Fake News Detection on Social Media Networks using Ensemble Leaning

Ankur Meena, Deepanshu Bhardwaj, Gautam Kumar Singh, Suraj

Sayani Ghosal, Amita Jain

Netaji Subhas University of Technology Sector 3, Dwarka, New Delhi-110078

Abstract:

There are numerous channels available such as social media, blogs, websites, etc., through which people can easily access the news. It is due to the availability of these platforms that the dissemination of fake news has become easier. Anyone using these platforms can create and share fake news content based on personal or professional motives. To address the issue of detecting fake news, numerous studies based on supervised and unsupervised learning methods have been proposed. However, all those studies do suffer from a certain limitation of poor accuracy.

The reason for poor accuracy can be attributed due to several reasons such as the poor selection of features, inefficient tuning of parameters, imbalanced datasets, etc. In this article, we have proposed an **ensemble classification model** for detection of the fake news that has achieved a better accuracy compared to the state-of-the-art. The proposed model extracts important features from the fake news datasets, and the extracted features are then classified using the ensemble model comprising of two popular machine learning models namely, **Random Forest and KNN**.

***Keywords**:* Fake news; clickbaits; social media; classification; ensemble learning; KNN; Random Forest Classifier; StopWords.

1. Introduction:

The concept of fake news has been in existence even before the emergence of Internet and other computational technologies. Dissemination of fake news and misleading information has always been used as a weapon to fulfil immoral objectives since ages. The advancement of Internet and web technologies has made it very easy for anyone to post anything in online platforms like blogs, comments to news articles, social media, etc. The advancement of technologies has enabled convenient access to authentic and falsified information even faster posing a real challenge. Consequently, it also creates an impression among readers such that the general perception and responses towards authentic news also gets diluted hampering the balance of news ecosystem. The main objective is to detect the fake news, which is a classic text classification problem with a straight forward proposition. It is needed to build a model that can

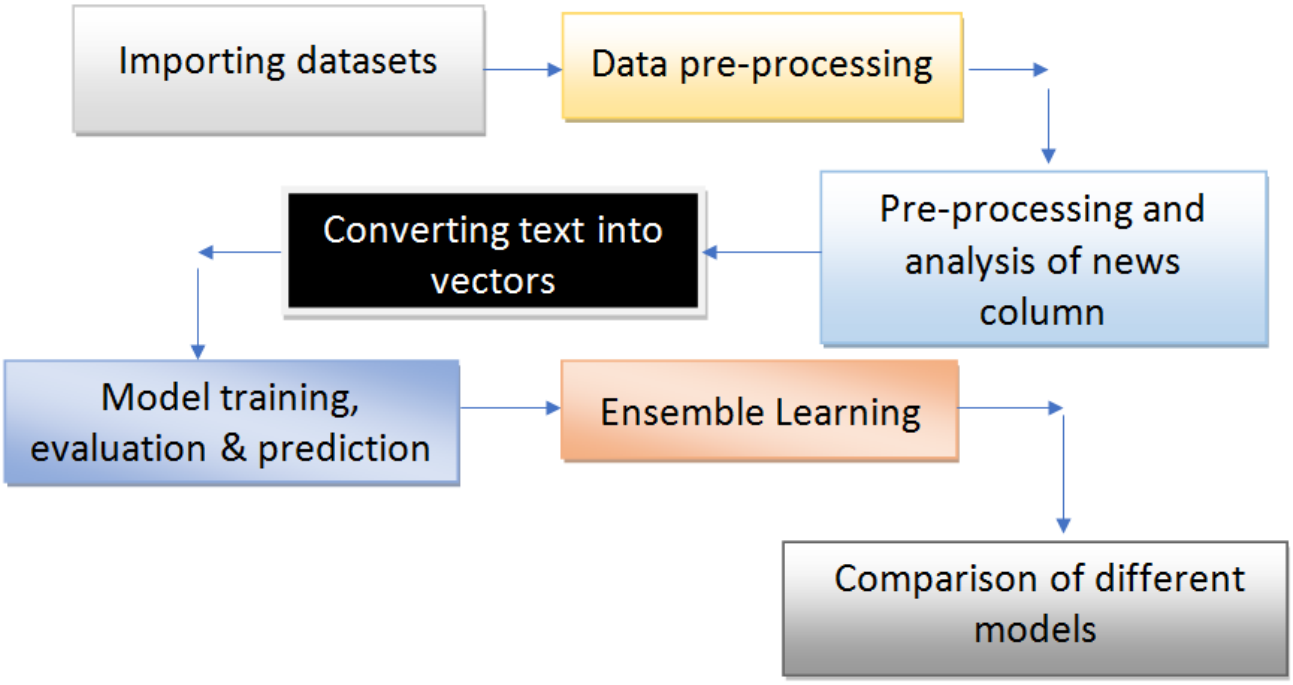
differentiate between "**Real**" news and "**Fake**" news. Here we are using **ensemble learning** for better accuracy than different models.

