

Fake News Detector using Machine Learning Algorithms

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Abstract

With the Covid-19(Corona Virus) spread all around the world, people are using this propaganda and the desperate need of the citizens to know the news about this mysterious virus by spreading fake news. Some Countries arrested people who spread fake news about this, and others made them pay a fine. And since Social Media has become a significant source of news, there is a profound need to detect these fake news. The main aim of this research is to develop a web-based model using a combination of machine learning algorithms to detect fake news. The proposed model includes an advanced framework to identify tweets with fake news using Context Analysis; We assumed that Natural Language Processing(NLP) wouldn't be enough alone to make context analysis as Tweets are usually short and do not follow even the most straightforward syntactic rules, so we used Tweets Features as several retweets, several likes and tweet-length we also added statistical credibility analysis for Twitter users. The proposed algorithms are tested on four different benchmark datasets. And Finally, to get the best accuracy, we combined two of the best algorithms used SVM (which is widely accepted as baseline classifier, especially with binary classification problems) and Naive Base.

Keywords:

Fake News, SVM, NLP.

1. Introduction

Nowadays, Social Media has been taking a considerable part in people's lives. It has become one of the most common places for fake news as it has no restrictions on people's posts since anyone can edit their posts whenever they want. However, that didn't stop people from using Social Media as their source. The extensive use of social media has an enormous impact on many aspects of our life. Considering the harmful outcome of spreading fake news, it has an enormous social impact as it can mislead citizens into believing misinformation about a specific product/person or situation and the spread of economic and political fake News can directly affect the stock market and government economics in general. For example, publishing

politically fake news can affect the society, security, tourism, economics, and many more things; as it was found that, during the 2016 US presidential election on Twitter it was responsible for the early promotion of misinformation, that they targeted influential users through replies and mentions and that the sharing of fact-checking articles nearly disappears in the core of the network, while social bots proliferate.

These results had raised the question of whether such misinformation campaigns could alter public opinion and endanger the integrity of the presidential election, moreover, as when they published fake news about the death of the previous president Mohamed Hosny Mubarak which was first published by the Egyptian journalist Ibrahim Eissa in 2005 and had a significant impact on the following day on the Egyptian stock market.

This fake news spread several times, and the last one was on the 12th of December, the rumor also spread vigorously through the social networking site " Twitter" to top the hashtags" Mubarak Matt," the list of the most frequently used tags on" Twitter," and ranked first in the list of the most traded in Egypt.

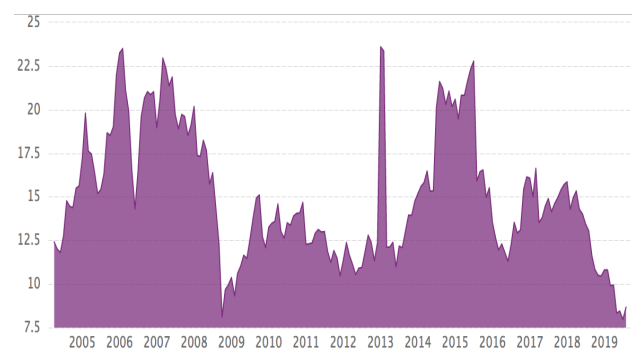


Figure 1. statistics show how the stock market was affected by the fake news.

Also, Tourism income can be affected by fake news, as spreading fake news in countries can make tourists not interested in visiting certain places, which costs losing much revenue. This targets social media users that rely on social as their source of information.

The studies show that the ability of the human to detect the fake news doesn't exceed 54 percent, so we developed a web-based system using machine learning and artificial intelligence to help people differentiate between real and fake news because as statistics and researches show that most of the world is exposed to fake news especially in turkey and Mexico , Also we tried to modify and achieve a better accuracy from the related work by using multiple features and a hybrid of algorithms like SVM , neural network and decision tree.

2. Related Works

[1] Fake News Detection Using A Deep Neural Network
The social media is a double edges weapon; However, it's an easy way to be accessed and doesn't consume a lot of time; different entities can also manipulate it. So in this paper, it identifies fake news using various models and classifiers; They proposed a Dataset for Kaggle, which combines multiple technologies as machine learning, natural language processing, and deep learning. Using these datasets and techniques, they investigate the analyses to identify linguistic properties that are present in the content.

[2] Fake News Detection As Facebook has considered one of the most popular platforms for news and information, and this paper applied its methodology on it by using the Naive Bayes classifier, which classifies whether the post is real or fake. To increase accuracy, a considerable Dataset of posts must be used to obtain better results.

