

Master thesis

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Fake news detection using machine learning

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Acknowledgement

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Abstract

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Chapter 1

Introduction

1.1 What are fake news?

1.1.1 Definition

Fake news have quickly become a society problem, being used to propagate false or rumorous informations in order to change behaviors of peoples. Before stating to work on detecting fake news, it is needed to first understand what they are. It have been show that propagation of fake news have had a non negligible influence of 2016 US presidential elections[1]. A few facts on fake news in the United States:

- 62% of US citizen get there news for social medias[2]
- Fake news had more share on facebook than mainstream news[3].

Fake news have also been used in order to influence the referendum in the United Kingdom for the "Brexit".

There are two aspects of fake news detection that need to be taken into account according to Shu et al[4]. The first is characterization or what are fake news and the second is detection. In order to build detection models, it is need to start by charaterization, indeed, it is need to understand what are fake news before trying to detect them.

Fake news definition is made of two part: authenticity and intent. Authenticity means that fake news content fale information that can be verified as such, which means that conspiracy theory is not included in fake news as there are difficult to be proven true or false in most cases. The second part, intent, means that the false information have been written with the goal of misleading the reader.

1.1.2 Fake News Characterization

Definition 1 *Fake news is a news article that is intentionally and verifiably false*

The part of the definition introducing the intent of misleading the reader automatically discard satire news medias, that is why this works will focus on the first part, the fact that the piece of information is verifiably false or true. Indded, even if satire news medias does not have the intent to misslead the readers, not all of them have the ability of making

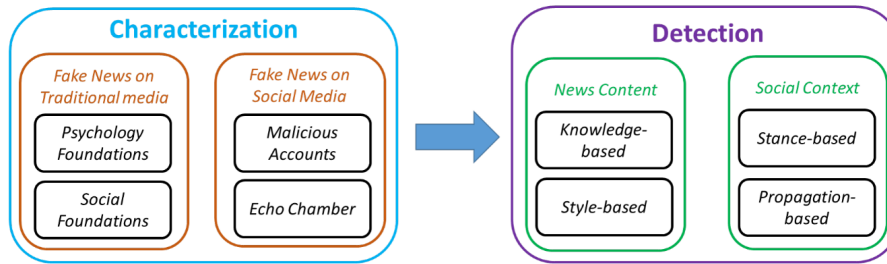


Figure 1.1: Fake news on social media: from characterization to detection.[4]

criticism and not taking it to the first degree. On the other hand, in the case of political media, even if it clearly try to influence the consumer, verifying the authenticity of there claims is usually harder as, in most of the cases, openly lies.

1.1.3 Feature Extraction

Now that fake news have been defined and the target have been set, it is needed to analyze what features can be used in order to classify fake news. Starting by looking at news content, it can be seen that it is made of four principal components:

- **Source:** Where does the news come from, who wrote it, is this source reliable or not.
- **Headline:** Short summary of the news content that try to attract the reader.
- **Body Text:** The actual text content of the news.
- **Image/Video:** Usually, textual information is agremented with visual information such as images, videos or audio.

1.2 Datasets

1.2.1 Fake News Corpus

This works uses multiples corpus in order to train and test different models. The main corpus used for training is called Fake News Corpus[5]. This corpus have been automatically crawled using `opensources.co` labels. In other words, domains have been labeled with one or more labels in

- Fake News
- Satire
- Extreme Bias
- Conspiracy Theory
- Junk Science

- Hate News
- Clickbait
- Proceed With Caution
- Political
- Credible

These annotations have been provided by crowdsourcing, which means that they might not be exactly accurate, but are expected to be close to the reality. Because this works focus on fake news detection against reliable news, only the news labels as fake and credible have been used.

TODO: Expliquer comment le dataset a t nettoy et mis dans une base de donnees afin d'augmenter les performances.

1.2.2 Fake News Net

The second dataset used is fake news net[6, 7, 4]. This corpus is made of news from two different sources, PolitiFact and GossipCop. An older version also provide news from BuzzFeed. News are categorized in two classes: fake and non fake. Being quite smaller than fake news corpus, this dataset will be used as a test dataset.

1.2.3 Liar, Liar Pants on Fire

The third and last dataset is **Liar, Liar Pants on Fire** dataset[8], which is a collection of twelve thousand small sentences collected from various sources and hand labeled. They are divided in six classes:

- pants-fire
- false
- barely-true
- half-true
- mostly-true
- true

This set will be used a second test set. Because in this case there are six classes against two in the other cases, a threshold should be used in order to fix which one will be considered as true or false.

It should be noted that this one differ from the two other dataset is it is composed only on short sentences, and thus it should not be expected to have very good results on this dataset for models trained on Fake News Corpus which is made of full texts.

1.3 State of the Art

Chapter 2

Data Exploration

2.1 Introduction

A good starting point for the analysis is to make some data exploration of the data set. The first thing to be done is statistical analysis such as counting the number of text per class or counting the number of words per sentence. The second step consist of doing Latent Dirichlet Allocation[9] in order to make unsupervised clustering of the text and see if there is some kind of correlation between the clusters to which a text belongs and its labels.

2.2 Dataset statistics

2.2.1 Fake News Corpus

Because **Fake News Corpus** is the main dataset, the data exploration will start with this dataset. And the first thing is to count the number of items per class.

Because the dataset have been cleaned, numbers provided by the dataset creators and number computed after cleaning will be provided. We found the values given at **Table 2.1**. It shows that the number of fake news is smaller by a small factors with respect to the number of reliable news, but given the total number of items it should not cause any problems. But it will still be taken into account later on.

Type	Provided	Computed
Fake News	928,083	
Satire	146,080	
Extreme Bias	1,300,444	
Conspiracy Theory	905,981	
Junk Science	144,939	
Hate News	117,374	
Clickbait	292,201	
Proceed With Caution	319,830	
Political	2,435,471	
Credible	1,920,139	

Table 2.1: Number of texts per categories

To have a better view of the distribution of categories, an histogram is provided at **Figure 2.1**.

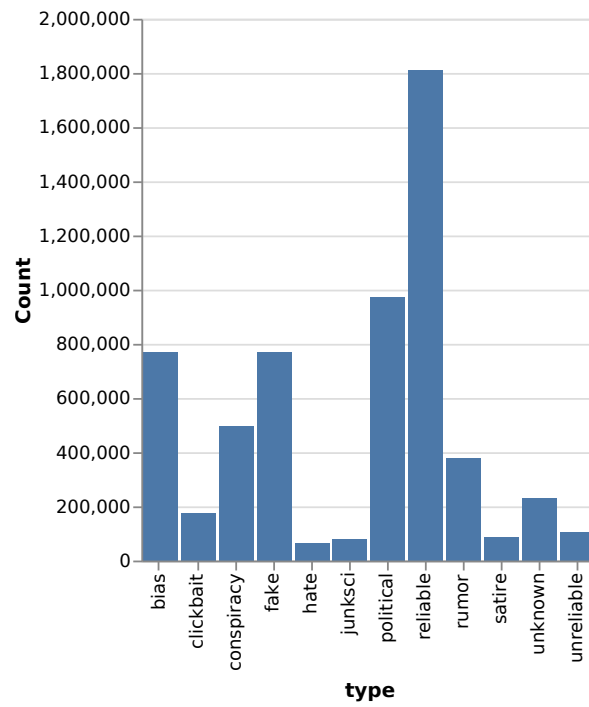


Figure 2.1: Histogram of text distribution along their categories on the computed numbers.

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