Novel Approaches to Analyzing and Distinguishing Fake and Real News to Mitigate the Problem of Disinformation

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Abstract. Identifying fake news has become an important challenge. Increasing usage of social media has led an increase in the number of people who can be influenced, thus the spread of fake news can potentially impact important events. Fake news has become a major societal issue and a technical challenge for social media companies to identify and has led to extreme measures, such as WhatsApp deleting two million of its users every month to prevent the spread of fake news. The current challenge of fake news is rooted in the historical challenge of disinformation, which is false information deliberately and often covertly spread (as by the planting of rumors) in order to influence public opinion or obscure the truth. Our work addresses the challenge of identifying fake news by (i) detecting and analyzing fake news features (ii) identifying the rhetorical and cultural characteristics fake news features.

Keywords: fake news · real news · fake news identification · data analysis · deep learning · sociocultural textual analysis

1 Introduction

Identifying fake news has become an important challenge. Increasing usage of social media has led an increase in the number of people who can be influenced, thus the spread of fake news can potentially impact important events. Fake news has become a major societal issue and a technical challenge for social media companies to identify and has led to extreme measures, such as WhatsApp deleting two million of its users every month to prevent the spread of fake news. The current challenge of fake news is rooted in the historical challenge of disinformation, which is false information deliberately and often covertly spread (as by the planting of rumors) in order to influence public opinion or obscure the truth. Our work addresses the challenge of automatically and accurately classifying a message as disinformation or fake news by (i) detecting and analyzing fake news features that make it distinct from other information (ii) identifying the rhetorical and cultural characteristics fake news features.

2   Related Work

2.1   Sociocultural Textual Analysis

While the cultural-rhetorical and (socio)linguistic research on fake news and misinformation often employ different but related methodologies to the problem of its identification, they generally align on the need to develop literacies with certain sensitives to certain linguistic constructions and cultural-historical significance. Linguists, for instance, have used news articles engaging with disinformation and fake news to study syntax and lexical cohesion [1], but have not turned this attention to language construction as a tool for distinguishing disinformation from reputable reporting. While folklore scholars have examined of the unique vernacular uses of language fake news [2] and Media Studies researchers have developed analyses of consumption patterns for fake news audiences [3], the vast majority of language- and text-oriented research on disinformation from the humanities and social sciences comes from pedagogically-focused research on developing robust student literacies. Emphasizing that the problem of disinformation is neither new nor unique to our highly-mediated moment, research focusing on teaching the evolving concept and practice of information literacy can be found in the disciplines of Library Science [4, 5] and Rhetoric and Composition [6–8].

3   Methodologies

For this challenge we addressed the problem of fake news identification using three approaches to make it manageable and more accurate. These methodologies include: sociocultural textual analysis, data analysis, and textual classification using deep learning. The cultural and sociolinguistic approach allows us to identify the rhetorical and textual characteristics that distinguish real or fake information. From the data science approach we dig into the data analytic by building the words and phrases frequencies, from the deep learning approach we built a binary classifiers that extract features from fake and real news using deep learning models, such as Long Short Term Memory (LSTM), Recurrent Neral Network (RNN) and Gated Recurrent Unit (GRU).

3.1   Sociocultural textual analysis

Identifying the rhetorical, cultural, and textual characteristics that distinguish real or fake information provides a useful methodology for understanding the problem of recognizing disinformation. Accounting for the sociolinguistic, historical, cultural, and ideological meanings attached to particular words, phrases, and syntactical constructions, the methodologies of rhetorical and cultural analysis can show patterns in both the duplicitous forms used in fake news to present itself as true information and the ideological intent attached to certain language constructions.

3.2 Text classification

Text classification is the process of assigning tags or categories to text according to its content. It is one of the fundamental tasks in Natural Language Processing (NLP) with broad applications such as sentiment analysis [9], topic labeling [10], spam detection [11], and web search [12].

4 Dataset

To approach the challenge we worked with datasets extracted using the Fake-NewsNet[3] tool. The final dataset contains both fake and real news in the political domain. The main characteristics of the datasets are shown in Table 1. [13–15]

Table 1: Dataset overview

Total Number	Fake	Real
News articles	432	624
News articles with text	420	528
News articles with images	336	447

5 Results

5.1 Sociocultural textual analysis

From a textual and rhetorical analysis perspective, the devious tactics of disinformation is frequently located in assumptions made about a readerships literacy. Such fake news articles often rely on the having a basic understanding of the signifiers of journalistic and investigative integrity, but are deployed under the assumption that these signifiers will not be given close scrutiny over the dubious content itself.

