Fake News Detection Classification Using Machine Learning

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Chapter 1

Introduction

Social media for news consumption can be compared with a double-edged sword. It is comparatively low cost, easy to use and access, and rapid dissemination of information leads people to consume news from social media. But this however comes at the cost of questionable trustworthiness and significant risk of exposure to 'fake news', i.e., low quality news with intentionally false information.

1.1 Project Overview

We spent a significant amount of time in our lives interacting with people through social media platforms. We tend to seek out and consume news from social media rather than traditional news organizations. The reason behind this change in consumption behaviors can be derived as:

(i) it is less expensive to consume news on social media compared with traditional news media, such as newspapers or television.

(ii) it is easier to further share, comment on, and discuss the news with friends or other readers on social media.

Despite having these advantages, the authenticity of news on social media is significantly lower than traditional news organizations. Because of its easiness and cheapness, large volumes of fake news, i.e., those news articles with intentionally false information, are produced online for a variety of purposes, such as financial and political gain. One individual or society can be badly impacted by this immense spread of fake news. Nowadays, it is very difficult to identify a news whether it is fake or real. So, we will build a machine learning model that will automatically detect if a news is true or not.

1.2 Motivation

Fake news can be extremely dangerous and misleading in a society. According to stats in the last ten years, there are several brutal incidents reported due to the spread of falsified

news in social network platforms which are considered as the easiest media for spreading rumors. Mostly clumsy and innocent people are used to lead this violence because they are prone to believe these rumors. To help mitigate the negative effects caused by fake news-both to benefit the public and the news ecosystem-It's critical to develop methods to automatically detect fake news on social media

1.3 Objectives

The objective of this project is to discover the viability and impediments of language-based systems for detecting any type of fake news which is detected using machine learning algorithms, AI calculations.

- The aim of this project is to provide a systematic evaluation of the machine learning algorithm for fake news prediction
- This can save time for people. Online news readers would be more benefited by using this project.

1.4 Methodology

- **Manually curate corpus:** Preprocessed dataset on this field especially in Bangla is very rare. So, for training this system, curating data from different social media is needed.
- **Manually preprocess data:** The dataset, which has been curated manually, is real-life data. First of all, they have to be labeled as "Real" or "Fake", which is very difficult to insure. Also, the data-set is incomplete, unstructured, and noisy. So, the dataset has to be manually preprocessed.

After that a machine learning model can learn without being explicitly programmed. it can improve its performance by gaining more data. Then we can use our trained machine learning model to classify fake or true news.

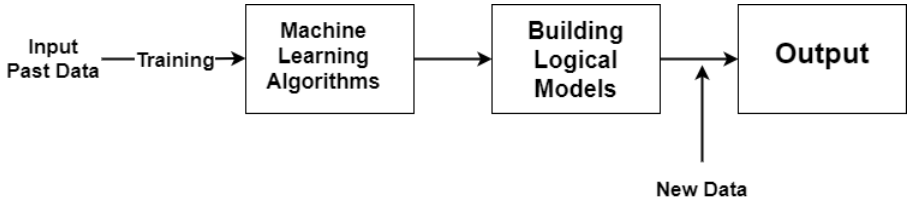

Figure 1.1: Simple Machine Learning model

1.5 Project Outcome

Our goal is to identify fake news from social media. For reaching our goal, we are expecting to make a web service with the properties of identifying fake news. Which will work as an extension or plugin with social media websites. The service will take keywords from a specific post or news from a particular media and run different algorithms over it. Then it will finally predict whether the **social media post** or news is possibly fake or not.

Chapter 2

Background

2.1 Preliminaries

We have reviewed several research paper based on our project topic and gathered a lot of knowledge about the topic.

