

# Automated Fake News Detection Using Linguistic Analysis and Machine Learning

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**Abstract.** Recently, there have been multiple instances of unverified or false information spreading rapidly over online social networks. For example, there were recent reports about Russian hacking of an electrical grid in Vermont [1] and reports mentioning that Emmanuel Macron's presidential campaign is financed by Saudi Arabia [2]. Such unverified news have been spreading at a rapid pace in recent times and with the growth of “big data” in these fields it is impossible to manually filter such news. Hence, in this work we propose a novel text analysis based computational approach to automatically detect fake news. The results obtained for a test dataset show promise in this research direction.

**Keywords:** Fake News, Text Processing, Machine Learning

## 1 Project Description and Results

We ground this project on automatic fake news detection on the “Kaggle Fake News” dataset as provided by the SBP-BRIMS organizers. However, we also realize that this dataset only contains examples of news reports which were marked as fake or “BS” in some sense. Hence, such data needs to be compared and contrasted with another dataset that includes examples of valid and reliable new stories. We consider the problem of differentiating between “fake” and “valid” news to be of critical importance; arguably of more importance than differentiating between the various sub-categories of fake or “BS” news.

Hence, for exploratory purposes, we have created another dataset of 345 “valid” news articles. This dataset includes an equal number of news reports from three well-known and largely respected news agencies: National Public Radio, New York Times, and Public Broadcasting Corporation. The data has been released as a public resource for the community and is available at: <https://dl.dropboxusercontent.com/u/5887580/credible%20sample.csv>. It includes the following metadata: author, published, title, text, language, crawled, site\_url, country, thread\_title, spam\_score, main\_img, and type.

Our novel contributions include:

- (1) Creation of a new public dataset of valid new articles.
- (2) Creation of a text-processing based machine learning for automatic identification of Fake News with 87% accuracy.

## (3) Identification of features most commonly associated with fake news.

We created a sample of 345 valid news articles as above and complemented it with another set of 345 randomly selected articles from the Kaggle dataset on “BS” news. We used LIWC (Linguistic Analysis and Word Count) package to obtain linguistic features for each of the articles. Each feature was normalized using Z-score normalization. We undertook an 80-20 split on the data for the training and test sets.

We created multiple machine learning models based on well-established algorithms such as logistic regression, support vector machine, random forest, decision tree, k-neighbors classifier etc. and focused on the performance of the algorithms for the test set. Among these algorithms, Support Vector Machine method gave the best prediction results. The results obtained are shown below:

<b>Overall Accuracy</b>	0.87			
<b>Classification Report</b>	<b>(Support Vector Machine)</b>			
	Precision	Recall	F1-Score	Support
Valid News	0.89	0.89	0.86	65
Fake News	0.86	0.90	0.88	73
Avg\total	0.87	0.87	0.87	138

We also tried to identify the features with the highest difference of values between valid and fake news articles as shown below.

	<b>Mean (valid)</b>	<b>Mean (fake)</b>	<b>Absolute Diff mean (credible-fake)</b>	<b>Difference (Std. dev.)</b>
Word Count	1009.78	686.77	<b>323.00</b>	0.47
Authentic	16.72	24.04	<b>7.32</b>	0.47
Clout	76.49	70.37	<b>6.12</b>	0.53
Tone	42.25	36.33	<b>5.93</b>	0.24
Analytic	87.90	85.09	<b>2.81</b>	0.21

Looking at the top five features in terms of the difference between the valid and fake news categories, we note that the fake news articles tend to be shorter in length, convey less clout (expertise or confidence), appear more negative in tone (greater anxiety, sadness, or hostility), and denote lesser analytical thinking (more informal, personal, here-and-now, and narrative thinking). Surprisingly, though, fake new articles also appear to be more *authentic*. In LIWC, a higher score for authenticity is associated with a more honest, personal, and disclosing text, while lower numbers suggest a more guarded, distanced form of discourse. Thus fake news articles seem to adopt a more personal disclosing tenor.

These early results motivate a further in depth analysis of this phenomena and also suggests that it may be important to use multiple features to create comprehensive detection modules for fake news, rather than using a single feature (e.g. authenticity). A combination of such text-analysis based features, however, is found to yield reasonably

high accuracy (87%) at automatically detecting fake news articles, thus motivating further research in this direction.

## **References**

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