Machine Learning to Limit the Spread of Misinformation

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Abstract - **The coronavirus pandemic has taken the world by a storm. People all around the world are affected and hence talking about the same. Although a lot of the news generated post coronavirus in India as well as globally is accurate, there are still an alarming number of highly misinformed pieces of information, which has affected the doctors and social workers battling coronavirus every day. This study brings forth the discrepancy between the popular sentiment among the public and contrasts it with a database of the research articles that have been published in revered journals. The study culminates with an application based on the concept of natural language processing, which can then be used to gain complete insights into any piece of information and validate one's beliefs and assumptions on the topic. The main benefit of the application is for the media personnel who can validate news using it. The application is recommended for the purpose of news reporting as well as for summarization of the various research papers related to a topic.**

keywords - **Natural Language Processing, Machine Learning, Clustering, Topic Modelling, Coronavirus.**

I. INTRODUCTION

In these unprecedented times of the Coronavirus pandemic, doctors, scientists, academic scholars, and researchers around the world are conducting research on the details, symptoms, patterns, and cures for the same. The pandemic has affected several lives all around the world and thus, has become a household conversation. The misinformation being circulated about it, however, has brought the pressing need to limit misinformation among people [1]. It is an unrealistic expectation to believe that all people will have an equally accurate and precise understanding of every topic and piece of information that impact their lives and hence, this application enables them to be made aware of all the databased, well -researched articles available on the internet, which is also the most convenient and used platform for people to gather their information from.

Natural language processing is a subset of machine learning and it is the automatic manipulation of natural language, such as speech and text, by application. Furthermore, the concepts of deep learning integrated with natural language processing can be used to achieve higher efficiencies and better performance by models that require more data and less linguistic expertise to train and operate [2].

Topic modelling is used in order to identify the top keywords and the sentiment of the research articles or the published papers being considered. This is followed by the concepts of clustering, which then categorically groups the various topics identified into coherent clusters.

The aim of the study is to use natural language processing along with the concepts of clustering as well as topic modelling for the purpose of identifying and then grouping the various articles pertaining to the news or information that is being validated. The application is targeted towards news channels and newspaper reporters to find and validate pieces of information on the go and for them to be able to find directed, highly complex and specific research articles summarised and simplified for their perusal. It is also extremely helpful to the academic scholars as well as research scientists to find complete and summarised articles at for specific and modifiable cluster groups of broader topics.

This paper is different from others because, although there are a lot of studies being conducted on the concept of fake news [3] and how to identify it, when the person at the origin is well aware of the fact that this piece of information is false, this is not the case with misinformed news pieces being circulated, wherein the person at the origin is not aware of the intricacies pertaining to the topic. Therefore, this application acts as a validating source and thereby, preventing people from falling prey to both fake news as well as misinformed pieces of news and information around them pertaining to the various topics.

II. RELATED WORK

Over the last decade, several studies have been undertaken on the issue of fake news facing the global front with large scale consequences, impacting several people. These studies use different kinds of technologies viz. data mining, big data, machine learning and neural networks, artificial intelligence. However, not a lot of studies have been undertaken on the issue of limiting misinformation and fake news.

II.I. Data Mining

Some studies that have been conducted for the purpose of fake news and to limit misinformation have facilitated data mining techniques. These techniques involve detection of fake news pieces and pieces of misinformation by using the data collected of the source or the person propagating the fake news that is, his engagements on the social media platform extracted using the techniques of web crawling and stylometry. This has been done in the works published by Kai Shu et al [4]

and Afroz et al [5]. The study focussed on how to detect the fake news items on various social media platforms based on data mining techniques. Another study by Saranya and Min [6], concertantes on identifying tweets propagating fake news. This study is specific to the social media platform of twitter and has used data mining algorithms to recognise fake tweets.

II.II. Big Data

Fake and misinformed news can also be detected using Big Data technologies. The tools developed on this concept such as the one by Torabi Asr et al [7], focuses on analysing and detecting cases of misinformation and fake news on various social platforms using deception detection. They scrape fact checking websites and attempt to procure the data required to validate the same. In the study published by Rubin et al [8], the genuine news articles are contrasted with the fake news articles using big data with respect to homogeneity in lengths and homogeneity in the writing manner along with the writing timestamps and other metadata.