Some of these indicators are easier to see than others. Oftentimes the text of such disinformation takes journalistic conventions to unusual extremes. Some of these conventions include: excessive signifiers of urgency or extreme overuse of quotation marks.

In both real and fake news articles, headlines will often begin with a word like breaking in all capital letters to catch a readers attention and communicate an urgency to the information in the article.

Headlines and the article content may redeploy such words and phrases, like explosive new report or warning issued, that may not in themselves indicate

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[3] https://github.com/KaiDMML/FakeNewsNet

BREAKING: Nancy Pelosi Was Just Taken From Her Office In Handcuffs

Stryker   Bass, Free Head Examinations, Pre-Owned Honda Civic   0

BREAKING NEWS

SECRET VIDEO: Romney Tells Millionaire Donors What He REALLY Thinks of Obama Voters

When he doesn't know a camera's rolling, the GOP candidate shows his disdain for half of America.

(a) Example from fake news   (b) Example from real news

Fig. 1: Example of the use of all capital letters in both fake and real news story headlines to communicate urgency

the truth or falsity of an article, but the repetition and excessive use of such phrases will often be more prevalent in a piece of disinformation because its aim is to: keep readers attention, influence readers through an appeal to emotion (what is known in rhetorical studies as pathos), and mask the lack of verifiable information behind an authoritative tone. Such urgency can also be noted in the inappropriate overuse of capital letters, which a reputable news source would not include.

Quotation mark usage also shows how punctuation is duplicitously used to represent disinformation as truth. In a real news article, quotation marks signify that information is coming directly from a source and, assumedly, has not been deliberately misrepresented to deceive readers. A common characteristic of fake news articles, however, is an overuse of quotation marks, sometimes placing each paragraph in quotation marks, to signify truth simply through a symbolic gesture.

Beyond the use of quotation marks for presenting information indicated as factual, understanding sourcing is especially problematic for distinguishing real news from disinformation. A first layer of making this distinction is to note whether or not an online article offers a source at all; fake news will often report information without even including a source, simply using phrases such as told reporters or is being reported to signify credibility rather than offering actual sourcing.

Some articles, however, will include sources, but will either only reference them without directly linking to the source of the information or, potentially even more suspicious, only referencing and linking to information internal to the website to suggest that the author has researched the particular issue being reported on but actually not presenting information that would corroborate their analysis. That said, only internal linking may signify something to be suspicious of, but is also dictated by the economics of web-based content: you dont want site visitors to leave, and, in fact, you want to increase clicks. Such an example

It is being reported that Australia is becoming the first nation in the world to begin

(a) Example from fake news page stating it is being reported rather than citing a reputable source for this information

As Alice Slater, the New York director of the Nuclear Age Peace Foundation, wrote for The Nation, U.S. military bases are not only responsible for such massive amounts of greenhouse emissions but also devastating impacts caused by pollutants and toxic weapons.

(b) Example of real news article directly referencing source, even if no direct hyperlink is provided

Fig. 2: Examples of in-text reference and sourcing in fake and real news pages

presents an important problem to keep in mind: profit-driven news organizations will always have interests outside of journalistic and investigative integrity.

Furthermore, these characteristics and methods of spreading disinformation across media can also have more complex structures, as in a far-right websites now infamous piece Birth Control Makes Women Unattractive and Crazy that makes various appeals to authority through quotations and links to outside sources but is, in fact, ideologically-driven disinformation that deliberately misrepresents information with a misogynist intent.

Taking this far-right website example of linking to and quoting outside sources but, in fact, presenting misinformation, readers can take note of the use of words like unattractive and crazy in the headline. The use of these words represents perhaps one of the most significant differences can be seen in the use of adjectives and adjectival phrases, especially when referencing specific public figures. For example, consider these two introductions to Congresswoman Nancy Pelosi: Liberal menace and purveyor of lies, Nancy Pelosi (D-California) versus House Minority Leader Nancy Pelosi.