[3] Sentiment Analysis Based on Support Vector Machine and Big Data: In this paper, Lukas Povoda, Radim Burget and Malay Kishore Dutta discussed that Support Vector Machine[SVM] is mainly used in text analysis as it can be trained by the huge amount of data and can deal with complex combined words as well as dealing with different languages. While working with big data [SVM] improved the accuracy

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the accuracy while working with big data with a percentage of 11, and the best accuracy obtained was 95.31 percent. For recognition of the rate of positivity and negativity.

[5] In this paper Dr. Eslam Amer has talked in the first about the social media and how it's a right place for the fake news, he also mentioned that Facebook has a percentage of 50% of fake news traffic. He said that 62% of US adults get their news from social media. He also discussed the impact of the fake news and how useful this project will be and how it will help people to overcome this problem. The paper also mentioned that NLP is used to reach optimum results. The utilized algorithms are RNN and LSTM, and he used the Liar dataset

[6] In This paper Gilda, Shlok used two different datasets, which are signal media, which gets news from local news, blogs, and articles as well as the outgoing list of fake and real News from OpenSource.co. They used SVM, Bounded decision tree, Random Forests, and Gradient Boosting as classifiers to increase accuracy and to get the difference between them. SVM happened to get the highest accuracy level with 77.2 percent.

[7] Fake news identification on twitter: In this paper the authors aim to Identify relevant features associated with fake news stories without previous knowledge of the domain, they used a variety of dataset like CharlieHebdo • SydneySiege • Ottawa Shooting • Germanwings-Crash • Ferguson Shooting, and classifiers like LSTM-CNN, LSTMdrop.

[8] identify tweets with fake news: These papers aim to identify fake news by making users analysis and context analysis by using NLP.using only one classifier which is SVM, and the result accuracy was 62

[9] Credibility Detection in Twitter Using Word N-gram Analysis and Supervised Machine Learning Techniques: In this paper, the authors choose tweets features to work on and also select LSVM and KNN as a classifier to test the best accuracy also worked on the Effect of increasing character N-grams on the efficiency of LSVM classifier to finally choose the best approach.

[10] sentiment aware of fake news detection on online social networks: in this paper, they used machine learning and deep learning classification and the sentiment analysis feature to detect the effect of the news on people's emotions by using an equation. The authors train their classifier by using PHEME labeled twitter dataset.

[11] Identifying fake news and fake users on Twitter: in this paper, the authors have credibility models to calculate the score for each of the tweets and the users and uses

TWITTER CRAWLER for gathering data to use it as a dataset to train.

3. Method

Our Proposed model aims to detect fake news by using machine learning and a combination of algorithms The proposed diagram using MVC model (Model View Controller), The user's view a web-based application, entering a topic to search then passing tweets related to this topic to the controller, these tweets need pre-processing to be well-defined data to work on like (stemming, stop words, tokenizer, n-grams). After that, the controller will send the organized tweets to work on additional features

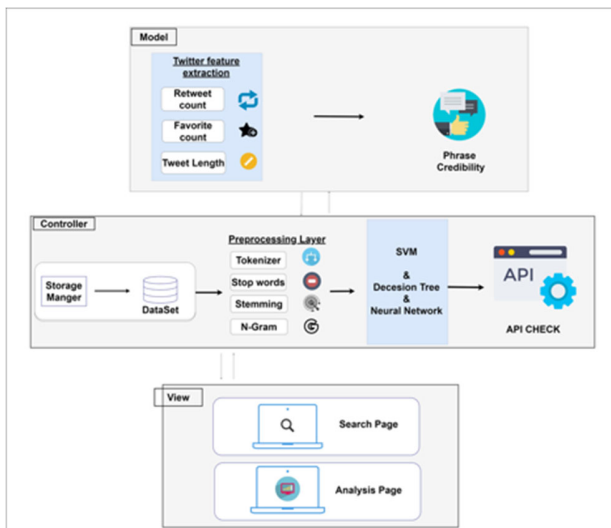


Figure (2) Architecture Diagram

3.1 Architecture Design

A- *Model*: The model part is responsible for the functionality of the system, which is first doing pre-processing on data to make it in the form that is suitable for the functions to use (Tokenizer, stop words, Stemming, N-Gram) and then extracting tweet features like Retweet count, Favourite count and Tweet length, sentiment analysis, and phrase credibility, the final step is entering those features is a hybrid classifier between SVM, Decision Tree and Neural networks those are the algorithms we will use and sends it to the controller to save it in the database.

