Google Scholar, PubMed, Springer Link, and IEEE Xplore were the main electronic databases that have been used in this work. Table 6 provides the keywords for the search terms used in the online databases.

Table 6: Keywords for the search strings.

Search Keywords	Databases	Number of Papers	Number of Articles After Filtering (2015-2025)
(**"**Arabic**"** OR "Arabic news" OR "Arabic language" OR "Arabic text") AND ("Fake" OR "Fake news" OR "Fake news detection")	Google Scholar	49400	18600
	PubMed	12	11
	Springer	529	485
	IEEE Xplore	65	64

Given that direct filtering is a feature of surfing sites, 23087 articles were totally obtained after direct exclusion (between 2015 and 2025). This literature study did not contain all of these papers. Papers were selected based on the following four conditions:

(1) Exclusion of articles published before 2015 (Table 6)

(2) Exclusion of books, chapters, master's, and doctoral theses

(3) Appearance of false news in the title or abstract

(4) Appearance of Arabic in the title or abstract

Overall, 25 articles were obtained based on the above conditions. The full texts were read, and each article underwent analysis. Research paper data and methodologies were extracted, and early study findings were examined and merged. Figure 3 summarizes and explains the selection and sorting mechanism.

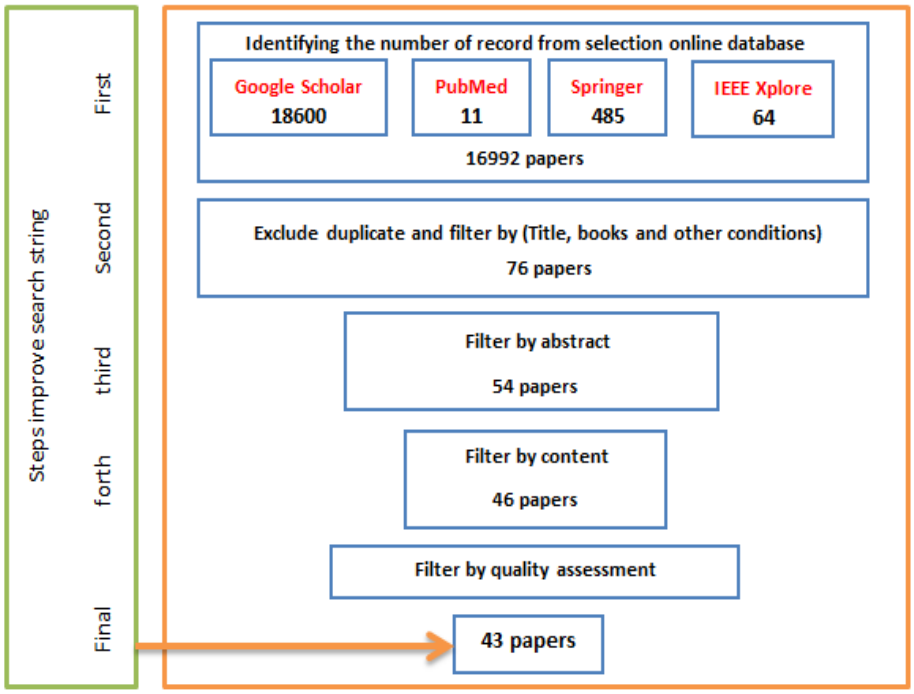

Figure 3. Search process strategy and filtering in Arabic fake news detection.

3.4 Synthesis of the systematic literature

In general, 25 articles were chosen while taking into account the goal established in the context of this work. The findings of preliminary investigations were examined and merged, and data and methods were taken from research articles. The usage of ML to address the Arabic FND challenge comes first in the search chain for Arabic FND, followed by the idea of DL. Figure 4 shows the taxonomy of Arabic FND methods based on previous research. It was found that 25 studies used Arabic FND approaches, among which 11 and 14 used the ML and DL approaches, respectively.

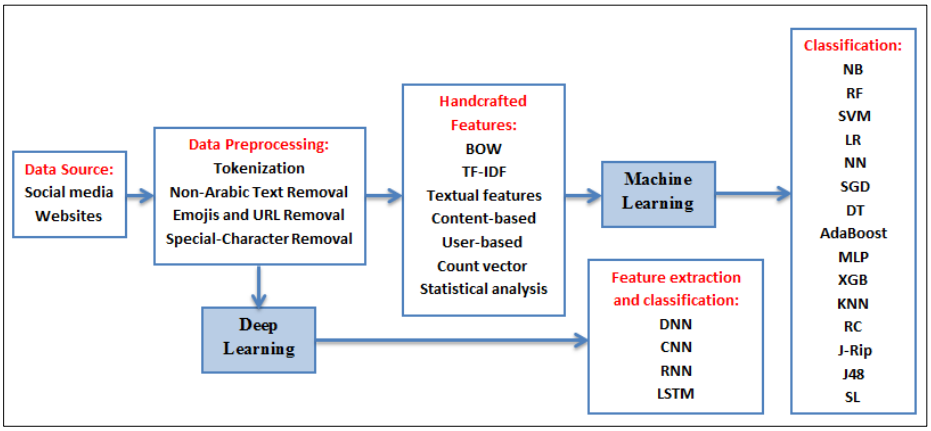

Figure 4. Arabic fake news taxonomy process.