Liberal menace and purveyor of lies, Nancy Pelosi (D–California), v

(a) Example of adjectival phrases providing non-factual, politically-motivated description on fake news page

House Minority Leader Nancy Pelosi

(b) Example of adjectival phrase used to provide contextual information on real news page

Fig. 3: Examples of use of adjectives and adjectival phrases for prominent figures referenced in the text

The latter example is from a reputable news source and provides useful contextual information by marking Congresswoman Pelosis significant position within the House of Representatives. The former introduces her as a menace and a purveyor of lies, neither of which provide contextual information but offer value judgments on her person to elicit an emotional response from the leader. It is also important to observe, however, that the former includes the common journalistic practice of identifying a politicians party and state affiliation(D-California)such that while the fake news article is employing rhetorical tactics that signal its disinformation agenda it is also signifying journalistic style. Such an example represents the need to assess the entire semiotic structure of an example from online news media. That is, rather than isolating individual textual or rhetorical aspects, these elements must be assessed in their systematic relationship to one another based on the cultural and ideological contexts in which they are working.

Furthermore, it must be noted too that a clear signaling of particular political orientation within a published piece of writing does not in itself indicate that the information in the piece is fabricated or deliberately misrepresented. The ability to discern true information from such sources requires readers to have a literacy strong enough to understand the difference between information and analysis of the information, and the ideological investments in the textual and rhetorical methods of organizing and distributing information.

That said, there are some basic clues beyond the rhetorical organization of the written information that are a part of the visual rhetoric of such web articles. Irrelevant or content-less photos, missing publication date, missing author biography or an author biography that provides no information about their journalistic affiliation, and, perhaps one of the most obvious indicators, erroneous metadata.

By VERENA DOBNIK, Associated Press Writer – Wed Aug 25, 4:24 pm ET

(a) Example from real news article containing full author name, affiliation, and publication date of article

👤 Stryker   🗁 Bass, Free Head Examinations, Pre-Owned Honda Civic

(b) Example from fake news tagging the page with erroneous metadata and no identifying information about the writer

Fig. 4: Examples of differences in publication information for real and fake news pages

5.2   Data Analysis

We parse though the real and fake news headlines and text in identifying top-20 words (Fig. 8).

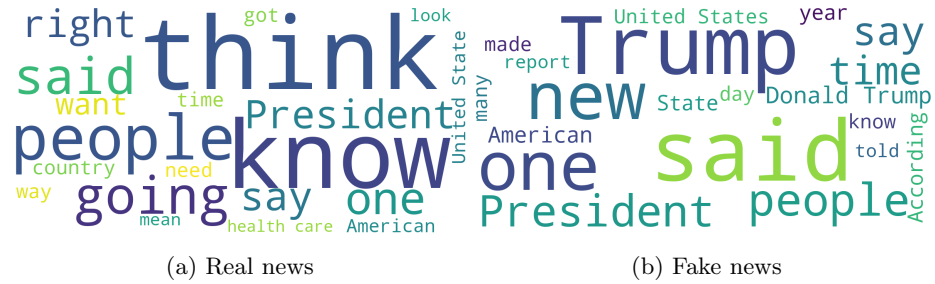(a) Real news   (b) Fake news

Fig. 5: Wordclouds of top 20 words.

One of the notable signs we can extract from wordclouds is that in fake news the word "Trump" word is more prevalent, while in real news "president" is used to address the key news maker. This distinction between the office of the president and the individual begins to show that fake news has a stronger investment in affective and ideological approaches than real news.