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1-Algorithm:

- a) SVM: SVM plot each data item as a point in n-dimensional space where n is the number of classes we have, which is fake and real, then we perform classification by finding the hyperplane that differentiates the classes very well.
- b) Decision Tree: Decision tree uses the tree representation to solve the problem in which each leaf node corresponds to a class label, and attributes are represented on the internal node of the tree.



Figure (3) Decision Tree Diagram

- c) Neural networks: Set of algorithms, modeled loosely after the human brain, that is designed to recognize patterns. They interpret sensory data through a kind of machine perception, labeling, or raw clustering input.

2- Libraries:

Twitter API: its REST API allows you to read and write Twitter data; in other words, it can be used to create new tweets, read user-profiles and the data of followers (among other data from each profile), since it identifies the various Twitter applications and the users who register.



Figure (4) Twitter API Diagram

- NLTK: the Natural Language Toolkit (NLTK) is a platform used for building Python programs that work with human language data for applying in statistical natural language processing (NLP). It contains text processing libraries for tokenization, parsing, classification, stemming, tagging, and semantic reasoning.



Figure (5) NLTK

- ◦ SKLEARN : Scikit-learn is a free machine learning library for Python. It features various algorithms like support vector machines, random forests, and decision trees, and it also supports Python numerical and scientific libraries like NumPy.
- ◦ Numpy: This library is responsible for handling arrays.

B- *View*: It is responsible for the presentation of data and representing the User Interface(UI). We have two different interfaces one is responsible for retrieving the data from the user, and the second one is responsible for displaying the output data for the user and the analysis related to the data.

C- *Controller*: It is responsible for binding the view and model. The interactions and requests made within the view are taken and sent to the database to fetch data with the use of models, then it forward data to the view again to be shown. The controller we have is the user controller that deals with the user input that will be stored in the database. After applying our functionality to it, it then sends data to the view model to display the result for the user.

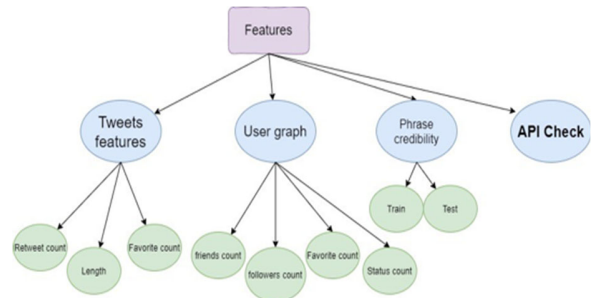


Figure (6) Features diagram

After that, the controller sends the organized tweets they have to work on additional features which are :

- The first feature is gathering information about each tweet and actions made upon them like the retweet count, length of the tweet, and the favorite count helping us determining the credibility of the tweet and generating a prediction
- The second feature is the user graph which is gathering information about each user and actions made by them like the friend's count
- , screen name and the favorite count and representing it using a graph structure helping us determining the credibility of the person is he trusted or not
- The second feature is the phrase credibility; we check if this tweet is credible or not and generating a prediction.
- The Final feature is the API check; we check if this piece of news does exist in a credible source of news like BBC or not and generating a prediction.

Those features differentiate between real and fake accounts and tweets on twitter.

3.2 Dataset

A	B
text	label
BREAKING First NFL Team Declares Bankruptcy C	0
National Federation Independent Business	1
Court Orders Obama To Pay 400 Million In Restit	0
comments Fayetteville NC	1
UPDATE Second Roy Moore Accuser Works For M	0
Romney makes pitch hoping close deal Election	1
Oscar Pistorius Attempts To Commit Suicide	0
Democratic Leaders Say House Democrats Are U	1
Trump Votes For Death Penalty For Being Gay	0
Budget United States Government FY 2008	1
Putin says Pope Francis Is Not A Man Of God Mu	0
Donald Trump exaggerates says China total cont	1
New York Man Wanted For Infecting 240 Men Ar	0
25th Amendment	1
Saudi Arabia Behead 6 School Girls Being With T	0
Malia Obama Fired From Cushy Internship At Sp	0
Briefing White House Press Secretary Robert Gil	1
Target Discontinue Sale Holy Bible	0
A Solar Grand Plan Scientific American	1
Youngest World Leader Bans George Soros Foun	0
Cautioning Young Adults Under Affordable Care A	1