4 Techniques for Arabic Fake News Detection

This section provides an overview of Arabic fake news detection methods. Examples of fake news in Arabic are presented to highlight the variations and similarities between strategies and their impacts on performance. As shown in Figure 4, these methods mainly employ ML and DL techniques based on the defined features.

4.1 Machine learning techniques

Researchers' interest in Arabic fake news identification has grown because of the growing and pervasive propagation of false information in Arabic-speaking nations. Numerous ML algorithms have been employed to discern between legitimate news sources and fake news. Himdi et al. [13] put out a method for identifying fake news in Arabic. They obtained legitimate news stories from trustworthy sources and used crowdsourcing to change legitimate news pieces into fake ones in order to mimic the manufacturing of fake news in the real world. Using a method for Arabic natural language processing created by the researchers, four types of textual characteristics are retrieved, including language, polarity, part of speech, emotion, and linguistic textual qualities. Three separate classifiers, namely, Naive Bayes (NB), Random Forest (RF), and Support Vector Machine (SVM), were trained using the mentioned characteristics. They evaluated the accuracy of the model prediction, and the RF classifier produced the best result (79%). They specifically stated that the most important indications for spotting misleading material in fake news are linguistic elements that have been retrieved.

To enable the automatic categorization of news headlines as "Fake" or "Not fake" using an ML model, Bsoul et al. [14] published a dataset of Arabic false news. More than 3000 news records were sampled from 24 Jordanian news publishers' tweets over five months. Seven ML classifiers are applied to this dataset to test its usability, including Logistic Regression (LR), SVM, Random Forest, Naive Bayes, Stochastic Gradient Descent, Nearest Neighbor, and Decision Tree (DT). These models generated macro-F1 score values of up to 0.81, demonstrating the viability of the automatic identification of fake news headlines using ML. Jardaneh et al. [15] proposed new characteristics for the identification of forged Arabic news using content- and user-related variables as well as sentiment analysis. They chose four algorithms from a variety of ML techniques used to train the classification models (i.e., RF, DT, AdaBoost, and LR). The applied dataset included all 1862 tweets published on topics related to the Syrian situation. There were 1051 credible and 810 non-credible tweets in the dataset, which is rather evenly distributed between the two classifications. The experimental assessment demonstrated the suggested system's 76% accuracy in detecting fake news.

Mahlous et al. [16] addressed the issue of spotting fake information about coronavirus disease 19 (COVID-19) in Arabic tweets. The coronavirus epidemic has been mentioned in more than seven million Arabic tweets. The

gathered tweets were used to extract a tiny corpus, which was then manually classified into classifications that were fake or real. To train an LR ML classifier, they employed a collection of features derived from tweet contents called the term frequency-inverse document frequency (TF-IDF) and count vector feature. An automated technique for spotting false news in the Arabic language was developed using the manually annotated corpus as a starting point. The classification of the manually annotated dataset produced an F1 score of 87.8% using the classifier LR and the feature TF-IDF, whereas the classification of the automatically annotated dataset generated an F1 score of 93.3% using the same classifier and the count vector feature. In the same context, Alazab et al. [17] developed a method to evaluate whether Arabic news is fraudulent. The suggested method comprised four main phases, including data collection, pre-processing, processing, and system assessment. It was based on a mix of text-mining algorithms. Using the Twitter Search Application Programming Interface (API), they collected 206,080 tweets on real and fake events. To reduce noise, they utilized preprocessing techniques, including tokenization, emojis, special characters, and URL removal. 64,447 features have been chosen using the TF-IDF technique. The presented model was trained using nine classifiers; they included naive Bayes, K-nearest neighbors, SVMs, RF, J48, LR, random committee (RC), J-Rip, and basic logistics. The evaluation was performed using a 10-fold cross-validation procedure. The 200-feature set and the RF and RC classifiers were used to achieve the best accuracy (97.3%). Wotaifi et al. [18] created an Arabic false news detection model, this study puts more emphasis on the text, user characteristics, and text features than other studies that relied on examining the content of tweets. Using the TF-IDF approach, the words in the tweet's content were transformed into features, and the features with the highest ranks were identified accordingly. On the other hand, a fuzzy model was employed for the user-relevant characteristics. The RF method was finally modified and enhanced. The improved RF has an accuracy of (0.895), while the NB and SVM approaches have accuracy values of (0.809) and (0.848), respectively. For research reasons, Alkhair et al. [19] presented a brand new Arabic corpus of fake news identification. They provided vital information regarding the data that had been gathered and described the collection procedure in full with regard to the passing of three Arab celebrities. An exploratory study of fake news was conducted to identify some characteristics of fake news, such as the frequent usage of specific terms. To investigate the possibility of differentiating between false and authentic news, the classification task was performed using three classification methods, including SVM, DT, and Multinomial Nave Bayes. The SVM classifier had the highest accuracy (95.35%). Mohdeb et al. [20] introduced a new dataset for Arabic fake content automatic detection, which covers several social media posts and news articles on the subject of the COVID-19 outbreak. Then, they explored the FND task using count vectorization and TF-IDF as candidate features, with the baseline classification models (NB, SVM, LR, RF, and Gradient Boosting). The results revealed that SVM is effective for certain text problems, such as FND, with an accuracy rate of 94%. Hawashin et al. [21] proposed an optimized fake news classification method for Arabic texts. TF.IDF was used to find the weight matrix for each term in each post. Features appeared in less than three documents. Different types of classifiers have been utilized, including SVM, NB, RF, LR, KNN, and AraBert. Experimental work showed that optimizing feature selection can improve the performance of fake news classification in comparison with no feature selection, and such performance can be close to that of the DL method (AraBert), which provides the best F1-score (97%) with much improvement in model complexity and training time. Himdi et al. [22] introduced a supervised ML model that can classify a piece of news content based on only its textual features. Four different classifiers (i.e., NB, RF, SVM, and LR) have been used in this work. Based on experimental results, the RF classifier could provide the best accuracy of about 77%. Aljwari et al. [23] developed an approach using TF-IDF as a feature that is utilized to represent news articles. Three different ML classifiers (i.e., NB, RF, and LR) have been employed, and the results of the experiment demonstrated that the RF classifier outperformed the other two classifiers. It had the best accuracy (86%). NB and LR had accuracy rates of 84% and 85%, respectively. A summary of all the above Arabic FND works that employed ML techniques is provided in Table 7.

