

Fake News Detection System

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Abstract - The problem of fake news is a huge nightmare in the digital world nowadays, and in India, the impact is much closer and more threatening. This was evident with the COVID-19 pandemic, as fake or pseudo Science health information was spreading on WhatsApp significantly faster than even the real information, and the majority of the population had no good option of finding out whether what they were reading was even real or just another fake news. The biggest issue is that a majority of the detection tools available in market are build on the basis of Western datasets. They simply do not work with Indian news which is a combination of English and Hindi, local politics and some specific viral forwards. The current project is an endeavor to correct that A system was built using three models—LinearSVC, Logistic Regression, and Gradient Boosting—trained on the Indian Fake News Dataset (IFND). This has over 56,000 fact-checked articles that actually represent the messy data seen in real life. The system does not simply scan the text but checks such aspects as the sensationality of the headline and the possibility of the source to be credible. All these signals are inputted into a model whose decision-making system is based on the majority-vote system. This method achieved 88.4% accuracy of the 11, 343 articles in testing. I also applied SMOTE in the training process to ensure that the model was not biased on real news simply because of the sheer number of such in the data. It also has a manual override in case of health misinformation, and a gibberish check such that the system does not give a sure answer to random typing on the keyboard. Everything is put into a web app with a React frontend and a Flask backend. A user just pastes an article and gets a prediction with a simple reason why it's flagged as real or fake.

I. INTRODUCTION

As the consumption of media and consumption of information among ordinary citizens increases, the increase in fake news is also quite high. It is not always that some propaganda is used to spread fake news or simply some normal sarcasm or a joke. In case the news is fake then it does count and it is incorrect. False news may misdirect and deceive individuals. There are

also some individuals who may be in very life-threatening circumstances just in case they are misinformed by a specific fake news so being fake is a very risky thing as it does not only create an impression in the mind of a normal person on a specific situation, but can even plunge someone into trouble. In case the individual or a user suspects falsified health news on some health news, this may be very important to their health. It is not necessarily about strict grammar rules in the book in India. It's way more fluid. Individuals mingle in their local languages and a great deal of emotional reasoning that you simply do not encounter in a US or UK setting. Due to this reason, the vast majority of AI detection systems that are simply trained on Western data simply become confused. They fail to do so since they are not actually conversant with how an Indian person speaks or writes.

It is currently one of the largest nations in the world in terms of population in India. By present time the population is well more than 1.45 billion or above and calculated by many methods of population calculation. It is the most populated nation worldwide, and in fact there is very large number of internet penetration here as well, so fake news can literally be spreading like forest fire unless it is well-considered. That is why in a nation such as India, it is very important to check any specific news before trusting it, and the dataset used in this project covers 2013-2021, with significant events related to politics, violence, terrorism, and other aspects, which are highly basic things where fake news may occur. It also records one of the biggest ones like COVID-19, which had spread in India during early 2020, in the month of February or March.

Fact-checking may be adopted, though it is time consuming as one has to navigate through the internet and once more when the news is generated with a specific aim of propagating or spreading misinformation that is meant to be fake, then users will

still access the fake news. This is why a fake news detector becomes so significant as a fast and highly dependable source of the news in case it is fake or not. As stated above, it is a good thing that experts or analysts do the fact-checking, but it is usually slow. It is also unreliable at times since some of the large newspapers also attempt to peddle news since some of the propaganda or monetary reasons as well.

To solve this specific problem of fake news spreading, a plethora of agencies and even several models of AI are operational, yet the issue lies in the fact that most of the AI models are operating on the Western datasets, and it is more about the US-based fake news and suchlike things. To speak about these things, they apply TF-IDF and supervised learning, which is good, and such techniques have 80 percent to 85 percent accuracy that is, the news that will be predicted by the AI will be correctly identified as true or false.

In a country like India then there are more than 500 of languages and officially recognized languages are 22 the fake news is not only in the typical western or specifically us or uk based English it is often blended with the Indian English which is a kind of similar to the standard English but it has some word Which are present in UK or UK English but the word structure and the grammatical context and the meaning of those words are very different in Indian context the Indian English is based on the emotional logic on the already Indian languages that's why it makes it hard for a US based Detection system to correctly judge if its real news or fake news.