- Using feature extraction to use the most significant features that influence the classification of fake news.
- Selection of an Ensemble model to achieve optimized accuracy in classification.
- Reduction of training time of the ensemble classifier.

There are various approaches to collecting datasets for fake news detection, including manual collection, web scraping, and using existing datasets. Here for this model we are considering existing datasets to train our model. The data is related to the news of US Election of 2016. It is the data set of size 110MB containing 44919 samples. As it is a very big size, so to make it easily processable for laptop. We have taken only 16450 samples.

	title	text	subject	date	class
0	Donald Trump Send	Donald Trump just c	News	December 31, 2017	0
1	Drunk Bragging Trum	House Intelligence C	News	December 31, 2017	0
2	Sheriff David Clarke	On Friday, it was rev	News	December 30, 2017	0
3	Trump Is So Obsesse	On Christmas day, D	News	December 29, 2017	0
4	Pope Francis Just Ca	Pope Francis used hi	News	December 25, 2017	0
5	Racist Alabama Cop	The number of case	News	December 25, 2017	0
6	Fresh Off The Golf C	Donald Trump spent	News	December 23, 2017	0

2. Proposed Methodology:



4.1. Importing Libraries & datasets:

Firstly we imported all the necessary libraries in our project program.

4.2. Format of data:

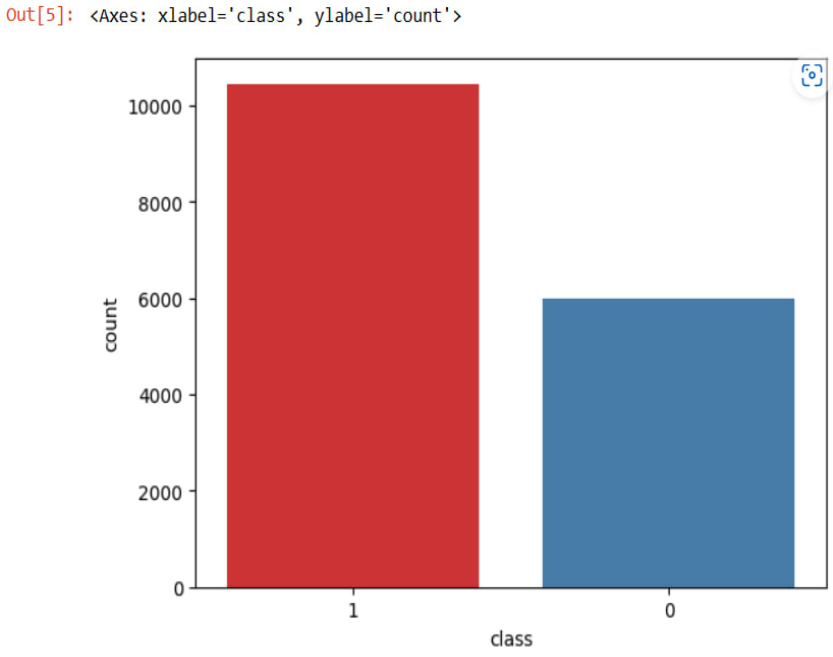
Our dataset is about news spread during US elections, 2016. It has five columns: title, text, subject, date, and class.

As out of these columns we need only text and class. So we had removed the remaining columns.

We process the data by changing the shape of data, deleting data containing null values, unimportant columns, and shuffle the dataset to prevent the model to get bias.

2.3. Showing the count of real data and fake data:

We represented the count of real and fake news present in our dataset in the form of **1 & 0**.