II.III. Machine Learning and Neural Networks

There are a couple of studies that are being undertaken using neural networks. One such study by Yaqing et al [9], talks about Event Adversarial Neural Networks, which tackle the problem of detection of fake or misinformed pieces of news on newly emerged events. This neural network is capable of deriving event variant features and thus aid the detection of fake news on recent events. Text and Image information based Convolution Neural Networks have also been used for the purpose of detecting and also diminishing the bias among these news articles. The study by Yang et al [10] emphasizes on the same technology and thereby explores the possibility of the same.

II.IV. Artificial Intelligence

The study published by Mykhailo and Volodymyr [11] uses a naïve bayes classifier for detecting fake or misinformed news articles. It has been implemented as a application system and has been tested against a Facebook dataset of posts. The study achieved an accuracy of 74% in detecting and categorising the fake posts, thereby, suggesting that artificial intelligence methodologies might also be quite successful in identifying and categorizing fake and misinformed news articles. The study by Feyza and Bilal [12] highlights a two-step method for identifying fake news in social media and the experimental evaluation of the intelligent classification methods using superficial artificial intelligence algorithms.

II.V. t-Distributed Stochastic Neighbour Embedding

t-SNE is and unsupervised, non-linear methodology which is majorly used for data exploration and visualizing high dimensional data. It gives the overall feel or intuition of how the data will be arranged in a high-dimensional space [13]. Due to the fact that t-SNE is based on probability distributions with random walk on neighbourhood graphs to find the optimal structure within the data. t-SNE is also the only non-linear methodology which is capable of retaining both the local as well as the global structure of the data at the same time [14]. Thus, making t-SNE the most effective methodology to represent the high dimension data on low dimension, non-linear manifold.

III. MATERIALS AND METHODS

The study is based a database and has been developed using the machine learning concepts of natural language processing along with the methodologies of clustering and topic modelling.

III.I. Dataset for Research Paper

The dataset has been built from a scraping of the web for research articles and published papers containing the words "Coronavirus" or "Covid" in their abstracts. It contains 83496 articles published between the dates 1st January 2020 until 1st July 2020. It includes their abstracts, the number of words in the research paper, the authors and the date of publication.

III.II. Topic Modelling

Topic modelling is a methodology of natural language processing under the topic of machine learning. It is a type of statistical model to discover the abstract topics that occur in a collection of documents [15]. It is an unsupervised machine learning algorithm, wherein it considers all the words that go together. The model is then also capable of picking out which portions of a document cover which topic specifically. Topic modelling is a frequently used text mining tool. The database for the research articles and published papers are then used to summarise and categorise the articles and papers based on the topic being emphasised on in the abstracts and the summaries.

III.III. Clustering

Clustering is a machine learning methodology to divide the population or the data points into a number of groups in such a manner that the data points in the same group are more similar to the data points in the same group as compared to data points in other groups [16]. It segregates research articles and published papers belonging to a particular topic by assigning them to clusters.

K-Means clustering algorithms have been used for the development of this application and has been optimised using the t-SNE algorithm. The various research articles and published papers, after being inferred for the particular topic they represent to the largest extent, are segregated and grouped into coherent clusters. The clusters are then used to differentiate between the various topics that are being searched by the user.

III.IV. The Application

The application has been developed keeping in mind the demographic of news reporters and media personnel. The application permits the users to manoeuvre and fill the specifications they wish to find using a scroll bar for the cluster numbers as well as a search bar to find keywords among those clusters. As the user enters their cluster number preference and the keywords or just the cluster number to be searched for or just a few keywords they wish to discover, the cluster groups align themselves to show the given results. They also provide a summarised version of what is in the report on hovering over the data points. The hover also includes metadata regarding the research articles or the published paper comprising of the author name(s), the journal of publication and the link to the article or paper. Each of the data points constituting different cluster groups are demarcated with distinguishing colours. The search box also provides suggestions into the most relevant keywords related to the specific topic.

