Fake News Detection

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Abstract - *Fake News is a growing concern in recent times. with lesser access to newspapers, people now rely on online sites to keep themselves up to date with the outside world. But, given how easy it is to make an article/post to one of the sites on the internet and make it viral. its quite difficult to ensure whether this news is trustworthy or a hoax. We try to solve this issue by implementing various machine learning and deep learning algorithms. Our app tells if a given statement is true or not, if an image is being altered or not using machine learning and deep learning algorithms.*

Key Words: **convolutional neural network , SVM, LSTM, error level analysis, tokenization, stemming, machine learning, deep learning.**

1. INTRODUCTION

In this new normal, where everything is shifting to the internet. People don't meet or interact in person due to social distancing. People are now more dependent on quaternary sector for their entertainment, meetings, studying and reading news etc. In this era of digital news where anyone can create and publish news is as easy as clicking a button and it is accessible to everyone in an instance. And where there is no or very little way of checking the veracity of the news. Fake news has been a major issue on the internet these days. The impact of fake news has become a worldwide phenomenon. Research has shown that fake news hurts social media and online based outlets far worse than traditional print and TV outlets. After a survey was conducted, it was found that 58% of people had less trust in social media news stories as opposed to 24% of people in mainstream media after learning about fake news. There is increasing evidence that consumers have reacted absurdly to news that later proved to be fake. One recent case is the spread of novel coronavirus, where fake reports spread over the internet about the origin, nature, and behaviour of the virus. The situation worsened as more people read about the fake contents online. Identifying such news online is a daunting task.

The Overall Objective of the project 'Fake news detection' is to classify the news article or other documents into certain or not. We explore identification of fake news using various machine learning and deep learning models and classifiers and predict the accuracy of different models and classifiers. Through this project, we examine which model will give more accuracy and classify the news into real or fake. In this project, we generate models for the duty of fake news detection. We propose a dataset for images that includes real and altered images and implements various deep learning algorithms on this dataset, another dataset that we have used for text implements various natural language processing and machine learning algorithms. Using this dataset, we handled diverse exploratory analyses to identify linguistic properties that are broadly present in deceptive content.

We use Natural Language Processing, machine learning and deep learning techniques to implement our models and compare which models will give more accuracy i.e will precisely classify the given dataset into real and fake news.

2. LITERATURE SURVEY

The Available literature reviews various machine learning and deep learning techniques for classification of news as real or fake.

A. [1]Fake news detection using a Deep Neural Network - Computer science and Engineering, Bennett University, Greater Noida, India - Rohit Kumar Kaliyar, 4th conference on computing communication and automation (2018)

- In this research, the author has used various Machine Learning, Natural Language Processing and Deep learning techniques on datasets collected from Kaggle which contains a mixture of real and fake news articles to detect fake news classify the news as real or fake.

- Author used various techniques to identify the linguistic properties and predicted the accuracy of each model, then compared the results and examined which model is giving maximum accuracy.

- For easy analysis of models , they made use of the Nvidia DGX-1 supercomputer.

- The author explored identification of fake news

using different machine learning models like Naive bayes, Decision tree, K nearest neighbours and Deep Learning networks like CNN, VDCNN, LSTM, GRU, and combination of CNN-LSTM and predicted the accuracy of these models.

- It was found that the combination of CNN-LSTM model was most promising with the dataset used by the author as compared to other models. They've got an accuracy of 91.3% .

- The accuracy was further increased to 98.3% with the increase in depth of the network by a few layers.

- Whereas, by implementing other models like Naive bayes, Decision tree, Random forest, K nearest neighbour they've got an accuracy of 90%, 75%, 72% and 55% respectively.

B. [4]Detection of online Fake News-A Survey. - Sahil Gaonkar, Sachin Itagi, Rhethiqe Chalippatt, Avinash Gaonkar, Shailendra Aswale, Pratiksha Shetgaonkar, International Conference on Vision towards emerging trends in communication and Networking (ViTECoN) (2019).

- This paper proposes a model for classifying the news as real or fake after computing a score.

- It focuses on various parameters obtained from URL (source, publisher, headline, article) to distinguish between real and fake news.