Table 7: Summary of ML techniques used in Arabic FND.

Researchers	Features	Classifier	Dataset	Performance
Himdi et al. [13] (2022)	Textual features	NB, RF, and SVM	Collected 1098 articles	RF: 78%
Bsoul et al. [14] (2022)	BOW and TF-IDF	NB, LR, NN, SGD, NB, and RF	Collected 3235 tweets	SGD: 81%
Jardaneh et al. [15] (2019)	Content- and user-based features	RF, DT, LR, and AdaBoost	Collected 1862 tweets	RF: 76%

Mahlous et al. [16] (2021)	TF-IDF and count vector feature	NB, LR, SVM MLP, RF, and XGB	Collected 36066 tweets related to COVID-19	LR: 93.3%
Alazab et al. [17] (2022)	TF-IDF	RF, KNN, RC, SVM, NB, J-Rip, J48, SL, and LR	Collected 206,080 tweets	RF: 97.3%
Wotaifi et al. [18] (2022)	TF-IDF with fuzzy	RF, NB, and SVM	Collected 3000 tweets	RF: 89.5%
Alkhair et al. [19] (2019)	Statistical analysis	Multinomial NB, SVM, and DT	4079 Comments from YouTube	SVM: 95.35%
Mohdeb et al. [20] (2021)	TF-IDF and count vector feature	NB, SVM, LR, RF, and Gradient Boosting	1290 news articles	SVM: 94%
Hawashin et al. [21] (2023)	TF-IDF	SVM, NB, RF, LR, KNN, and AraBert	60000 news posts	AraBert: 97%
Himdi et al. [22] (2023)	Textual features	NB, RF, SVM, and LR	1088 news articles	RF: 77%
Aljwari et al. [23] (2022)	TF-IDF	SVM, NB, and RF	16600	RF: 86%

Note. BoW: Bag-of-Words; TF-IDF: *Term frequency*-inverse document frequency; ML: Machine learning; FND: Fake news detection; NB: Naive Bayes; RF: Random Forest; SVM: Support vector machine; NN: Neural network; SGD: Stochastic gradient descent; DT: Decision tree; LR: Logistic regression; MLP: Multi-layer perceptron; XGB: Extreme gradient boosting; KNN: *K-nearest neighbor*; RC: Random committee; SL: Simple logistic.

4.2 Deep learning techniques

DL approaches have recently received extensive attention compared to traditional ML techniques because of their superior accuracy and speed when classifying data for predictions. Based on the Arabic dataset known as the AraNews dataset, Wotaifi et al. [24] suggested DL approaches to detect false Arabic news. News items from a variety of topics, including politics, economics, culture, sports, and others, may be found in this collection. It has been suggested to increase accuracy by using a hybrid deep neural network (NN). To create an effective hybrid model, this network focuses on the characteristics of both the long short-term memory (LSTM) and text-convolution NN (Text-CNN) architecture. The required features are found using text-CNN, and the long-term sequence dependence is handled by LSTM. The outcomes demonstrated that the proposed model outperformed both the Text-CNN and the LSTM when trained independently. The accuracy of the hybrid deep NN was employed as a metric for model quality, and it was 0.914, while the accuracy rates of the text-CNN and LSTM were 0.859 and 0.878, respectively.