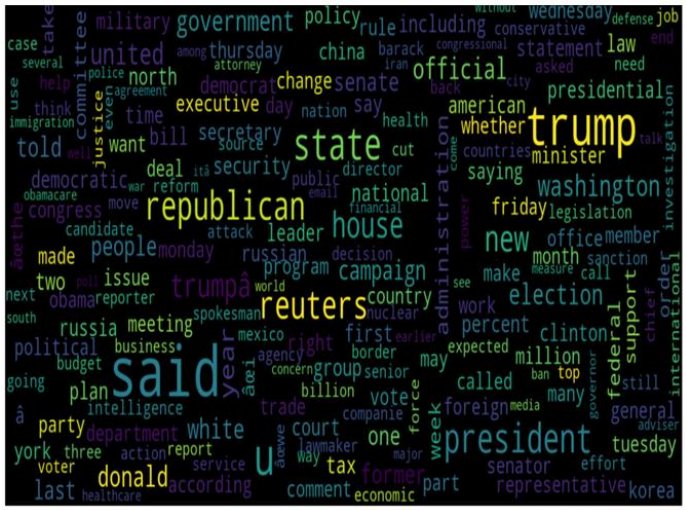
2.4. Data Pre-processing:

Firstly we will remove all the stopwords, punctuations and any irrelevant spaces from the text. For that, **NLTK library** is required and some of its module needs to be downloaded.

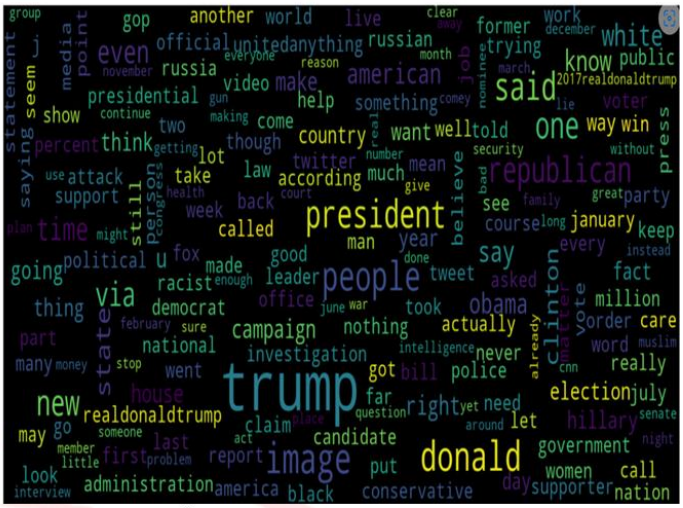
StopWords are the set of unnecessary words of any language like in English (is, am, are) etc.

Once we have all the required modules, we can create a function name **preprocessed_text**. This function firstly removes the stopwords then stores the important words in an array.

2.5. *Visualize the WordCloud combination of tokens that are said to be real & combination of tokens that are said to be fake:*