- Author claims that providing URL as an input to the model will not only validate but can also validate the site behaviour and other related parameters.

- They have used a variety of datasets obtained from different sources like Tweets and articles from PolitiFact, Facebook news posts, 75,000+ news articles, Legit website, content and author, 1600+ articles by BuzzFeed and passed these to various ML algorithms to find the model that gives the best results and could give maximum accuracy.

- The highest accuracy for text based news which was obtained in the papers was 92% using SVM.

C. [2]Exploiting Multi- Domain visual information for fake news detection - Peng Qi, Juan Cao, Tianyun Yang, Jintao Li, IEEE International Conference on Data Mining (2019).

- In this paper, the author focuses on multimedia posts since they provide better storytelling and also they attract the user easily.

- They examined the inherent characteristics of both tampered and misleading images

- The model used in this paper is MVNN (Multi-domain Visual Neural Network). The model has three components:

  1. Frequency domain sub-network (physical level) - at this level, the low quality fake images would be clearly reflected,

  2. Pixel domain sub-network (Semantic level) - the visual impacts and emotional provocations would be reflected at semantic level and

  3. Fusion sub-network - which is a combination of physical and semantic level.

- MVNN can effectively capture the intrinsic characteristics of fake news images. MVNN achieves an accuracy of 84.6% outperforming existing approaches by 9.2% at least.

D. [7]Tracing Fake-News Footprints: Characterizing Social Media Messages by How They Propagate.- Wu, Liang, and Huan Liu, Computer Science and Engineering , Arizona state university(2018).

Through this paper, the author talks about the propagation of messages in social networks. According to the author, the available research done on the classification of social media content is based on text categorisation such as hashtags and words, which intentional spreaders may easily manipulate to make it look like real news. So, it is important to identify useful features from such content. Thus, the author proposed a novel approach called TRACEMINER to infer the embedding of social media users in social network structure and to create a LSTM-RNN model to represent the path of messages. This approach provides high classification accuracy and is better for interpreting real world dataset as compared to traditional approaches. This approach is different from traditional approach as they directly concentrate in modelling the information and making predictions.They have provided optimization methods to traceminer to guarantee the correctness and evaluate the performance of the real world social network data. Thus, this approach is better for real world datasets. To demonstrate the performance of this approach, the author evaluated with traditional approaches on twitter data.

E. [3]Fake News Detection Using Machine Learning approaches: A systematic Review.- Syed Ishfaq Manzoor, Dr Jimmy Singla and Nikita, proceedings of the third international conference on trends in Electronics and Informatics (2018).

- The easy access of data on social media has made it difficult to distinguish between real and fake news. Through this paper the author has applied machine learn ing techniques. Also, this paper reviews limitations of such approaches and improvisation by way of implementing deep learning techniques.

- Author focuses on the Images that look valid but

are actually tampered with.

- The paper includes three major forms in which social media networking Sites read a news item:
  – Text (Multilingual):is analyzed by computational linguistics which focuses the genesis of text semantically and systematically. since much of the posts are produced in the form of texts much work has been carried out on its analysis.
  – Multimedia: Multiple forms of media are integrated in a single post. This may include audio, video, images, and graphics. This is very much attractive and it fetches the attention of the viewers without bothering about the text.
  – Hyperlinks enable the originator of the post to cross reference to different sources and thus gains viewers the trust by certifying genesis of the post. Even cross reference to other social media networking sites and embedment of snapshots is in practice.
- Various detection techniques used by authors are - Linguistics basis Deception modelling, Clustering, Predictive modelling, Content cue based methods, and Non text cue based methods

F. [5]Fake News Detection System using Article Abstraction - Kyeong-hwan kim ,Chang sung jeong, Korea University, IEEE (2019).

- Utilizing linguistic features of the news has difficulty in sensing highly ambiguous fake news which can only be detected after identifying meaning of the data and collecting latest information available about the subject. Thus, the authors of this paper try to resolve this problem by using a new Korean fake news detection system. They have used a fact DB which was built and updated by human's direct judgement.
- In this research, they took a preposition and checked for the semantically related articles in fact DB. The model used for string matching was a deep learning model, bidirectional multi-perspective matching for natural language sentences (BiMPM). But, it has some limitations - its performance degrades as the length of sentence increases. Thus, the author used article abstraction and entity matching set along with this string matching algorithm and he claims that using this combination the performance was highly improved.