2.2 Literature Review

Event Adversarial Neural Networks for Multi-Modal Fake News Detection

Published year: 2018
Author: Wang, Yaqing and Ma, Fenglong and Jin, Zhiwei and Yuan, Ye and Xun, Guangxu and Jha, Kishlay and Su, Lu and Gao, Jing
Publisher: Association for computing machinery(ACM)
Summary: Since news reading on social media becomes widely popular, fake news becomes a major issue concerning the public. It can take advantage of multimedia content to mislead readers which can cause a huge negative impact on one person or society. Most of the existing approaches do not handle the fake news on newly emerged events. The machine learning model tends to learn event-specific features that can not be transferred to unseen events. So in this paper, they proposed an end-to-end framework named Event Adversarial Neural Network (EANN), which can derive event-invariant features and thus benefit the detection of fake news on newly arrived events. Their framework consists of three components: the multi-modal feature extractor, the fake news detector, and the event discriminator. The multi-modal feature extractor is responsible for extracting the textual and visual features from posts. It cooperates with the fake news detector to learn the discriminable representation for the detection of fake news. The role of the event discriminator is to remove the event-specific features and keep shared features among events. They collected data from Weibo and Twitter. They claimed that their result outperformed

state-of-the-art-methods. [1]

Fake News Detection on Social Media A Data Mining Perspective

Published year: 2017
Author: Shu, Kai and Sliva, Amy and Wang, Suhang and Tang, Jiliang and Liu, Huan
Publisher: Association for computing machinery(ACM)
Summary: Social media for news consumption can be compared with a double-edged sword. It is comparatively low cost, easy to use and access, and rapid dissemination of information leads people to consume news from social media. But however, this comes at the cost of questionable trustworthiness and a significant risk of exposure to 'fake news', i.e., low-quality news with intentionally false information. In this paper, the main focus was on the understanding of fake news. The characterization of fake news. In this survey, they presented a comprehensive review of detecting fake news on social media, including fake news characterizations on psychology and social theories, existing algorithms from a data mining perspective, evaluation metrics and representative datasets. They used some widely popular datasets such as "BuzzFeedNews", "LIAR", "BS Detector", "CREDBANK". They used Knowledge-based approach and Style based approach for solving this problem.[2]

Fake News Detection on Social Media using Geometric Deep Learning

Published year: 2019
Author: Federico Monti, Fabrizio Frasca, Davide Eynard, Damon Mannion, Michael M. Bronstein
Publisher: Unknown
Summary: Context-based analysis to detect fake news poses some challenges. Like, often political, social commonsense, or ethical knowledge is required to interpret the news, which current natural language processing algorithms are still missing. From recent studies, it's come to life that, fake news and real news spread differently on social media. Forming a propagation pattern, and that could be used for automatic fake news detection. In this paper, a novel automatic fake news detection model based on geometric deep learning has been introduced. The model was trained and tested on news stories, verified by professional fact-checking organizations, that were spread on Twitter. In this paper, a geometric deep learning approach has been presented for fake news detection on social network like Twitter or other. [3]

Defending against neural fake news

Published year: 2019

Author: Zellers, Rowan and Holtzman, Ari and Rashkin, Hannah and Bisk, Yonatan and Farhadi, Ali and Roesner, Franziska and Choi, Yejin
Publisher: Unknown
Summary: as technology progress in recent years in machine learning, specifically in natural language processing, it has raised a dual-use concern. As the fake news classification is becoming more and more popular, the technology might also enable adversaries to generate neural fake news (targeted propaganda that closely mimics the style of real news). This paper investigates the threats posed by adversaries seeking to spread disinformation. They presented a model for controllable text generation called Grover. It can generate the rest of the article from a given article like "Link Found Between Vaccines and Autism". Also, they found that the best current discriminators can classify neural fake news from real, human-written, news with 73 percent accuracy, assuming access to a moderate level of training data. They claimed that the best defense against Grover turns out to be Grover itself, with 92 percent accuracy. They are going to release the Grover publicly soon.[4]