The fake news in the Indian context does not necessarily originate in the traditional TV channels. It goes viral on websites such as WhatsApp, Face book, Reedit, and Twitter, and in most cases, it does not pass through any sort of professional gate keeping. Such messages are commonly employed with certain political agenda or propaganda or even justification of a pseudoscience simply because some individuals have believed in their specific beliefs excessively. This statement can be more reliable and minimal, and this is one of the examples of this during the COVID-19 pandemic which are properly reported. WhatsApp forwards were regularly asserting that hot water, raw ginger and some unproven herbal blends could eliminate the virus in the throat. What was more worrying was the fact that pseudoscience was used to support traditional rituals by people. Another instance of such type of fake news were the viral messages

stating that NASA satellites had detected the existence of positive energy or that, the vibrations caused by clapping and lighting lamps would damage the molecular structure of the virus. These types of pseudoscience are believed by many due to the reason that they think that when they use a language with some kind of scientific names such as molecules and other names then people think that it is real and that makes it alarming that people do not fact check it is real or not and just spread it especially in Whatsapp and Face book groups.

The other huge problem is that the news in India is closely tied to politics, religion, and regional events. To illustrate, a political issue in Jammu and Kashmir is entirely varied compared to a regional issue in Kerala or Mizoram, as the historical background is varied And over that the regional background is varied, the politics is varied depending on the local communities, languages, and customs. Most current AI systems, however, are being trained on Western data. They have no actual knowledge of these regional differences of India and this is why their precision fails when they attempt to make judgments about Indian news.

II. LITERATURE REVIEW

Detection of a fake news has now emerged as one of the most important problems in applied machine learning and deep learning in particular in this era of the spread of misinformation among all digital formats at very high rate and speed on top of that in a country like India where Internet has penetrated to almost even the most remote areas and locations there the impact of unchecked fake news has been of a more serious nature than usual the scope of things being range of some communal tensions to misinformation during health crisis. The research in the area has developed much over the past decade drawing together thoughts across fields as unrelated as data mining then natural language processing then social network analysis then psychological behavior also so that the universal solution is not coming at a specific rate[1],[17] the area has progressed through several overlapping stages where each new direction brings the better but also has shown the new constraints which is the next way of the various approaches will need to address the problems generated by the specific improvement in the specific stage of the progression.

From basic text features to the early models people used

Some early attempts at automating this kind of feature where based on a pretty simple idea or a concept the concept was that fake news just sounds different from the real reporting researchers like Shu et al. [1], Sharma et al. [4], and Shaikh and Patil [5] Build this early frameworks by pulling out word frequency and writing styles to see if they could separate the two verdicts that is if it's either fake or a real news then Khanam et al. [2] and Baarir and Djefal [3] Tried testing standard algorithms like SVM and Naïve Bayes probability algorithms they found out these worked ok is but only if the preprocessing was done very carefully and with very correct and standard approach the big take away from this early work which Gupta et al. [6] Properly pointed out that the way you engineer your features actually matters just as much the classifier you pick if the features are bad then even the great model is bound to fail Ahmed et al. [15] this project went back to n-gram analysis to prove that the simple linguistic pattern are still readable way to catch Whether are the news is fake or not.

The generalization problem and why using multiple models came in

Once the field moved past this basic kind of ideas and systems then a much harder problem appeared the problem was these models often fall Apart on data they haven't seen before Mishra et al. [7] Raised this concern directly showing how a model could look great on a 1 particular data set that has trained that but would fail completely on another diversified data set that the model has not seen Alghamdi et al. [8] Compared this traditional methods to early deep learning and found that neural methods where Starting to win out this competition to get a better performance people started using assemble strategies for example Kaliyar et al. [9] Try to use a gradient boosting framework to move beyond just that true or false methods add into multiple categories of fake news similarly Park and Chai [10] Focused on user centered model mode showing that the mixing behavior signals that machine learning work better than just looking at the text by itself When it actually got the context of other things involved in the new headline of the news

A shift towards deep learning to better understand what words and sentences

have meaning in their sentence There was a high realization that just counting word wasn't enough to predict the news Brăsoveanu and Andonie [11] Argued for using a cementing signals that sentimental and factual relationship which definitely gave way better results than the earlier models. Kumar et al. [12] Tried to build entire NLP pipelines because they believed language corresponding has to happen before the classification even starts then the deep learning changed the game entirely Alnabhan and Branco [13] and Al-Tai et al. [14] Work on reviving how CNN and BERT Parikh and Atrey [16] Made a very good point that fake news isn't just a text its inbuilt with media richness meaning images and videos are also part of the problem too.

How social context and platforms also play a role

It is also significant to build the base in research which also pays off in good model working under letter stages. The 19 dataset by Wang [19] was a benchmark. Zhou and Zafarani [17] provided a vision and a method to structure these methods into content-based vs. hybrid structure That are used in order to determine which one is indeed better to be utilized as compared to the other one. However, it was demonstrated by such researchers as Shu et al. [18], [21] and Ruchansky et al. [20] that The systems the people are building has to look beyond the news content only there is models demonstrated that social context, including such information as who sharing the news what their user profile looks like what their news source is such like these are equally important as the text itself to actually decide whether the news is fake or not.