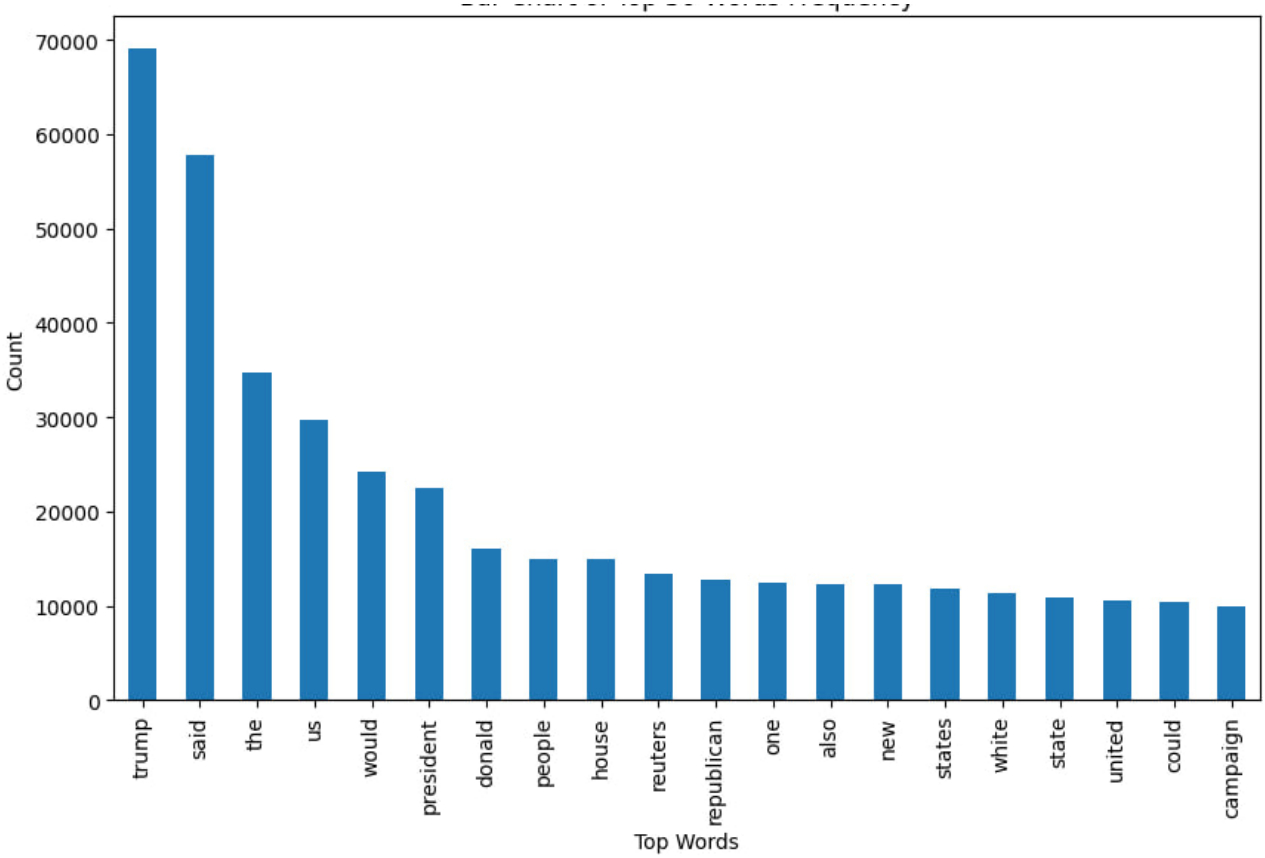
Real



Fake

2.6. *Plotting the bar graph of 20 most frequent words:*

Then, we store the count of important words and make a list of 20 most frequent words in the whole dataset. Then to visualize it, we plot this information using a bar graph.



2.7. ***Vectoriztion:TF-IDF***

Vectorization in machine learning refers to the **process of converting data into vectors or arrays of numbers** that can be processed by machine learning models. Vectorization is a key step in preparing data for machine learning algorithms, as most machine learning models can only operate on numerical data. Vectorization allows us to convert data such as text, images, or audio into numerical representations that can be used as input to machine learning models.

2.8. ***Classification:***

⇨ ***We use the following algorithms to classify our data;-***

2.8.1. K-Nearest Neighbor Classifier:

KNN (K-Nearest Neighbors) is a machine learning algorithm used for classification and regression tasks. It is a non-parametric model, meaning that it does not assume any specific functional form for the underlying data distribution. In KNN, a new observation is classified based on the majority class of its k nearest neighbors in the training set, where k is a predefined positive integer. The distance between observations is typically calculated using the Euclidean distance metric, although other distance metrics can be used as well.

- The result of this model is as follows:

Precision: Precision is a metric that measures the proportion of true positive predictions among all positive predictions. It is calculated as the ratio of true positives (TP) to the sum of true positives and false positives (FP).

F1 score: F1 score is a harmonic mean of precision and recall, and it provides a balanced measure of the two metrics. It is calculated as 2 * ((precision * recall) / (precision + recall)).
Support: Support is the number of samples in each class. It is the number of true positive and true negative predictions for a particular class.
Recall: It measures the proportion of actual positive samples that are correctly identified by the model.
It can be calculated as the ratio of true positives (TP) to the sum of true positives and false negatives (FN).

2.8.2. Random Forest Classifier:

Random Forest Classifier is a machine learning algorithm used for classification problems.

- The Random Forest Classifier algorithm consists of the following steps:

1. Randomly select a subset of the training data with replacement (bootstrapping).
2. For each subset of data, select a random subset of features to use for training the decision tree.
3. Build a decision tree using the selected subset of data and features.
4. Repeat steps 1-3 to create a forest of decision trees.

- The result of this model is as follows:

2.9. Ensemble Learning using above two models and voting classifier, we get results:

Ensemble learning is a machine learning technique that combines multiple individual models to improve the overall performance of a predictive model. The idea behind ensemble learning is that combining the predictions of multiple models can reduce the variance and increase the accuracy and robustness of the final prediction.