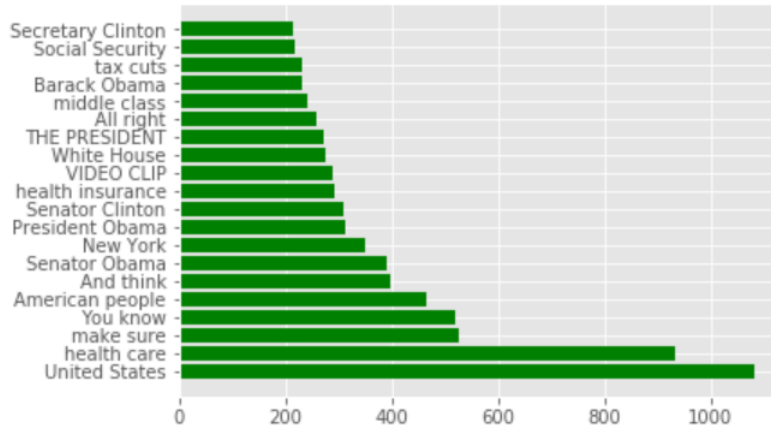Bigram represents top-20 phrase combination among real (Fig. 6) and fake news (Fig. 7).
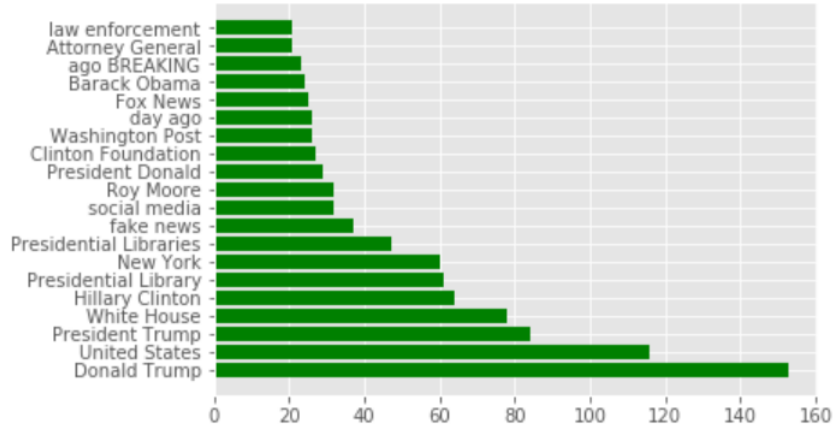

Fig. 6: Bigram of real news

Fig. 7: Bigram of fake news

5.3   Deep Learning Approach

To prepare the data for applying deep learning model, we have perform data preprocessing: cleaned the text from punctuations,

(a) Original text   (b) Cleaned text   (c) Encoded text
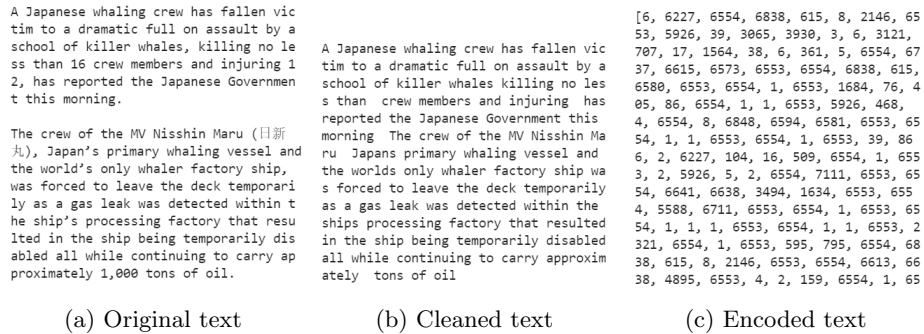
Fig. 8: Encoding the text.

We have applied a multiple of deep learning models to perform binary classification.

6   Conclusion and Discussion

After getting the preliminary results, we can notice one of characteristics of disinformation is its ideological context. We are also in the progress of synthesizing

Table 2: Hyperparameters overview

Parameter	LSTM	GRU	RNN
Layers	1	1	1
Activation	Hyperbolic tangent	Hyperbolic tangent	
Activation output	Sigmoid	Sigmoid	Sigmoid
Epochs	5	5	5
Validation Split	0.15	0.15	
Nodes 1-layer	512	8	
Nodes 2-layer	256	4	

more in-depth sociocultural linguistic analysis and automatic classifiers using deep learning tools.

This is the first time this kind of sociocultural textual analysis has been conducted using this dataset.

While these novel approaches were applied to this dataset, this dataset has its own characteristics of distinguishing information from disinformation that make the results of this research less able to generalized than they may otherwise be. In this dataset, rather than distinctions between real and fake news, it provides distinctions from primary sources (such as, transcripts of political speeches and interviews, and statistical reports from governmental agencies and non-profits) from secondary sources (such as, news and web articles reporting on this data). Regardless of whether or not the secondary sources were in fact real or fake news sources, they were marked as fake news in this dataset for reporting primary document information. The approaches presented in this research would be better developed and explored using a variety of different datasets distinguishing between real and fake news.

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