III. SYSTEM OVERVIEW AND PLANNING

3.1 Overview of Indian Fake News Detection System

This project is a web-based application that focuses on the Indian information ecosystem. Most fake news detection systems are built using Western datasets, mainly English news from the US or Europe. Because of that, they don't really fit how information spreads in India. Here, a lot of content comes in mixed languages, sometimes even in the same sentence, and a lot of news gets forwarded on WhatsApp without any clear source. Hence due to a lot of these kind of news detectors fail on Ind context because they are not just trained on a particular Indian data in Indian context.

As Shu et al. [1] point out, detecting fake news isn't just about analyzing the content. It's also about understanding how it spreads and where it comes from. This matters a lot in India, where platforms like WhatsApp play a big role, and information spreads in ways that are very different from Western platforms. So just using the existing models directly is not enough.

Right now, there are some solutions for this problem, but many of them are either manual or focused on Western data. Platforms like Snopes or FactCheck.org work on human fact-checking methods, They're accurate, but they're slow. Some automated systems, like Logically or ClaimBuster, exist, but they are mostly trained on US or European datasets.

In India, platforms like Boom Live and Alt News are doing important work, but they also rely on manual verification, not automated detection. There are some research-based systems using datasets like ISOT Fake News or FakeNewsNet, which show that machine learning can work for this problem. But most of them don't really take the Indian context into account. Zhou and Zafarani [17] also mention that most systems are either content-based or social-context-based, and both approaches still have limits, especially outside Western environments.

3.2 Requirement Analysis

The workflow of this particular system is that many users put their news heading in the input box. Then the backend starts doing its work. First, the backend checks if the text is valid or not. For example, it checks whether the text is actually a proper news heading or not, just some random numbers typed there. If random numbers are typed, then it immediately returns false news or fake news, why? Because that's not even news. So how can it be true news?

And so next, the text gets cleaned by taking out things like various things like URLs, special characters, extra spaces, exclamatory marks, and other things which are not needed. The context now is only some English words, nothing more than or less than that.

Now, after cleaning, the system adds some extra info which is based on a score in the backend. For example, there are two ways to do this, but not two ways, but there are two types. One is source credibility, like whether it is coming from an unofficial source like

WhatsApp, or whether it is coming from a different source like India TV or other Indian news channels.

Then the text is changed into various numbers using a technical method called TF-IDF vectorization. This kind of thing is done because machines do not understand what words like normal humans do in English or in any other language. Machines only understand the numbers given by the system and not our human spoken language, so they need numbers to work and find patterns.

3.3 Feasibility Study

Technical Feasibility

The total system framework is squarely based on the IFND (Indian Fake News Dataset) Which implies that the data set in question is a gold thing that solves the problem provided the data set itself is not fully corrected or fully in touch with the actual facts then the model is bound to operate correctly as well as in low end hardware devices. The primary technological breakthrough was to resolve the data imbalance issue. Due to the inherent scarcity of fake news compared to true news, the training stage employed SMOTE in order to balance the classes. The reason this was used was that since there were more real news where there so if a model predicted real then it would have or would actually do some work based on the data it was receiving with the help of this particular technologies to correct the issue of data imbalance.

Economic Feasibility

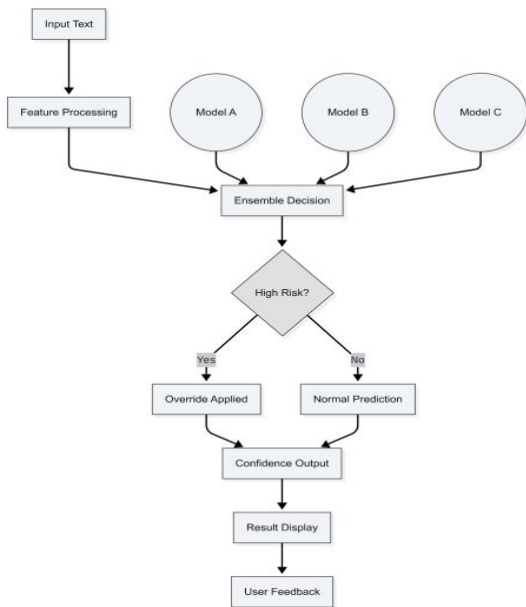
The overall cost of construction of this system can be very cheap relatively since it incorporates numerous open source software and publicly available data sets implying The cost is very dropped here and thus in essence there is no significant development cost as such as the effort put to construct the project itself. To be more precise, it can be developed on nearly any local machine or even a cloud system that does not cost much at all on a monthly basis and the size of the model is also small and the model does not store the storage of the user data nor does the bandwidth so those things are also very low, however it does not take continuous time to be spent on them as the model is encountered with a new data to the model.