Figure (7) politics dataset

- Dataset name: politics-data
- The data set composed of 2 columns the first one is Text (The tweet or the news) and label (0 means false and one means true)
- This data-set from kaggle.com

A	B	C	D
1 URLs	Headline	Body	Label
2 http://w	Four ways Bob Corker skewered Donald Trump	Image	1
3 https://w	Linklater's war veteran comedy speaks to modern America, say LONDON		1
4 https://w	Trump's Fight With Corker Jeopardizes His Legislative Agenda	The feud	1
5 https://w	Egypt's Cheiron wins tie-up with Pemex for Mexican onshore o	MEXICO	1
6 http://w	Jason Aldean opens 'SNL' with Vegas tribute	Country si	1
7 http://be	JetNation FanDuel League; Week 4	JetNatio	0
8 https://w	Kansas Tried a Tax Plan Similar to Trump's. It Failed.	In 2012,	1
9 https://w	India RBI chief: growth important, but not at cost of inflation - r	The	1
10 https://w	EPA chief to sign rule on Clean Power Plan exit on Tuesday	Scott	1
11 https://w	Talks on sale of Air Berlin planes to easyJet at risk of collapse: r	FILE	1
12 https://w	U.S. President Donald Trump Quietly Signs Law To Allow Warra	By Aaron	0
13 http://be	2017 Fantasy Football Team Defense Rankings - Week 5	2017	0
14 http://be	Just Shut Up & Play Some Damn Baseball!!	Just Shut	0
15 https://w	Deloitte cyber attack affected up to 350 clients: Guardian	FILE	1
16 http://be	10/7: Chuck Axed; HBD Brickyard, Adam, Moonlight Ace & Chuc	A Potato E	0
17 https://w	Gunman's Girlfriend Said She Didn't Know He Planned Harm	• The	1
18 https://w	Marilou Danley, Gunman's Girlfriend, Says She Was Unaware o	The	1
19 https://w	Trump's Immigration Rhetoric Echoes a Bitter Fight in the 90s	In bold do	1
20 http://be	Trump Bemoans 'Little Appreciation' As San Juan Mayor Begs F	Red Flag V	0
21 http://be	In Meeting With Military, Trump Talks Of 'Calm Before The Stor	In	0
22 http://be	Trump's Party's Outlets Re-Achieve With To Make Next Months	Red Flag	0

Figure (8) politics dataset 2

- Dataset name: politics-data2
- The data set composed of 4 columns the first one is Url of News, Headline of the tweet or News, Body of the tweet and label (0 for fake and 1 for real)
- This data-set from kaggle.com

	A	B
1	text	label
2	Did Miley Cyrus Liam Hemsworth secretly get married	0
3	Teen Mom Star Jenelle Evans Wedding Dress Is Available Her	1
4	Paris Jackson Cara Delevingne Enjoy Night Out In Matching O	0
5	Kylie Jenner refusing discuss Tyga Life Kylie	1
6	Celebrities Join Tax March Protest Donald Trump	0
7	Quinn Perkins	1
8	Cindy Crawford daughter Kaia Gerber wears wig dining Harry	0
9	I Tried Kim Kardashian Butt Workout Am Forever Changed	1
10	Full List 2018 Oscar Nominations Variety	0
11	Celine Dion donates concert proceeds Vegas shooting victims	1
12	Here What Really Happened When JFK Jr Met Princess Diana	0
13	Chris Evans Millie Bobby Brown Snoop Dogg stars Shower Bul	1
14	Biggest celebrity scandals 2016	0
15	Handmaid Tale Renewed Season 3	1
16	Caitlyn Jenner Addresses Rumored Romance With Sophia Hut	0
17	A Complete Timeline Selena Gomez Justin Bieber Relationsh	1
18	Taylor Swift Reportedly Reacts To Tom Hiddleston Golden Gl	0
19	When Will Claws Season 2 Be On Hulu	1
20	For The Love Of God Why Can Anyone Write Kate McKinnon A	0
21	Critics Choice Awards Critics Choice Awards	1

Figure (9) Celebrity dataset

- Dataset name: politics-data
- The data set composed of 2 columns the first one is Text (The tweet or the news) and label (0 means false and one means true)