To tackle the challenge of fact checking, Harrag et al. [25] presented a content-based solution utilizing CNN. The fact-checking job entails predicting if a given textual claim is factually accurate or incorrect. The Arabic Fact-Checking and Stance Detection Corpus, a publicly accessible Arabic dataset, was used in this research. Different well-chosen attributes were employed to train the suggested model. A thorough study was performed to show how effective the fact-checking assignment is in identifying Arabic false news. When utilized on the same Arabic dataset, the model performs better than state-of-the-art methods with a 91% accuracy rate. In a related context and for the identification of fake news in the Arabic language, Nassif et al. [26] created several transformer models. They applied two brand-new datasets, one of which was translated from the English language and the other was gathered from Arabic websites. For classifying fake news, eight transformer models were utilized, including Giga-Bert, Roberta-Base, AraBert, Arabic-BERT, ARBERT, MarBert, Araelectra, and QaribBert. In comparison to models based on translated data, those trained on the obtained Arabic data showed superior outcomes. ARBERT and Arabic-Bert represented the best, with 98.8% and 98% accuracy, respectively, whereas Roberta-Base achieved the lowest performance for both datasets, according to the performance evaluation method.

Using only textual characteristics, Fouad et al. [27] suggested ML and DL methods to identify bogus news in Arabic. The ML techniques include DT, RF, stochastic gradient descent, linear SVC, SVC, multinomial-NB, Bernoulli-Naive Bayes, and k-neighbors. The LSTM, bidirectional LSTM (BiLSTM), CNN, CNN+LSTM, and CNN+BiLSTM DL models have all been employed. Three separate datasets, one of which is real-world data, were used in the trials; each dataset contained the textual content of Arabic news items. The findings demonstrated

that when both simple data split and recursive training modes are utilized in the training process, the BiLSTM model performs better than the other models in terms of accuracy. In addition, in the same range, Alkhair et al. [28] focused on identifying automated Arabic fake news and applied DL models such as LSTM, BILSTM, and CNN for experiments with FND techniques. The models were adjusted to attain greater accuracy by fine-tuning critical hyperparameters and utilizing methods such as word2vec and TF-IDF. According to the findings, CNN had the highest accuracy rate at 95%.

Al-Yahya et al. [29] thoroughly compared the performance of NN- and transformer-based language models used for Arabic FND. Arabic COVID-19 pandemic tweets and COVID-19 fake databases were used in this study. The results of the experiment revealed that transformer-based models could outperform NN-based solutions, which increased the F1 score from 0.83 (when using an NN-based model) to 0.95 (when using a transformer-based model). The results also indicated that AraBERT (version 02) outperformed all the models compared in terms of generalization. Ali et al. [30] provided a dataset of fake news on social media. Over 6,000 scraped pieces of data have been carefully divided into fake and real categories. As pre-trained models, AraBERT and BERT base Arabic have been used. Based on the results, they discovered that AraBERT provided a superior outcome (0.9529) than BERT-based Arabic (0.9476). Successful results were obtained from the AraBERT model, which was trained on a sizable corpus of almost 60 million filtered Arabic tweets from a 100M collection. In a related context, the trained mini-BERT transformer model in Arabic was fed the Arabic dataset as part of the DL method given by Alawadh et al. [31] Both ML and DL techniques have been applied in this study. The total number of cases in the dataset was 323. One was eliminated since it was null, and the remaining examples were split into 100 trustworthy and 222 unreliable ones. On both the ML and DL approaches, the holdout validation scheme was used with data splits of 70/30, 80/20, and 90/10. The performance of the ML classifiers fluctuated between these divides. Unlike ML classifiers, which had behavior that is more inconsistent on different splits, the behavior of the mini-BERT classifiers demonstrated consistency with a rise in the training data; each kind of assessment measure represented an increase. The mini-BERT technique was more reliable given the maximum accuracy of up to 98.43% and its constant performance across all splits.

Alnabrisi et al. [32] proposed an approach to FND in the Arabic language, detecting whether Arabic news is real or fake. They utilized the "ArabicFakeNews" dataset, which consists of 2K pieces of fake information manually gathered from various sources. Applying the DL and transformer-based models to the dataset with varying average lengths (title, description, and text dataset) allowed them to investigate how the length of the news might affect the performance of the model. Considering that the average length of fake news in this dataset is somewhat close to the average length of actual news, the description dataset performs better in categorizing the news. According to the evaluation's findings, transformer models outperform DL models. With an accuracy rate of 0.97, 0.97 f1 score, 0.97 precision, and 0.9658 recall, AraBERTv2 on the "description" dataset outperforms all other transformers, according to the findings of the analysis. Moreover, an intelligent classification algorithm was developed by Awajan et al. [33] to recognize bogus news in Arabic-language tweets. DL and shallow learning were compared in this study. A fresh dataset of 206,080 tweets retrieved from the Twitter API was produced to test both shallow and deep classifiers. The results of applying the models to the dataset showed that the pre-trained BERT model outperformed all other classifiers, yielding an accuracy rate of 99%. The accuracy rates of the shallow learning and LSTM models were 95.92% and 96.71%, respectively.