Fig. 1 A sample of the search bars for the user to enter their data.

Fig. 2 A sample of the metadata and summary on hovering over the data points representing research papers and articles

The application can be rendered on a web browser separately as well as in Python itself. The home screen opens to the two search bars (Fig. 1), one to adjust the cluster numbers and the second to search for the specific keywords. Once the user enters their particulars, they are redirected to the result page which gives the cluster groups with the research articles and published papers as the data points and with the summary and its related meta data on hovering over the particular data point (Fig. 2).

IV. RESULTS

The application is created to cater to the demographic of news reporters and media personnel. The application opens to the home screen which asks the user to input their specifications, if any. After this, the second page opens to the cluster graph detailing the data points representing the articles and published papers specific to the search. The user can also reset the search options and go to the default cluster graph. The user can also enter their specifications on the second page once they have crossed the first page. The changes get reflected in the cluster graph immediately. The data points can be hovered over to display the meta data along with the summary of the research article or published paper.

The application is optimised with the help of the t-Distributed Stochastic Neighbour Embedding (t-SNE) for searching through and providing the required results using the database of research articles and published papers. The final default cluster graph (Fig. 3) displays the entire extent of the articles and papers, when the user has not made any selections of cluster number or keyword search. It is then capable of displaying the summary and metadata, including author name and link to the journal, using the hover tool (Fig. 4).
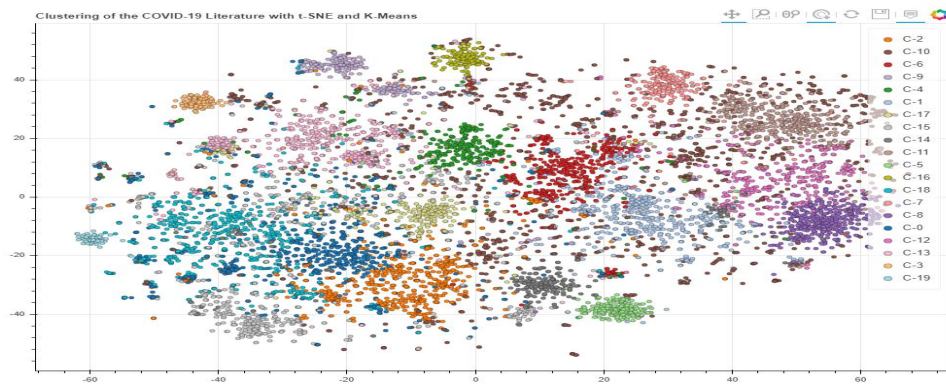
Fig. 3 Zoomed in sample of the application with default inputs (without user inputs)