Operational Feasibility

The system is also structured in a way that it can be easily used by various types of people e.g. by general users who want to check news before posting it on their friends or family groups on social media like Whatsapp or Facebook, The journalist who use it as a basic filter before doing a deeper research on a certain topic, even by the students or researchers who want to study fake news then this is a web based system and so there is no need to install a specific software or an app and run this specific thing on the local system of a user the process is very simple the user is only required to paste the text.

3.4 Plan for Development of System

Development was organised into four phases, each building on the previous one



3.1 System Architecture: Fake News Detection Pipeline

The first phase is mainly about preparing the data and training the model the Indian fake news data set was first cleaned by removing unwanted and corrupt entries after this phase is done it was explored to understand how exactly the data is distributed what are the column names of the data and what where the difference between fake and real news then the data set was split into training and testing parts like 80% was used to train the model and 20% was used to test the model if its works correctly or not using stratification.

Some basic preprocessing steps were also done like removing urls special characters and extra spaces which are just unwanted. Along With that a few extra features were also considered like source credibility sensational score and whether a claim looks realistic or not if claim looks very unrealistic then this system has overridden mechanism that basically says it's a fake news . For converting the text into features TF-IDF was used with unigrams bigrams and trigrams which resulted in around 12,000 features.

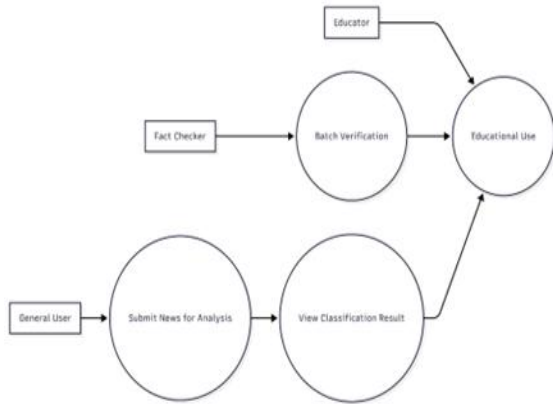
Different models were trained such as SVM, Logistic Regression, and Gradient Boosting. Before training, SMOTE was applied to handle the imbalance in the dataset. After training, all the models along with the vectorizer were saved so they can be used later during prediction.

The second phase was about building using the flask which is the python framework for backend development The application was divided into different models to keep things organized special attention was given to input validators so that case is like random or meaningless Text can be handled without affecting the normal input and news headlines. Then the text processing part also included checking source credibility detecting sensational language and identifying unrealistic claims using simple methods like pattern matching.

The third phase is focused on the front end that means creating a user interface for this react based interface was created where users can enter the news title or headline and get the result created by this model the design was kept in simplistic manner so that it is easy to use even for a normal people it shows predictions along with confidence cover and uses some color indications to make it easy to understand.

The final phase was testing and improvements different types of test were done including unit testing and checking the full system flow manual testing was also done using different kinds of inputs like fake news then the real news then extremely short text then a random text with combining some letters and numbers. Based On the feedback some changes were made like adjacent thresholds and improving the explanation part the system was also checked properly for performance to make sure it responds in reasonable time The user interface and the server works properly without any time delay

3.2 Use Case Diagram



IV. SYSTEM DESIGN

4.1 Introduction

Designing the fake news detection system was not just about choosing any ml model. There were other things also, like how different parts connect and whether the system will still work properly when everything is combined together. The main idea was to keep the system simple understandable and easy to obtain later with modular architecture it becomes really easy and relatively simple to update the systems compared to monolithic system, hence the design focuses on three things keeping components separate making output understandability user and keeping the system fast enough so that the output shown to users comes quickly.

4.2 System Architecture

The system follows a basic client server structure. The front end is built using react which handles everything the user sees and user interacts with special hooks like use state and use effect the back end is built using flask in python where all processing and prediction happens both parts communicate using REST API and JSON format. This makes it easier to modify the either the entire front end or the back end without affecting the whole system.

At the higher level the system mainly has three components the web interface running in the browser the flask Back end server and the trained machine learning model stored on the local systems each part has its own particular role and together they make the system works correctly and efficiently.