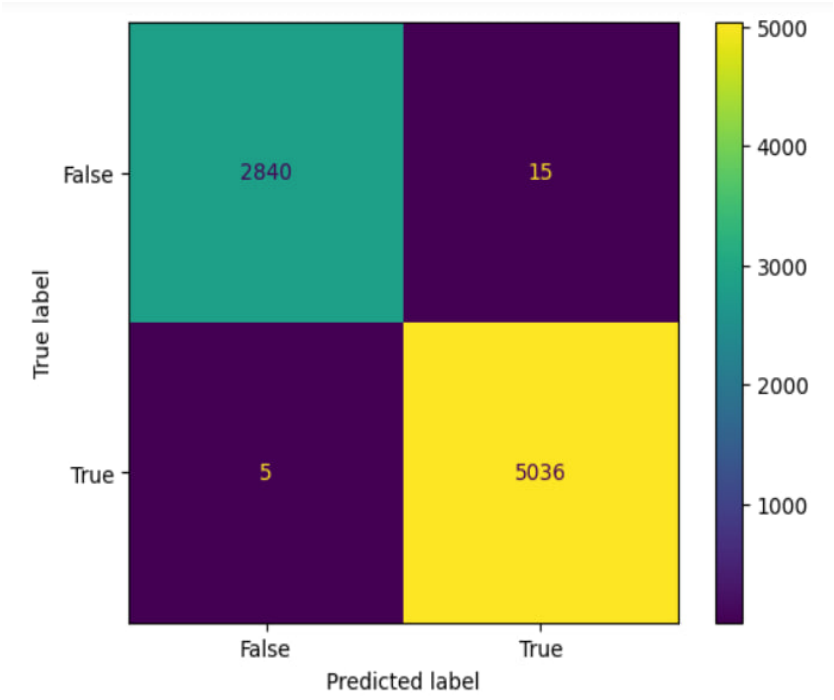
- The result of this model is as follows:

3. Results and Analysis:

This section presents dataset details, evaluation metrics, results, and findings for the proposed model. This research considers 80% dataset for training and remains for testing purposes.

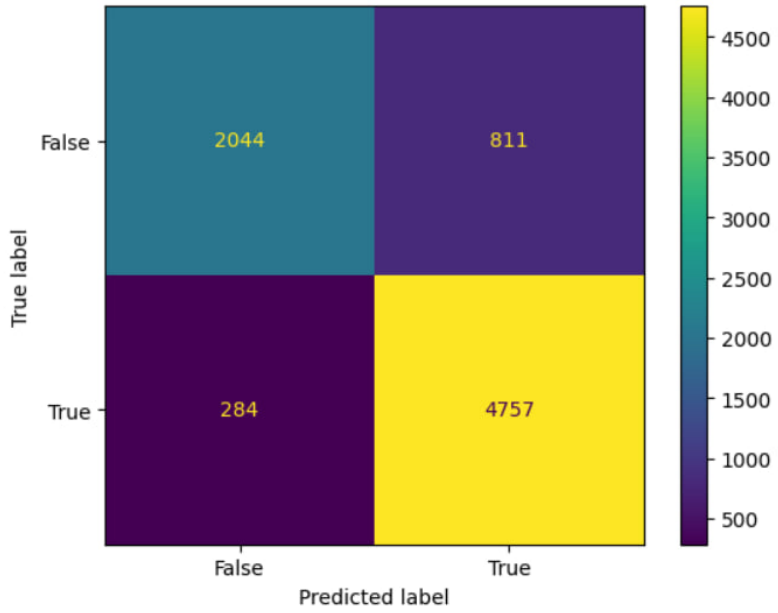
In our model, the maximum accuracy is achieved by:

Random Forest Classifier: **0.9974**



	precision	recall	f1-score	support
0	1.00	0.99	1.00	2855
1	1.00	1.00	1.00	5041
accuracy			1.00	7896
macro avg	1.00	1.00	1.00	7896
weighted avg	1.00	1.00	1.00	7896

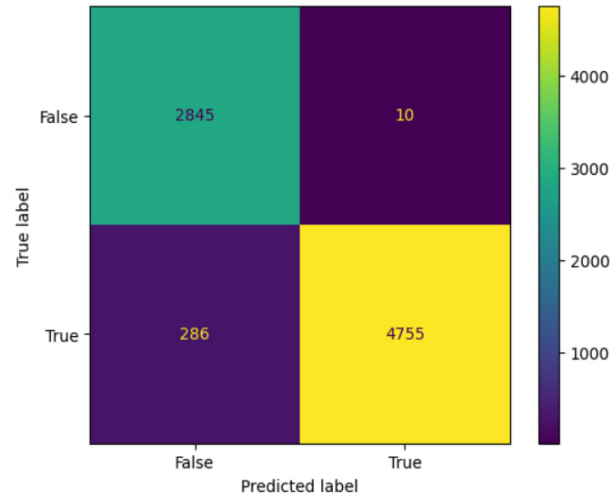
Accuracy achieved by **K-Neighbor Classifier** is **0.8613**.