V. DISCUSSION

The application has been developed using machine learning algorithms of natural language processing along with topic modelling and clustering. There are several reasons for this application to be pushed for use by news reporters and media personnel. It is unwise to presume that all media personnel are aware and well versed to find the flaws and/or vouch for the veracity of each report, especially when it comes to something as vast, extensive, new or catering to scientific audiences like medical news, coronavirus, historical government policies and this has in turn led to largely increasing instances where media channels or newspapers have divulged news which is not the most accurate representation of the situation in the world [17]. These subtle misinformation in pieces of news make a great source of great concern as they can grossly shape the government policies if not identified in time [18].
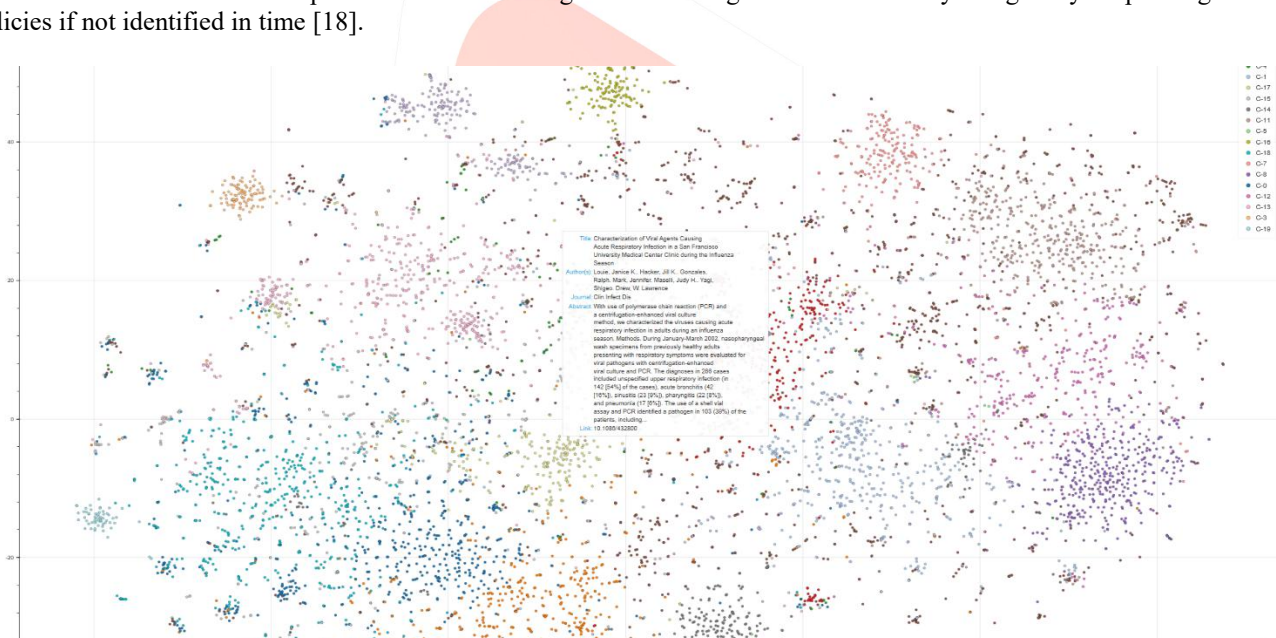

Fig. 4 Sample of the application along with the hover tip at default inputs

The application software can be used to augment the work of news reporters and media personnel by providing them with a platform to find simplified scientific explanations and summaries of the works published after great research by academic scholars pertaining to that particular field.

This software apart from aiding their professional work, can also improve the quality of news reporting by allowing the reporters and media personnel to delve deeper into areas which are difficult to completely comprehend and understand within the strict deadlines given to them for rolling out a story [19]. It helps the reporters to research on the topics which are relatively more scientific and expansive to be understood within a day or even a week, which is the maximum duration in most publishing and reporting news agencies and channels.

Fake news is becoming one of the biggest menaces facing the global world today [20]. This software proves itself to be the first phase of validation and by consequence eradication of the phenomenon at a more official and grass root level. This software presents better technical solutions than those based on data mining and web mining which are known to require large amounts of data and computational proficiency.

Like most software, natural language processing software are also cost effective [21]. Once developed, they require either little or no maintenance and can be distributed among several newspaper reporters, agencies, and media channels, not constrained by geographical borders.

VI. CONCLUSIONS

Computer based techniques are now being used increasingly for improving the quality of the content being churned into the world for the people to read [22]. The field of news reporting and media can be made more informed and secure using such software to prevent the cases of misinformation among news articles and pieces of information. The software is developed on a database of research articles and published papers on the topic of Coronavirus. This software has the ability to be integrated into their environment seamlessly and also ensures improvement in quality of the news reports while also conforming to the deadlines [23]. More importantly, this software has the ability to prevent fake news by allowing for a preliminary validating tool, accessible generally and can even be personalised by allowing the entry of select personnel using proper credentials.

The software can be modified with relative ease and can be customised to suit the requirements of the specific news agency or channel. Natural language processing and machine learning can be used to enhance the extensive and thorough process for the reporters and media personnel. It can also aid in providing more accurate and true information to the world and help shape an economy and a society which is more linked to its environment via news channels and media reports.

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