3. PROPOSED SYSTEM

The Proposed system Consists of two parts :

A. Text Based

1) Dataset: The dataset used has about 10000 rows . It consists of two fields :

- sentences/paragraphs and
- another attribute is true/false.

2) Preprocessing: : First of all, dataset is passed through some preprocessing steps before applying any machine learning algorithms to the data. Preprocessing of data is an important task and is very important for accuracy. This is because our data is mostly noisy and sometimes it has missing values. The steps which we have adopted are :

- Label Encoding : It is a process in which we convert categorical columns i.e strings into numerical values. This step is necessary because machine learning algorithms can only read numerical values. In this process Each word from a sentence is given a numerical value.
- Stop-word removal and lower case all text : "stop words" refers to the most common words in a language. These are removed from the text so that more focus can be given to those words which define the meaning of the text.
- Tokenization : It is a process of splitting/breaking the sentences into smaller units in a way that the machine can understand. Basically, we cannot work with the text data if we don't perform tokenization.
- Stemming and Lemmatization : Text documents contain different forms of a single word or it may have families of similar words with similar meanings for grammatical purposes. The main purpose of stemming and lemmatization is to reduce these inflectional forms or similar words into one common base form. Basically, It is a process of chopping off words into its root dictionary format. So as to obtain maximum accuracy by eliminating ambiguity.
- After preprocessing, we have divided our dataset into 70% training and 30% testing set. The training set is then passed for further processing.

3) Model Building:

- Training TF-IDF Vectoriser

Term Frequency and Inverse Document Frequency - This is used to convert the sentences into vectors. The role of this vectorizer is to find the most significant word from the document/sentence. It overcomes the disadvantage of Bag of Words i.e it

does not contain any semantic values. It doesn't just give output as zero or one like other algorithms the output may take a large range of values.

The result can be calculated as,

TF IDF = TFIDF

Where,

TF = term frequency i.e. frequency of words,

IDF = Inverse Document Frequency i.e. the weight of rare words.

$$TF(t) \quad \frac{number\ of\ term\ t\ appears\ in\ a\ document}{total\ number\ of\ terms\ in\ the\ document}$$

$$IDF(t) \quad \frac{log\ (total\ number\ of\ documents)}{(number\ of\ documents\ with\ term\ t\ in\ it)}$$

At the end of this step we get output as an independent feature which we will give to the training dataset and the output will be treated as a dependent feature.

· Training SVM model

After training the data using TF-idf vectorizer we give the output of that to our SVM model for further processing.

SVM is a supervised machine learning model that uses classification algorithms for two-group classification problems. After giving an SVM model sets of labeled training data for each category, they're able to categorize new text.

4) Model Testing: Model was tested on the testing dataset which gave accuracy of 60.28% with the SVM model which was the highest accuracy compared to the other algorithms which were tested on the same dataset.

Fig. 1. Proposed Flow for Text based model

B. Image Based

1) Dataset: The dataset used for images consists of about 12500 images. The dataset contains samples of real as well as tampered images.

2) Data Preparation: Here, we passed the entire dataset for ELA - we have performed analysis on the level of compression error Image. This is one of the crucial preprocessing steps for images which is used to increase the training efficiency of CNN model. Since features generated by ELA images are already focused on the part of the image that has a level error above limit. In addition, the pixels in the image ELA tend to be very similar in colour or very similar in contrast with the pixels nearby, so the training of the CNN model becomes more efficient. After preprocessing through ELA we have normalized the images by processing the images to a size of 128x128 pixels. The dataset is split into training and test sets for further processing in the range of 80-20 for training and testing respectively. After this step the images are fed to CNN for classification.