CSI: A Hybrid Deep Model for Fake News Detection

Published year: 2017
Author: Ruchansky, Natali and Seo, Sungyong and Liu, Yan
Publisher: ACM
Summary: Fake news has drawn attention both from the public and the academic communities. It provides malicious parties to manipulate the outcomes of public events such as elections and others. Because such high stakes are at play, automatically detecting fake news is an important issue, yet challenging problem that is not yet well understood. In this paper, it is mentioned that there are three generally agreed-upon characteristics of fake news. the text of an article, the user response it receives, and the source users promoting it. In this project, they proposed a model that combines all three characteristics for a more accurate and automated prediction. Specifically, they incorporated the behavior of both parties, users and articles, and the group behavior of users who propagate fake news. Their model CSI stands for Capture, Score, and Integrate. The first module based on RNN to capture the temporal pattern of user activity on a given article. The second module learns the behavior of users and the third module classifies an article as fake or not. Experimental analysis on real-world data shows that CSI achieves higher accuracy than existing models, and extracts meaningful latent representations of both users and articles.[5]

Detection of Bangla Fake News using MNB and SVM Classifier

Published year: 2020

Author: Hussain, Md Gulzar and Hasan, Md Rashidul and Rahman, Mahmuda and Protim, Joy and Al Hasan, Sakib
Publisher: IEEE
Summary: interest in research in this area(Fake News Classification) has risen because people can get easily contaminated by these fake pieces of news and their effects on the offline community. A significant amount of research has been conducted on the detection of fake news from English texts and other languages but a few in Bangla Language. So, In this paper, they offered a solution for fake news detection in the Bengali language. They used two supervised machine learning algorithms, Multinomial Naive Bayes (MNB) and Support Vector Machine (SVM) classifiers to detect Bangla fake news. Their approaches had good accuracy. SVM with linear kernel had 96.64 percent accuracy and MNB had 93.32 percent accuracy.[6]

Automatic Detection of Fake News
Published Year: 2017
Authors: Veronica Perez-Rosas,Bennett Kleinberg,Alexandra Lefevre,Rada Mihalcea
Publisher:ACM
Summary: Rapid increasing availability of social media feeds, news blogs, and online newspapers have made it challenging to identify trustworthy news sources. For getting rid of this problem they focus on the automatic identification of fake content in online news in this research. They have covered seven different domains of news and introduced two different datasets.One is the combination of manual and crowdsourced news data set, and the other is directly collected from the web. For the dataset build up, they have extracted five different features,they are: Ngrams, Punctuation, Psycholinguistic feature, Readability and Syntax. They used a linear SVM classifier and five-fold cross-validation, with accuracy, precision, recall, and F1 measures averaged over the five iterations. They conduct several exploratory analysis to identify linguistic properties that are predominantly present in fake content,and acquired 78 percent accuracy which is comparable to human ability to spot fake content.[7]

Automatic Deception Detection: Methods for Finding Fake News
Published year: 2015 Author : Nadia K. Conroy, Victoria L. Rubin, and Yimin Chen Publisher : Summary : This research surveys the current state-of-the-art technologies that are instrumental in the adoption and development of fake news detection. In this paper, “Fake news detection” is defined as the task of categorizing news along a continuum of veracity, with an associated measure of certainty. The paper provides a typology of several varieties of veracity assessment methods emerging from two major categories – linguistic cue approaches (with machine learning), and network analysis approaches. It also provides researchers with a map of the current

landscape of veracity (or deception) assessment methods, their major classes and goals, all with the aim of proposing a hybrid approach to system design. This paper drafts a basic typology of methods available for further refinement and evaluation and provides a basis for the design of a comprehensive fake news detection tool.[8]

2.2.1 Similar Applications

2.2.2 Related Research

2.3 Gap Analysis

[2] According to "Shu, Kai and Sliva, Amy and Wang, Suhang and Tang, Jiliang and Liu, Huan" at 2017, one of the major challenges for fake news detection is the fact that each feature, such as source credibility, news content style, or social response, has some limitations to directly predict fake news on its own. most existing approaches are supervised, which requires a pre-annotated fake news ground-truth dataset to train a model. However, obtaining a reliable fake news dataset is very time and labor-intensive, as the process often requires expert annotators to perform a careful analysis of claims and additional evidence, context, and reports from authoritative sources.