To determine whether a news headline is actually related to the parallel news article or not, Najadat et al. [34] introduced an Arabic FND method using various DL models, such as LSTM and CNN. A dataset regarding the Syrian conflict and other political topics in the Middle East was used in this research. The entire set of data included 3042 articles and 422 assertions. The collected findings demonstrated that CNN-LSTM provides more accuracy than LSTM; it achieved an accuracy rate of 70% compared to the first model, the accuracy of which was 68.2%. This translates into increased accuracy, precision, and recall when we merge two models. Saadany et al. [35] suggested a detection approach based on lexico-grammatical level differentiating characteristics. Their approach combines pre-trained word embedding from a CNN with handcrafted linguistic characteristics. By compiling 3,185 pieces of false news from two websites—Al-Hudood and Al-Ahram Al-Mexici—the research team created a new dataset. They supplemented these 3,710 authentic news stories with crawled content from BBC-Arabic, CNN-Arabic, and Al-Jazeera. A CNN with pre-trained word embedding achieved the highest accuracy (98.59%). Nagoudi et al. [36] addressed the problem of not having enough relevant data to train detection algorithms by proposing a technique for autonomously creating possibly fake Arabic news items. Additionally, they developed models to recognize Arabic news that has been edited, which led to the successful discovery of false Arabic news. They assessed their model using datasets from ATB and the newly available AraNews. The data are divided into three sections, with 80% going toward training, 10% going toward development, and 10% going toward testing. They also employed four pre-trained masked language models (mBERT, AraBERT, XLM-RBase, and XLM-RLarge), with the accuracy rate of the AraBERT pre-trained model reaching 89.23%. Alyoubi et al. [37] proposed a DL-based approach to identify fake news on Twitter. The suggested approach takes advantage of the social environment and news content of the individual who took part in news distribution. To discover a useful

model for the FND problem, they investigated the effectiveness of the Keras embedding layer with well-known pre-trained word embeddings (word2vec, fastText, ARBERT, and MARBERT). The performance of the model was found to be best for the contextual embeddings ARBERT and MARBERT, which yielded the most ideal word representations. In most cases, the CNN-based model architecture outperformed the BiLSTM in terms of DL algorithms. Combining MARBERT with CNN yielded the top performance with high accuracy and an F1-score of 95.60%. Table 8 lists all the above Arabic FND works that used DL techniques.

Table 8: Summary of DL techniques used in Arabic FND.

Researchers	Methods	Dataset	Accuracy
Wotaifi et al. [24] (2023)	CNN and LSTM	AraNews	LSTM: 91.4%
Harrag et al. [25] (2022)	CNN	The Arabic Fact-Checking and Stance Detection Corpus	CNN: 91%
Nassif et al. [26] (2022)	Transformer models (Giga-Bert, Roberta Base, AraBert, Arabic-BERT, ARBERT, MarBert, Araelectra, and QaribBert)	Collected and translated Corpus	ARBERT: 98%
Fouad et al. [27] (2022)	CNN, LSTM, and bidirectional LSTM (BiLSTM)	Collected 4561 news	BiLSTM: 74.98%
Alkhair et al. [28] (2023)	CNN, LSTM, and Bi-LSTM	Collected 4079 comments from YouTube	CNN: 95%
Al-Yahya et al. [29] (2021)	Deep neural networks and transformer-based models	Arabic COVID-19 pandemic, COVID-19-Fakes, AraNews, and ANS corpus	QARiB: 95%
Ali et al. [30] (2022)	AraBERT and BERT	Arabic COVID-19 dataset	AraBERT: 95.29%
Alawadh et al. [31] (2023)	Mini-BERT	Arabic dataset contains 323 instances	Mini-BERT: 98.43%
Alnabrisi et al. [32] (2022)	RNN and transformer-based models	Arabic fake news dataset which contains 8K news	AraBERT: 97%
Awajan et al. [33](2023)	LSTM and BERT	Collected 206,080 tweets using Twitter API	Bert: 99%
Najadat et al. [34] (2022)	Hybrid model using LSTM and CNN	The dataset comprises 422 claims and 3,042 articles	Hybrid: 70%
Saadany et al. [35] (2020)	CNN	Collected 6895 news	CNN: 98.59%
Nagoudi et al. [36] (2020)	mBERT, AraBERT, XLM-RBase, and XLM-RLarge	AraNews and Arabic Tree-Bank	AraBERT: 89.23%
Alyoubi et al. [37] (2023)	CNN and BiLSTM	5000 Twitter	CNN: 95.6%

Note. DL: Deep learning; FND: Fake news detection; CNN: Conventional neural network; LSTM: Long short-term memory; Bi-LSTM: Bidirectional long short-term memory; BERT: Bidirectional encoder representations from transformers; RNN: *Recurrent neural network*.

5 Arabic fake news detection datasets

A substantial dataset is required to apply ML and DL algorithms in order to discriminate between real and false news. Based on the data in Table 8, Arabic news websites and social media platforms are the two main sources of existing Arabic fake news datasets. The datasets obtained based on Twitter platforms [14],[15],[16],[17],[18],[33] and [37] had main limitations; the tweets are limited to a certain number of words, affecting the efficiency of learning and extraction of features. Several Arabic fake news datasets [24],[25],[26],[27],[29],[31],[32],[34], [36],[38] and [39] were collected from Arabic news websites; they are machine-generated datasets based on the real and fake news collected from different Arabic websites or the collected real and fake news.

Table 9: A summary of Arabic fake news datasets.

