**JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY**



**Information Retrieval and Semantic web**

Project-Based-Learning

**Fake news detection using Naïve Bayes**

Submitted to-

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1. **Introduction**

Internet and social media made the access to the news information much easier and comfortable. Often Internet users can follow the events of their interest in online mode, and spread of the mobile devices makes this process even easier. But with great possibilities come great challenges. Mass media have a huge influence on society, and as it often happens, there is someone who wants to take advantage of this fact. Sometimes to achieve some goals mass-media may manipulate the information in different ways. This leads to the production of the news articles that are not completely true or even completely false. There even exist lots of websites that produce fake news almost exclusively.

These days’ fake news is creating different issues from sarcastic articles to fabricated news and planned government propaganda in some outlets. Fake news and lack of trust in the media are growing problems with huge ramifications in our society. Obviously, a purposely misleading story is “fake news” but lately blathering social media’s discourse is changing its definition. Some of them now use the term to dismiss the facts counter to their preferred viewpoints.

The term 'fake news' became common parlance for the issue, particularly to describe factually incorrect and misleading articles published mostly for the purpose of making money through page views. Facebook has been at the epicenter of much critique following media attention. They have already implemented a feature to flag fake news on the site when a user sees it they have also said publicly they are working on to distinguish these articles in an automated way. Certainly, it is not an easy task.

In a landscape saturated with information, the detection of fake news has become a paramount concern. This project focuses on employing the Naive Bayes algorithm, a probabilistic model rooted in Bayes' theorem, as a strategic tool to discern the authenticity of news articles. The objective is to develop a systematic approach that leverages the inherent simplicity of Naive Bayes for efficient and accurate identification of misinformation. This presentation delves into the methodologies and strategies employed in utilizing Naive Bayes to fortify the boundaries against the proliferation of false narratives in the digital space.

1. **Problem Statement**

The proliferation of fake news in the digital landscape has become a pervasive challenge, necessitating effective solutions. In the realm of information dissemination, the critical issue lies in differentiating between credible news and misinformation to maintain the integrity of public discourse. Leveraging the Naïve Bayes classifier presents an opportunity to address this challenge. However, existing models often grapple with accuracy limitations and struggle to adapt to the dynamic nature of fake news creation.

Robust fake news detection techniques are indispensable for countering these challenges, offering a means to identify and mitigate the spread of false information. The Naïve Bayes classifier, with its simplicity and efficiency, holds promise in enhancing the accuracy of detection. Yet, issues such as imbalanced data, linguistic nuances, and scalability need thorough exploration to optimize its performance in real-world scenarios. Effective fake news detection not only safeguards the credibility of information sources but also encourages a digital environment where authenticity and reliability are paramount, fostering a culture of responsible information consumption.

1. **Objectives**

* Dataset Preparation:

Compile a diverse dataset of news articles, encompassing both real and fake sources, and ensure uniformity through preprocessing.

* Insightful Data Analysis:

Utilize exploratory data analysis (EDA) techniques to gain valuable insights into the dataset's characteristics and distribution.

* Title Significance Assessment:

Investigate the importance of article titles in fake news detection and incorporate title analysis to improve classification accuracy.

* Model Training and Accuracy Evaluation:

Implement the Naive Bayes algorithm for model training using a word frequency dictionary. Evaluate the model's accuracy on a test set to quantify its effectiveness in distinguishing between real and fake news.

1. **Naïve Bayes Classifier and its usage for Fake News Detection:**

In machine learning, naive Bayes classifiers are a family of simple probabilistic classifiers based on applying Bayes theorem with strong (naive) independence assumptions between the features. Naive Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set.

It is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable. Naive Bayes classifiers are a popular statistical technique of email filtering. They emerged in the middle of the 90s and were one of the first attempts to tackle spam filtering problems. Naive Bayes typically use bag of words features to identify spam email, an approach commonly used in text classification.

Naive Bayes classifiers work by correlating the use of tokens (typically words, or sometimes other constructions, syntactic or not), with fake and real news and then using Bayes theorem to calculate a probability that an news is or is not a fake news.

**Bayes’ Theorem:**

Bayes' theorem is also known as Bayes' Rule or Bayes' law, which is used to determine the probability of a hypothesis with prior knowledge. It depends on the conditional probability.

The formula for Bayes' theorem is given as:



Where,

P(A|B) is Posterior probability: Probability of hypothesis A on the observed event B.

P(B|A) is Likelihood probability: Probability of the evidence given that the probability of a hypothesis is true.

P(A) is Prior Probability: Probability of hypothesis before observing the evidence.

P(B) is Marginal Probability: Probability of Evidence.

1. **Methodology:**

* Data Loading:

(i)Import real and fake news datasets from CSV files using Pandas. (ii)Store the datasets in real\_df and fake\_df for subsequent analysis.

* Data Visualization:

(i)Utilize Pandas' info() method to display key information about each dataset, including data types and missing values.

(ii)Create a pie chart using Matplotlib to visually represent the distribution of real and fake news, providing an initial overview.

* Titles Analysis:

(i)Extract news titles from both real and fake datasets for subsequent analysis.

(ii)Implement a function, process\_news, to process titles by removing stopwords, hyperlinks, punctuation, and applying stemming for standardization.

* Building Words Frequency Dictionary:

(i)Build a dictionary of word frequencies within the training set, considering both positive (real) and negative (fake) labels.

(ii)Utilize the build\_freqs function to count the occurrences of words in each class.

* Model Training:

(i)Implement the Naive Bayes algorithm for model training, utilizing the constructed words frequency dictionary.

(ii)Train the model on the training set (X\_train and y\_train).

* Prediction and Accuracy Evaluation:

(i)Utilize the trained model to predict labels for the test set (X\_test and y\_test).

(ii)Evaluate the accuracy of the model on the test set and display the result.

* Random Prediction Inspection:

(i)Randomly select a news title from the test set for inspection. (ii)Predict its label using the trained model and compare it with the assigned label from the test set.

1. **Results:**

The Fake News Detection project, employing Naive Bayes methodology, has yielded impactful results. The datasets, comprising real and fake news, were successfully loaded and visually explored to understand their structures.

News titles underwent meticulous preprocessing, including stopwords removal and stemming. The project constructed a robust words frequency dictionary, enhancing the model's understanding of distinctive patterns in real and fake news.

The Naive Bayes algorithm was effectively implemented and trained, showcasing its proficiency in distinguishing between genuine and fabricated news articles. The model demonstrated an impressive accuracy rate of nearly 99% on the test set, affirming its reliability. Random inspections further highlighted the model's accuracy in predicting labels.

These results underscore the project's success in leveraging Naive Bayes for effective Fake News Detection, providing valuable insights into the complexities of distinguishing between authentic and deceptive news in real-world scenarios.

1. **Conclusion:**

The task of classifying news manually requires in-depth knowledge of the domain and expertise to identify anomalies in the text. The data used in work contains news articles from various domains to cover most of the news rather than specifically classifying political news. The primary aim of the project is to identify patterns in text that differentiate fake articles from true news. Here we extracted different textual features from the articles and used the feature set as an input to the models. The learning models were trained and parameter-tuned to obtain optimal accuracy.

In conclusion, the endeavor to employ the Naïve Bayes classifier for fake news detection represents a critical step in addressing the pervasive issue of misinformation within the digital landscape.

The exploration and analysis undertaken in this project shed light on various challenges inherent in utilizing this probabilistic model for distinguishing between authentic and deceptive information. While the Naïve Bayes classifier offers simplicity and efficiency, its effectiveness in the intricate realm of fake news detection requires careful consideration and refinement.

1. **References:**

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