[3] The experimental validation of the conjecture that the model is potentially language and geography-independent, being mainly based on connectivity and spreading features. The study of adversarial attacks is also of great interest, both from theoretical and practical viewpoints. according to "Federico Monti, Fabrizio Frasca, Davide Eynard, Damon Mannion, Michael M. Bronstein" in 2019, their hypothesis is that attacks on graph-based approaches require social network manipulations that are difficult to implement in practice, making the method particularly appealing. It could shed light on the way the graph neural network makes decisions.

[4] According to "Zellers, Rowan and Holtzman, Ari and Rashkin, Hannah and Bisk, Yonatan and Farhadi, Ali and Roesner, Franziska and Choi, Yejin" at 2019, the primarily leverage distributional features rather than evidence. In contrast, humans assess whether an article is truthful by relying on a model of the world, assessing whether the evidence in the article matches that model.

[5] According to "Ruchansky, Natali and Seo, Sungyong and Liu, Yan" at 2017, an interesting future direction would be to build models that incorporate concepts from reinforcement learning and crowdsourcing. Including humans in the learning process could lead to more accurate and, in particular, more timely predictions.

[6] According to "Hussain, Md Gulzar and Hasan, Md Rashidul and Rahman, Mahmuda and Protim, Joy and Al Hasan, Sakib" at 2020, future work can be done using

a larger dataset to expand the number of features and sufficient lexicons. Besides, a stemmer can be applied to minimize corpus size and enhance model efficiency. In the future, the rate of success can be improved by doing more research utilizing hybrid-classifiers.

[8] According to "Nadia K. Conroy, Victoria L. Rubin, and Yimin Chen" at 2015, there are two potential limitations in this method: the ability to determine alignment between attributes and descriptors depends on a sufficient amount of mined content for profiles, and the challenge of correctly associating descriptors with extracted attributes.

Ref. No.	Algorithms	Research method	Data Set	Accuracy	Lang	Limitation
[1]	Machine Learning(RNN, CNN)	The multi-model feature extractor,and the event discriminator	Real-life dataset Source: Twitter, Weibo Size:10805 (real), 12647(fake)	Twitter-71.5% Weibo-82.7p%	English	Accuracy can be improved by implementing some hybrid-classifiers.
[2]	Data Minning	Fake news Characterization and Detection			English	Requires a pre-annotated fake news ground-truth dataset to train a model
[3]	Geometric Deep Learning	Feature Extraction, Classification	Type: real-life Source: Twitter Size:1080	92.7%	English	Network manipulations that are difficult to implement in practice
[4]	NLP(BERT, Transformer)	Feature Extraction, Classification	Source: common crawl Size: 5000 news articles	92%	English	Primarily leverage distributional features rather than evidence
[5]	RNN	Capture(Text analysis) Score(source behavior analysis) Integrate(integration of both module)	Type: real-life Source: Twitter, Weibo Size:2845(real), 2811(fake)	Twitter-89.2% Weibo-95.4%	English	Incorporate concepts from reinfor cement learning and crowdsourcing
[6]	MNB and SVM Classifiers	Data Collection, Data Preprocessing, Feature Extraction, Classifier	Type: real-life + manually created fake news Source: online news portal Size:1548(real), 993(fake)	SVM-96.64% MNB-93.32%	Bengali	arger dataset to expand the number of features and sufficient lexicons
[7]	Linear SVM classifier	Linguistic Features Extraction, classification	Type: Manual and Crowdsourced Source: From web Size: 1627(Fake and real) Size: 240(Fake)	78%	English	Worked only on seven specific domains
[8]	NB and SVM Classifiers	linguistic cue approaches (with machine learning), network analysis approaches	Type: real-life + manually created fake news Source: from web		English	The ability to determine alignment between attributes and descriptors