Researchers	Dataset Name	Available	Source	Size	Distribution
Khalil et al. [45] (2022)	Arabic Fake News Dataset (AFND)	Yes	Collected from Arabic news websites	606,912 articles	Credible: 207,310 Non-credible: 167,233 Undecided: 232,369
Khouja et al. [46] (2020)	Arabic News Stance Corpus (ANS)	Yes	Collected from Arabic news websites	4,547 articles	Fake: 1,475 Not fake: 3,072
Wotaifi et al. [18] (2023)	AraNews	Yes	Collected from Arabic news websites	16,600 articles	Fake: 8,406 Not fake: 8,194
Himdi et al. [13] (2022)	Not mentioned	No	Collected from Arabic news websites	1,098 articles	Fake: 549 Real: 549
Bsoul et al. [14] (2022)	Arabic clickbait news	No	Twitter	3,235 tweets	Clickbait: 583 Not clickbait: 2,652
Jardaneh et al. [15] (2019)	Not mentioned	No	Twitter	1,862 tweets	Credible:1,051 Non-credible: 810
Mahlous et al. [16] (2021)	Not mentioned	Yes	Twitter	36,066 tweets	Fake: 20,417 Genuine: 15,649
Alazab et al. [17] (2022)	Not mentioned	No	Twitter	206,080 tweets	Fake: 46,796 Not fake: 159,284
Wotaifi et al. [24] (2022)	Not mentioned	No	Twitter	3,000 tweets	Fake: 1,300 Not fake: 1,700
Alkhair et al. [19] (2019)	Not mentioned	No	YouTube Comments	4,079 comments	Not mentioned
Harrag et al. [25](2022) and Najadat et al. [34] (2022)	The Arabic Fact-Checking and Stance Detection Corpus	Yes	Collected from news websites	422 claims	False: 219 True: 203
Nassif et al. [26](2022)	Not mentioned	No	Collected from Arabic websites and translated from English	20,000 news instances	Not mentioned

Fouad et al. [27] (2022)	Not mentioned	No	Collected from news websites	4,561 news instances	Non-rumor: 2,019 rumor: 2,542
Al-Yahya et al. [29] (2021)	ArCOV19-Rumors, COVID-19-Fakes, AraNews, and ANS	Yes	Collected from news websites	186,276 news instances	Four different datasets
Ali et al. [30] (2022)	Arabic COVID-19 dataset	NO	Collected from Twitter and Facebook	6,184 news instances	False: 1,876 True: 4,308
Alawadh et al. [31] (2023)	Not mentioned	No	Collected from news websites	322 news	Reliable: 100 Unreliable: 222
Alnabrisi et al. 32] (2022)	ArabicFakeNews	Yes	Collected from Arabic news websites	8,016 news instances	Fake: 2,016 Real: 6,000
Awajan et al. [33] (2023)	Not mentioned	No	Twitter	206,080 tweets	Legitimate: 159,284 Fake: 46,796
Saadany et al. [35](2020)	Satirical-Fake News-Dataset	Yes	Collected from Arabic websites	6,895 news instances	Satirical: 3,185 Real: 3,710
Nagoudi, et al. [36](2020)	AraNews and Arabic TreeBank	Yes	Collected from Arabic websites	61,404 instances	Two different datasets

A portion of the Arabic data used in previous studies [16], [26], [29], and [30] was gathered during the COVID-19 pandemic to research the pandemic from a social viewpoint. They were also utilized for Arabic FND connected to the COVID-19 pandemic. Some works [19] and [28] utilized YouTube comments and responses to investigate Arabic FND in the Middle East, with the information coming from posts on YouTube. The researchers in [30] used data collected from Twitter and Facebook to implement an Arabic FND system. Likewise, [35] employed satirical data, which are a type of fake news, but it is not enough to rely on them mainly to detect fake news. The purpose of satirical news is generally to provide humor for the reader and to refer to social or political reality humorously. However, fake news is completely fake work that convinces you to lie. The main limitation of Arabic datasets in Table 8 is that most Arabic fake news datasets are not balanced with the real news as more than fake or vice versa. Figure 7 shows the percentage of the existing Arabic datasets generated from websites and social media platforms.

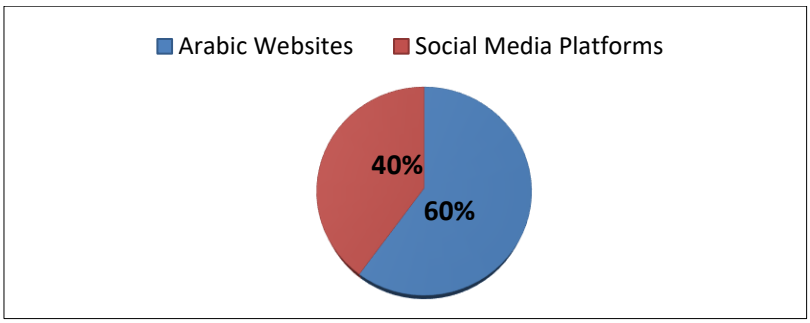

Figure 7. Distribution of Arabic fake news dataset sources.