The responsibilities are divided across these parts so that each one handles a specific task correctly this makes the system way easier to manage test and update if in future it's needed

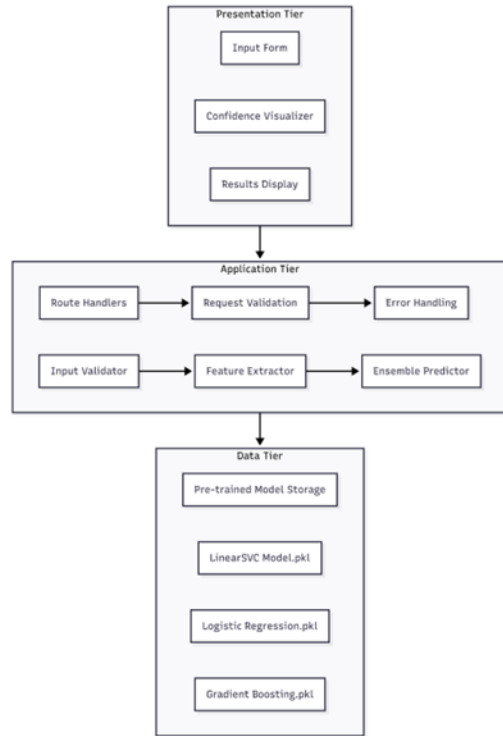


Figure 4.1 illustrates this high-level structure and the relationships between major components.

The above diagram Basically shows how the whole system is divided into different parts at the top level there is a presentation there which what exactly the user is going to see it has things like input form where user paste the news and then there is the confidence visualizer and the result display which basically shows how confidence is our model while predicting the news and the verdict which is either fake or true so this part is mainly focused on the interaction nothing much processing happening here.

Add the bottom there is a data layer this stores all the train models like SVM logistic regression and gradient boosting these are already trained and saves as a particular file so during prediction they are just loaded and used directly to do their prediction.

4.3 Data Flow Design

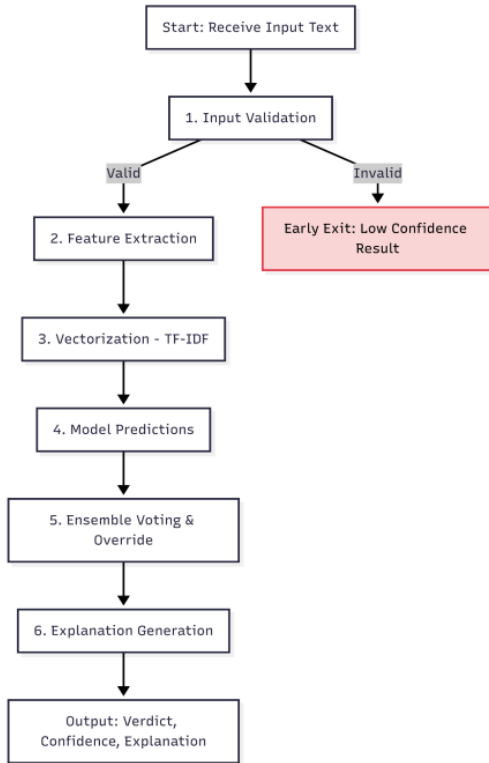


Figure 4.2 Level 1 Data Flow Diagram

VI. CONCLUSION AND FUTURE WORK.

6.1 Conclusion

The main goal of this project was to solve a specific problem that is most fake news detectors are built for American politics or general datasets and they don't work well with the unique type of news often seen in India. Specifically, they struggle with the kind of viral content found in WhatsApp forwards.

This project focused on developing a model specifically for the Indian context to handle these issues. By using a custom dataset and specific feature scoring, the system was able to achieve a test set accuracy of 94.74% across more than 11,000 articles. The ensemble approach also reached a precision of 95.49%, which shows that the system is very reliable when it identifies an article as fake.

Ultimately, this shows that a targeted approach works better than a general one. Because the system can run on a standard CPU without needing a powerful graphics card, it is a practical solution that can be used by regular people. On the client side a good interface is used so that users not only see if the news is fake or not but they can also understand

why exactly this particular news is labeled as a fake or real and they can also learn some patterns that will help them next time they see a fake news.

6.2 Future Scope

Obviously there is still a lot to be done. It currently has high proficiency in English, but the majority of the fake news also occurs in Hindi, Marathi or Tamil words mixed with English. Therefore, having something such as IndicBERT there is a massive priority in the future. Also, the data only goes up to 2021. The process of altering misinformation is fast and, therefore, requires a pipeline to retrieve new examples found in such websites as AltNews or Boom. In the future this system can be easily attach even to Whatsapp or other messaging app as a button man if you click that it will directly give you if it's fake news or real news so before forwarding you can check But it will require Further develop of API structure and involving with messengers particular requirements

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