Chapter 3

Standards and Design Constraints

3.1 Compliance with the Standards

3.1.1 Software Standards

Standards	Chosen	Reason	Alternatives
Programming languages	Python	Has extensive support libraries. simple and portable. High readability	R, Julia
Version Controller	GitHub	Open source, allows branching and provides cloud-based repository, free and reliable	BitBucket
Design Standard	UML	High readability, allows to design, thoroughly, visual representation, abundance of available tools	OAA
Project Management	JIRA	Allows teams to easily plan, release, track any associated issues. supports several agile methodologies.	Trello
Markup Languages	Latex	Better for tables and illustrations. Consistent handling of references and bibliography.	Microsoft Word,Google Doc
Data Formats	CSV	Faster to load and import, consumes less memory. Parsing data from it is trivial and Python library makes it easier to handle CSV.	Microsoft Excel
IDE	Google Colaboratory, PyCharm	Colab for Automatic history and versioning and sharing. TPU support apart from its existing GPU and CPU instances. Pycharm for its Coding friendly environment on local machines.	Jupyter Notebook, Weka

Table 3.1: Software Standards

3.1.2 Communication Standards

3.2 Design Constraints

3.2.1 Economic Constraint

This is an online-based machine learning process. So a subscription-based earning system could be applied.It will save time for social media users to verify the authenticity of any news and it is also cost-effective.It doesn't create or replace any jobs because there is no specific job for verifying the authenticity of social media news.

3.2.2 Ethical Constraint

It will help Disadvantaged people to be aware of fake news of niche marketing over them.In terms of diplomacy, it's questionable that if the truth behind it is really favorable or unfavorable.

3.2.3 Social Constraint

Social entropy could be reduced by using this system.People will get instant awareness between true and fake news. Wide uses of this system will greatly reduce the tendency of spreading misinformation or fake news.Sometimes false identification of news, devastating entropy could occur in Society also.But we all know fake news poses a substantial threat to every society, with serious negative consequences. As we are trying to get rid of this problem by the system, so it's definitely not against any social norms.Everyone of the society should accept it.

3.2.4 Sustainability

It is questionable until the validation stage. The machine needs to be updated from time to time.

3.3 Cost Analysis

Provide a cost analysis in terms of budget required and revenue model. In case of budget, you must show an alternate budget and rationales.

3.4 Complex Engineering Problem

3.4.1 Complex Problem Solving

P1: This project requires the study of existing models with similar goals(K8), corpus collection from social media(K4), statistical knowledge of data analysis(K3),

Table 3.2: Mapping with complex problem solving.

P1 Dept of Knowledge	P2 Range of Conflicting Requirements	P3 Depth of Analysis	P4 Familiarity of Issues	P5 Extent of Applicable Codes	P6 Extent of Stakeholder Involvement	P7 Interdependence
✓	✓	✓	✓			✓

knowledge of designing of the machine learning based model(K3, K4), integration of different components(K5, K6).

P2: Conflicting technical requirements: Collecting data from mainstream social media like Facebook is very difficult. To achieve higher accuracy from our model, we need a huge amount of data. We have to collect data that will be very tough to handle because they will be unstructured, incomplete, and noisy. So balancing good accuracy within limited data as well is a tough job.

P3: Due to the quantity and the quality of data of social media, no obvious formula can be applied to pre-process or classify as a Machine learning problem. Depth of analysis is needed to find a way to pre-process and select a specific algorithm.

P4: Since there is no agreed definition of the term "Fake News", it is very tough to characterize Fake news. It has a complex pattern. Many psychological and social theories are related to fake news. So, As a Computer Science and Engineering student, "Fake News Characterization" is very burdensome.

P7: The dependency of sub-systems in this project is common. Like data collection, labeling, and pre-processing, model training, building a user interface, etc.

3.4.2 Engineering Activities

Table 3.3: Mapping with complex engineering activities.

A1 Range of resources	A2 Level of Interaction	A3 Innovation	A4 Consequences for society and environment	A5 Familiarity
✓	✓		✓	✓

A1: In this project, our stakeholders are various kinds of social media users. We have to scrape data from mainstream social media like Facebook or Twitter. Our motive is to build an extension on social media.

A2: We have to interact with news experts and traditional newspapers to identify the authenticity of the news.

A4: The main consequence of classification social media news, is the false classification of news. As this is a machine, it's possible to get the wrong output. And to mitigate that we think we have to learn our machine more and more data so that our machine accuracy may increase.

A5: This project has been done previously in English and another language. But in Bangla, very few projects have been done, and also which are not widely popular.

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