The Arabic news on websites or social media platforms may contain noise and un-useful content; thus, the collected data must be processed before using this operation called pre-processing. Any ML or DL method must go through a pre-processing stage in order to extract the features from the data and increase system performance. Figure 8 illustrates the general steps of preprocessing in Arabic FND systems:

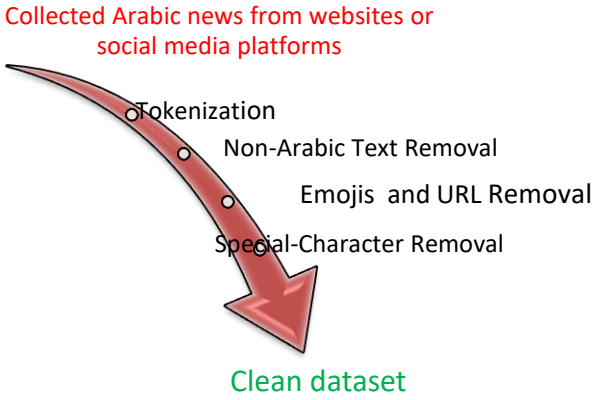

Figure 8. Preprocessing operation steps.

These steps include:

1. Tokenization: Each sentence has been divided into a series of phrases or tokens based on the presence of white spaces.
2. Non-Arabic text removal: Tokens have been scrutinized to ensure the elimination of all non-Arabic texts.
3. Emojis and URL Removal: To lessen the amount of noise, emojis and URL links have been eliminated from all texts.
4. Special-character removal: Special characters (e.g., @, *, %, and &) have been eliminated.

These are the general steps of preprocessing operations that are shared among most Arabic FND approaches; the steps can be increased or decreased according to the researcher's needs.

6 Discussion

This work mainly aimed to investigate ML and DL techniques that have been used to solve Arabic FND tasks. Moreover, it comprehensively studied the Arabic dataset that has been utilized for detecting Arabic fake news. ML and DL are the two main approaches that have been employed for designing and implementing Arabic FND systems. ML techniques use many feature extraction methods to extract valuable features from datasets. Based on the findings (Table 7), most Arabic FND based on ML techniques used TF-IDF as features to represent the input news data. The DL techniques employed in Arabic FND consist of two approaches; the first one includes the basic LSTM, BiLSTM, CNN, and the like models, and the second contains the transformer-based language models such as AraBert, MarBert, Araelectra, and the like that provide the best results, according to comparison in Table 8. The AraBert transformer model provides the best results in most Arabic FND systems that are based on DL. While studying recent articles, we have explored some of the research gaps that can be summarized as follows:

- Considering that DL-based techniques analyze data more accurately than other algorithms, there is a new possibility for improving its acceptance in the future.
- Arabic FND may be influenced by selecting appropriate feature extraction and classification techniques. For solving Arabic FND, many types of classifiers were evaluated; RF, which delivers the best accuracy in most ML approaches, was the best classifier.
- The use of sequence models (e.g., LSTM) necessitates the analysis of lengthy textual characteristics. As a result, there is a greater requirement for focus when selecting features and classifiers to improve performance.

The relation between accuracy and dataset size is displayed in Figures 9 and 10, demonstrating the variation in the results between different works. Considering that databases are from different sources and their data differ from each other in addition to the difference in size, it is difficult to compare different works according to their accuracy. Figure 11 depicts the percentage of the existing machine and DL works in Arabic FND.

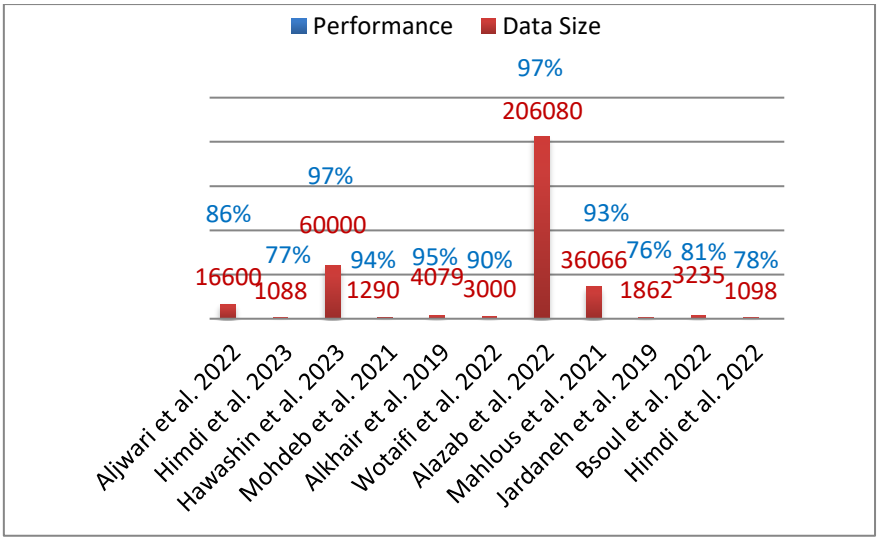

Figure 9. A comparison between ML Arabic FND.

Note. ML: Machine learning; FND: Fake news detection.