	precision	recall	f1-score	support
0	0.88	0.72	0.79	2855
1	0.85	0.94	0.90	5041
accuracy			0.86	7896
macro avg	0.87	0.83	0.84	7896
weighted avg	0.86	0.86	0.86	7896

- The average accuracy of two models = **<u>0.9293</u>**

The accuracy attained by ensemble learners = **<u>0.9678</u>**.



	precision	recall	f1-score	support
0	0.91	1.00	0.95	2855
1	1.00	0.94	0.97	5041
accuracy			0.96	7896
macro avg	0.95	0.97	0.96	7896
weighted avg	0.97	0.96	0.96	7896

- The difference between average accuracy & accuracy of ensemble learner = **<u>0.0384</u>**.

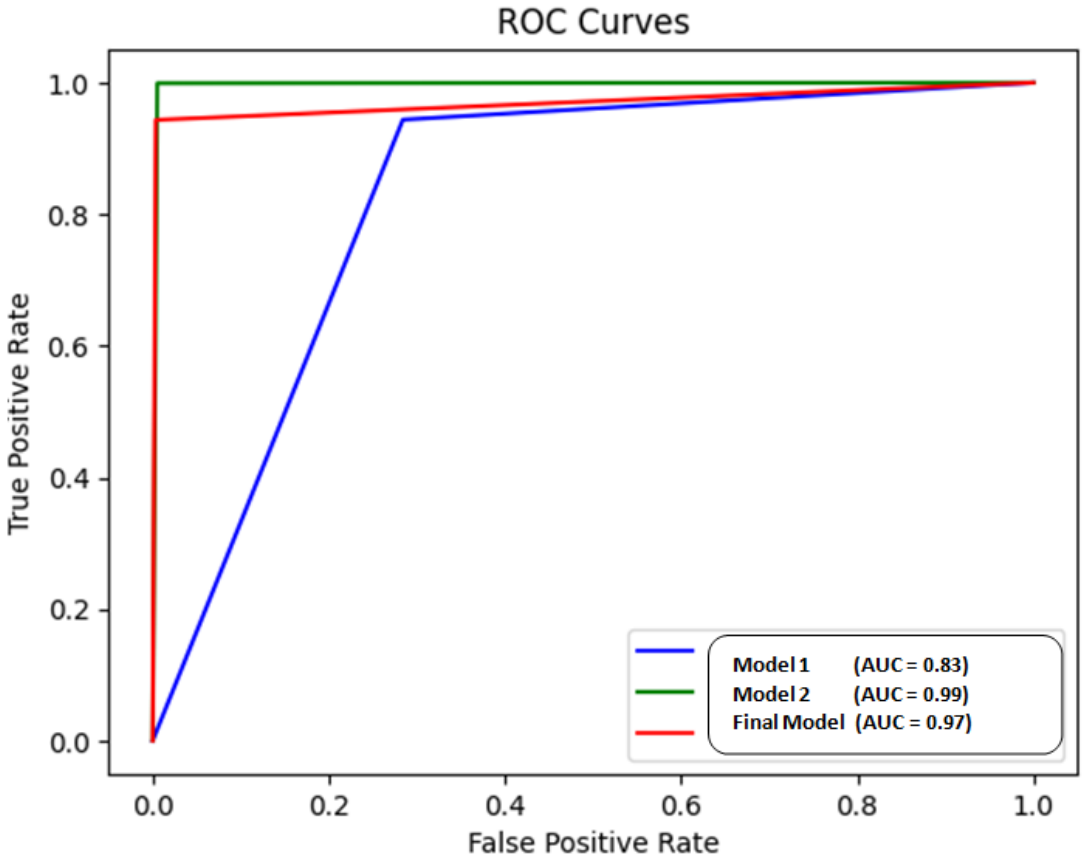


Fig: ROC Curves

4. Conclusion and Future Work:

We proposed a simple but effective approach to allow users install a simple tool into their personal browser and use it to detect and filter out potential Clickbaits. The preliminary experimental results conducted to assess the method's ability to attain its intended objective, showed outstanding performance in identify possible sources of fake news. Since we start this work with limited data set, so we will try to improve it and make its range wider.

This is text based news. But, nowadays the news also comes in the form of images and videos. So, we can improve it to read texts from images and videos. We can also add feature of visual meaning understanding of images using deep learning. And can also add the feature of audio to text conversion and live news reading.

5. References:

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