- This data-set from kaggle.com

	A	B	C	D	E	F	G
1	screen_name	followers_count	friends_count	favourites_count	listed_count	statuses_count	bot
2	"HoustonPokeMap"	1291	0	0	10	78554	1
3	kernyeahx	1	349	38	0	31	1
4	mattlieberisbot	1086	0	0	14	713	1
5	sc_papers	33	0	0	8	676	1
6	lucarivera16	11	745	146	0	185	1
7	danthemprover	1	186	0	0	11	1
8	jill_of_us_	193	0	0	19	6068	1
9	Katamaritime	8227	2	26	89	2597	1
10	AutophagyPapers	275	0	23	17	9922	1
11	HSC_papers	51	3	0	9	2515	1
12	everychesse	51	1	0	12	1111	1
13	gyr_papers	2	1	0	4	230	1
14	lavon_court	0	29	0	0	0	1
15	AjstyleAlen	1	206	0	0	0	1
16	Rupesh9505	0	38	0	0	0	1
17	hard_to_yelp	109	0	0	16	16097	1
18	tuckeverywordta	290	0	0	25	31721	1
19	yeahTonyaGonzal	15	1941	319	1	406	1
20	bbbbggf	190	1899	27	0	0	1
21	ecin_gnhtaseod	181	0	0	24	21506	1

Figure (10) User dataset

- Dataset name: politics-data
- The data set composed of screen_name column : The username Followers count number of followers for the user
- Friends count : Number of friends for the user etc....

4. Results

Here are some experiments we used to decide the best classifiers and increase the accuracy:

Here shows how we give each function a specific weight by doing this experiment

4.1 Comparison of a variety of weights on features

Test2

Tweet: Taylor Swift cancels all appearances

Type: True

Number of tweets: 9

API check	Phrase	Tweet-Features	Sentiment	TP	FN	FP	TN
1.5	1	0.5	0.5	6	3	0	0
0	0.5	1	0.5	0	9	0	0
1.5	1	0.5	0	9	0	0	0
1	1	1	0	9	0	0	0
1	1	1	1	5	4	0	0
1	1.5	1	0	2	7	0	0
0.5	0	1.5	1.5	1	8	0	0
1.5	1.5	1.5	0	9	0	0	0
0.8	0.9	0.9	0.3	5	4	0	0
1	0.7	0.9	0.2	8	1	0	0
0.7	1	0.9	0.2	4	5	0	0
0.9	0.9	0.9	0.5	5	4	0	0

Test Figure(11)

RESULT

Test	API check	Phrase	Tweet-Features	Sentiment
Test1	1.5	1	0.5	0
Test2	1.5	1	0.5	0
	1	1	1	0
Test3	1.5	1.5	1.5	0
	1.5	1	0.5	0.5
	0.8	0.9	0.9	0.3
	1	1	1	1
Test4	0.9	0.9	0.9	0.5
	1	0.7	0.9	0.2
	1.5	1	0.5	0
Test5	1	1	1	0
	1.5	1.5	1.5	0
	1.5	1	0.5	0
	1	0.7	0.9	0.2
	1.5	1.5	1.5	0

Best Weight Combination:

API check	Phrase	Tweet-Features	Sentiment
1.5	1	0.5	0

Test Result Figure(12)

4.2 Classifiers

```

Decision tree Accuracy 81.13050706566915
Decision tree FScore [0.82443929 0.79604672]
Decision tree Precisoin [0.84202212 0.77719298]
Decision tree Recall [0.80757576 0.81583794]
Neural Network Accuracy 84.70490440565254
Neural Network FScore [0.86268657 0.82739212]
Neural Network Precisoin [0.85 0.843212]
Neural Network Recall [0.87575758 0.8121547 ]
svm Accuracy 84.53865336658353
svm FScore [0.8575804 0.83090909]
svm Precisoin [0.86687307 0.82046679]
svm Recall [0.84848485 0.84162063]
hybird Accuracy 85.20365752285952
hybird FScore [0.86535552 0.83579336]
hybird Precisoin [0.86404834 0.83733826]
hybird Recall [0.86666667 0.83425414]

```

Figure (13) Hybrid combination Diagram

Here We tested each classifier alone to detect its result, and my also tested the result of combining them, and it was the best one; therefore, We used a hybrid classifier of Neural Network (NN), A support vector machine (SVM) and Decision Tree.

5. Conclusion

In recent years, detecting fake news on social media plays a huge role especially this year as there is a pandemic and a disease spreading all over the world, most people take this as a chance to spread fake news and mislead people causing them to panic, in this paper we explain our web-based system that aims to detect the fake news by using machine learning and training the system with a large number of datasets and categories to help achieve the best accuracy, also combined features with experiments finding the best of them working together and with a combination of algorithms like SVM, decision tree and neural network.

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