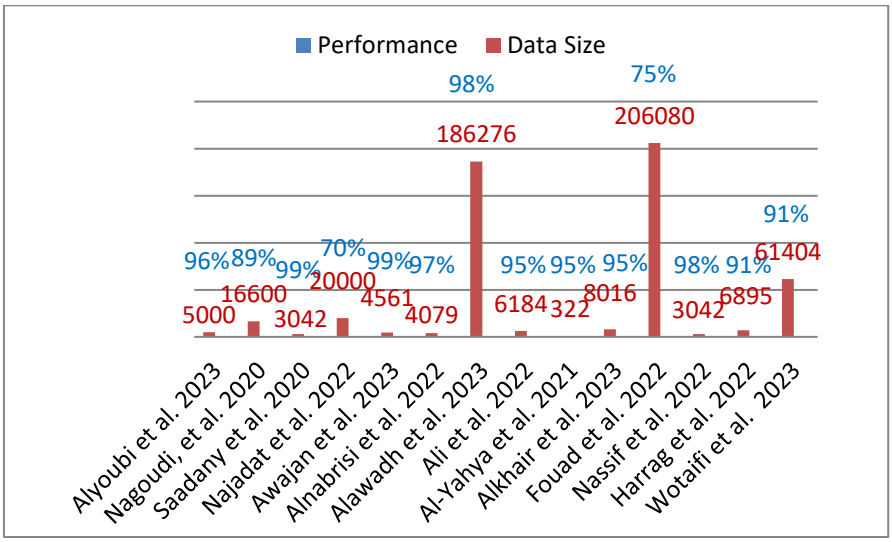

Figure 10. A comparison between DL Arabic FND techniques.

Note. ML: Machine learning; FND: Fake news detection.

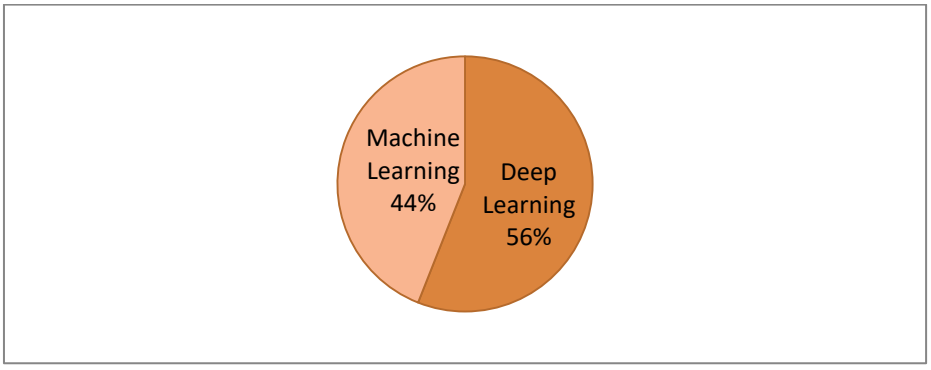

Figure 11. Distribution of Arabic FND systems.

Note. FND: Fake news detection.

It is important to be able to identify fake news to avoid being misled. Some tips for spotting fake news are as follows:

- Check the source: Is the source reputable? Does it have a history of publishing accurate news?
- Look for evidence: Does the story provide any evidence to support its claims? Can you find other sources that corroborate the story?
- Beware of sensational headlines: Clickbait headlines are often designed to mislead you. Read the story carefully before sharing it.
- Use your common sense: If a story sounds too good to be true, it probably is. Do not believe everything you read online.

6.1 Research challenges

Based on our study, we explored some of the obstacles and challenges in the Arabic FND field, which can be summarized as follows:

- The Arabic language has far fewer resources to identify fake news, which is not surprising considering its status as a low-resource language.
- As provided in Table 8, there is a lack of Arab datasets for fake news, and the available dataset is generated from either websites or Twitter. Additionally, not all of these datasets are publicly available, and the datasets are not balanced.
- Although Arabic is the official language of 24 nations, there has not been much research specifically on Arabic content. Arabic is harder to learn than English is since it is more difficult and has a more complex morphology.

6.2 Recommendation

The recommendations focus on three key areas regarding which policy is required to achieve the Arabic FND.

- Gathering a new balanced dataset from social media or websites is highly recommended since there is a lack of Arabic fake news datasets
- Developing Arabic FND systems based on hybrid models
- Designing Arabic FND models that can deal with visual information.

7 Conclusion and future work

This paper reviewed ML and DL models for Arabic FND and described the definitions, consequences, and datasets related to Arabic FND. Several ML techniques have been used in this field with different feature extraction methods and classifiers. According to our findings, the TF-IDF features and RF classifier are the best choices for designing an Arabic FND system. On the other hand, transformer models such as AraBert in the DL approach provide promising results. Although Arabic FND is limited, it is a promising research field due to the lack of studies in this field. Detecting fake news in Arabic languages has several challenges, such as the multiplicity of dialects, orthographic rules, rich vocabulary, and the lack of availability of Arabic datasets. Future research is expected to concentrate on employing ensemble approaches to identify Arabic fake news and collect information from numerous social media sites or translate it from another language.

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