3) Model Building:

· CNN (Convolutional Neural Network) :

This artificial neural network is known to roughly mimic the human vision system. For better efficiency, these networks need a lot of data and computational resources. As these networks are composed of multiple layers of neurons, this model has high ability in large scale image classification. The artificial neurons are mathematical functions, they calculate the weighted sum of multiple inputs and output the activation function.The behaviour of these neurons is defined by the inputs/weights we provide, It comprises of three major layers Each of these layers has different parameters that can be optimized and performs a different task on the input data :

- Convolutional layer - the kernel : This is the first group of layers in CNN. These are the layers where filters are applied to the original image. In this layer, basically we apply multiple filters to the image in order to extract features or say, our model learns these features. This layer usually learns basic features detection such as horizontal, vertical, and diagonal edges. The output of this layer is provided as input of the next layer, which extracts more complex features, such as corners, edges, etc. As you go deeper into the convolutional neural network, the layers start detecting higher-level features such as objects, faces, and more.The number of kernels (each 2D slice of filters) and also their size are the most important parameters of this layer.

- Pooling layers - these layers are used to reduce the dimensionality of the network and are almost similar to convolutional layers, but perform tasks such as max pooling or average pooling which takes the maximum/average value in the filter region.
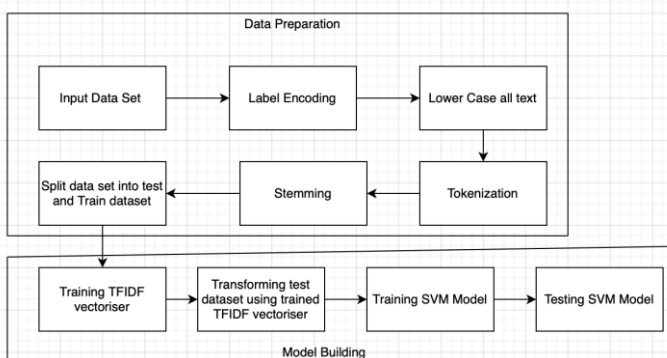
This layer learns to detect the parts of objects.

– Classification layers - this is the last layer of the network which is used to flatten the results before classification.This layer takes input from final convolutional layer and outputs the set of confidence score (values between 0 and 1) that specify how likely the image is to belong to a "class."

In the method used here CNN consists of two convolutional layers with the size of kernal 5x5 and the number of filters as much as 32 each and a max pooling layer with a size of 2x2 which added dropouts of 0.25 to prevent overfitting. Next layer is connected with neurons and ReLU activation function. Once fully connected dropouts is increased to 0.5 to prevent overfitting and layer output used have activation function softmax.

Fig. 2. Proposed Flow for image based model

4. METHODOLOGY USED

A. Text based

- For checking of the news when user opens the app the first activity that appears is for text based checking. User has to enter the news in the input field.

Fig. 3. News Text Input

- After entering the news in the input field when the user clicks on check button the text is sent to the model and acknowledgement is received from the server in the form of output which gets displayed on the screen.
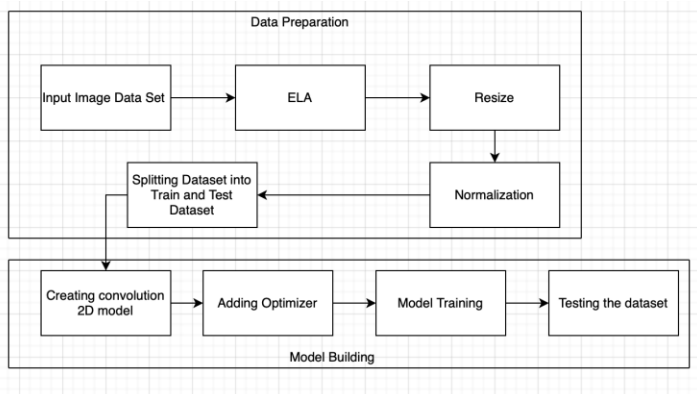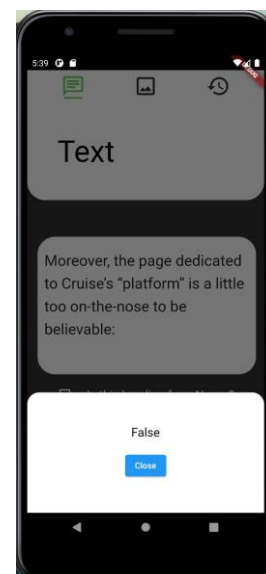

Fig. 4. News Text Output

- We have kept an option for searching related news online. In order to do that user have to check the box right below the input field and press the check button. This would be helpful for the news without body and just heading.
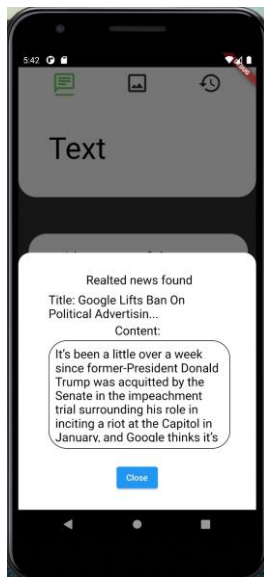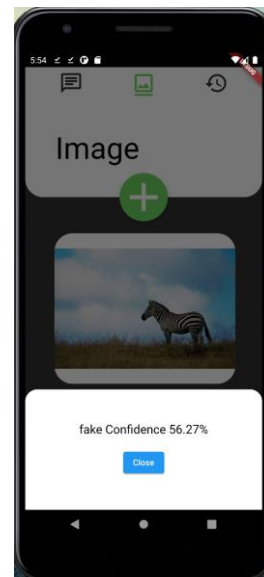
Fig. 5. News Heading output

B. Image Based

· The activity to the left of text based news is for images. In order to upload an image user has to click the add button and select the image from gallery.

Fig. 6. News Image input

· After selecting the image from gallery, when the user clicks on check button the image is fed to the model and the output describing the confidence level of the image is being displayed on the screen.

Fig. 7. News Image output

5. RESULTS

Figure 8 shows accuracy for every model on which we have performed the experiment on text based data. By observing the results, SVM model gave the highest accuracy compared to others.

Algorithm	Accuracy
SVM	60.28 %
Naive Bayes	59.86 %
Neural Networks	55.14 %
Random Forest	55.82 %
Logistic Classification	55.14 %

Fig. 8. Model accuracies

For Image based analysis we adopted CNN along with ELA. It was found that passing the dataset through ELA before actual model building highly increases the accuracy of the model. Figure 9 shows the loss and accuracy curves for training and validation of the model. Figure 10 shows the confusion matrix for the predicted output.
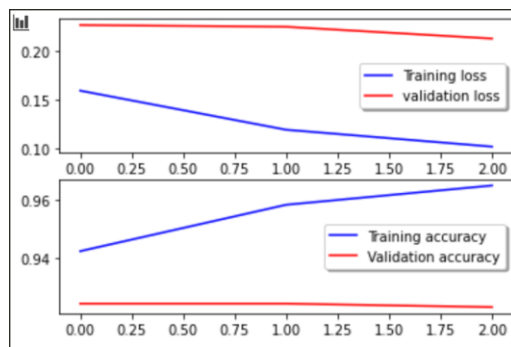
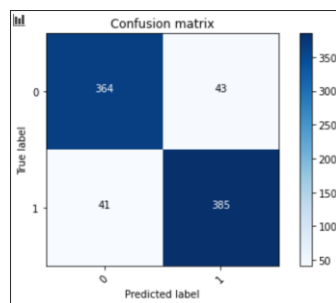**Fig. 9.** Loss and accuracy curves for training and validation

Fig. 10. Confusion Matrix for Image Model

6. FUTURE SCOPE

The fake news detection topic can be extended to work with videos for determining the trueness of the video.

7. CONCLUSION

Fake News Detection is the analysis of socially relevant data to distinguish whether it is real or fake. In this we explored Machine learning model SVM and Deep Learning networks Convolutional Neural Networks (CNN). TF-IDF features were extracted and used in our model. We also compared the presented techniques based on several factors. Moreover, the techniques were also compared in terms of their specified goals and datasets used. For our dataset SVM was found to be most promising according to the literature survey done. False news identification on social media networks is an issue that needs to be explored because of the serious repercussions of such news at individual as well as collective level.

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