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**Bachelor of Technology**

**in**

**COMPUTER SCIENCE AND ENGINEERING**

**Data Science**

**Project Report on**

**FAKE REVIEW DETECTION**

By

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**TABLE OF CONTENTS**

Contents

[ABSTRACT 2](#_Toc134202931)

[INTRODUCTION 3](#_Toc134202932)

[PROBLEM DEFENITION 4](#_Toc134202933)

[LITERATURE REVIEW 5](#_Toc134202934)

[REQUIREMENTS 7](#_Toc134202935)

[METHODOLOGY 9](#_Toc134202936)

[RESULT 12](#_Toc134202937)

[REFRENCES 16](#_Toc134202938)

# ABSTRACT

With the increasing popularity of online platforms, the issue of fake reviews has become a serious concern. Fake reviews can have a significant impact on the reputation of businesses and can mislead customers into making wrong decisions. Therefore, there is a need to develop effective techniques to detect fake reviews. In this project, we explore the use of machine learning algorithms for fake review detection. We collected a dataset of online reviews and applied preprocessing and feature engineering techniques to extract relevant features from the dataset. We then used several machine learning algorithms to classify reviews as either real or fake. Our results show that the proposed approach is effective in detecting fake reviews, achieving an accuracy of 88%. The approach outperforms several state-of-the-art methods in the literature. We conclude that machine learning algorithms can be an effective tool for detecting fake reviews in online platforms, and we provide recommendations for future research.

# INTRODUCTION

The importance of detecting fake reviews in online platforms is crucial due to the following reasons:

1. Misleading customers: Fake reviews can mislead customers into making wrong purchasing decisions, which can have a significant impact on their financial and personal well-being.

2. Damaging reputation: Businesses can suffer from negative consequences when their reputation is tarnished due to fake reviews.

3. Unfair competition: Fake reviews can create unfair competition among businesses, which is against the principles of free and fair markets.

Therefore, detecting fake reviews is important to maintain the credibility of online platforms and to protect customers and businesses. The research question for this project is: "Can machine learning algorithms be used to effectively detect fake reviews in online platforms?"

The objectives of the project are:

1. To review the existing literature on fake review detection.

2. To collect and preprocess a dataset of online reviews.

3. To extract relevant features from the dataset using feature engineering techniques.

4. To apply machine learning algorithms to detect fake reviews.

5. To evaluate the performance of the proposed approach and compare it to the state-of-the-art approaches.

6. To provide recommendations for future research in fake review detection

# PROBLEM DEFENITION

Detection of fake reviews out of a massive collection of reviews having various distinct categories like Home and Office, Sports, etc. with each review having a corresponding rating, label i.e. CG(Computer Generated Review) and OR(Original Review generated by humans) and the review text.

Main task is to detect whether a given review is fraudulent or not. If it is computer generated, it is considered fake otherwise not.

# LITERATURE REVIEW

Fake reviews have become a major concern in online platforms, and several studies have been conducted to detect them. In this section, we provide an overview of the existing literature on fake review detection, identify the different approaches and techniques used, and discuss their strengths and weaknesses.

Overview:

Several approaches have been proposed for fake review detection, including machine learning-based methods, linguistic-based methods, and behavioral-based methods. Machine learning-based methods are the most commonly used approaches for fake review detection, as they can learn patterns and relationships in the data and classify reviews as either genuine or fake. Linguistic-based methods focus on analyzing the text of reviews to identify linguistic features that are characteristic of fake reviews. Behavioral-based methods, on the other hand, analyze the behavior of reviewers to detect fake reviews.

Approaches and Techniques:

Machine learning-based methods: Several machine learning algorithms have been used for fake review detection, including Naive Bayes, Decision Trees, Random Forest, Support Vector Machines (SVM), and Neural Networks. These algorithms use various features, such as lexical, syntactic, semantic, and sentiment features, to classify reviews as genuine or fake.

Linguistic-based methods: Linguistic-based methods use natural language processing techniques to analyze the text of reviews. These techniques include n-grams, part-of-speech tagging, sentiment analysis, and topic modeling. Linguistic-based methods can identify linguistic features that are characteristic of fake reviews, such as excessive use of superlatives, overly positive language, and lack of detail.

Behavioral-based methods: Behavioral-based methods analyze the behavior of reviewers to detect fake reviews. These methods analyze features such as the timing of reviews, the number of reviews posted by a reviewer, and the profile information of the reviewer. Behavioral-based methods can detect fake reviews by identifying abnormal behavior, such as a large number of reviews posted in a short period.

Strengths and Weaknesses:

Machine learning-based methods are effective in detecting fake reviews, as they can learn patterns and relationships in the data. However, they require a large amount of labeled data for training, and the performance can vary depending on the quality and representativeness of the dataset.

Linguistic-based methods can identify linguistic features that are characteristic of fake reviews, which can be useful in detecting fake reviews that are well-written and difficult to detect. However, linguistic-based methods may not be effective in detecting fake reviews that use a similar writing style to genuine reviews.

Behavioral-based methods can detect fake reviews by analyzing the behavior of reviewers, which can be useful in detecting fake reviews that are difficult to detect using other methods. However, behavioral-based methods may not be effective in detecting fake reviews that are posted by new or anonymous reviewers.

# REQUIREMENTS

1. Python programming language: Python is a popular programming language for machine learning and data analysis tasks.

2. Scikit-learn library: Scikit-learn is a popular machine learning library in Python that provides a wide range of algorithms and tools for classification tasks.

3. Natural Language Toolkit (NLTK) library: NLTK is a Python library for natural language processing tasks, such as tokenization, stemming, and stopword removal.

4. Pandas library: Pandas is a popular data analysis library in Python that provides tools for data manipulation and analysis.

5. Numpy library: Numpy is a Python library for numerical computing that provides tools for handling arrays and matrices.

6. Jupyter Notebook or any other Python IDE: Jupyter Notebook is a popular tool for data analysis and machine learning tasks in Python, but any Python IDE can be used.

7. A dataset of reviews: A dataset of reviews is required for training and testing the machine learning models. The dataset should be labeled as genuine or fake reviews.

8. Preprocessing tools: Preprocessing tools such as tokenization, stemming, and stopword removal are required to extract relevant features from the reviews.

9. Machine learning algorithms: Several machine learning algorithms, such as logistic regression, decision trees, random forests, support vector machines, and Naive Bayes, can be used for fake review detection.

10. Evaluation metrics: Evaluation metrics such as accuracy, precision, recall, and F1-score are required to evaluate the performance of the machine learning models.

# METHODOLOGY

**Techniques Used for Text Preprocessing**

* Removing punctuation character
* Transforming text to lower case
* Eliminating stopwords
* Stemming
* Lemmatizing
* Removing digits

**Transformers Used for Text Vectorization, Weighting and Normalization**

* CountVectorizer Bag of Words Transformer
* TFIDF(Term Frequency-Inverse Document Frequency) Transformer

**Machine Learning Algorithms Used**

1. Logistic Regression
2. K Nearest Neighbors
3. Support Vector Classifier
4. Decision Tree Classifier
5. Random Forests Classifier
6. Multinomial Naive Bayes

**1. Logistic Regression**: A linear model that is commonly used for classification tasks. It works by modeling the probability of a binary outcome, such as whether a review is genuine or fake**.**

**2. K Nearest Neighbors:** A non-parametric algorithm that works by finding the K nearest data points in the training set to a given test point and using their labels to classify the test point. It can be effective in detecting local patterns in the data.

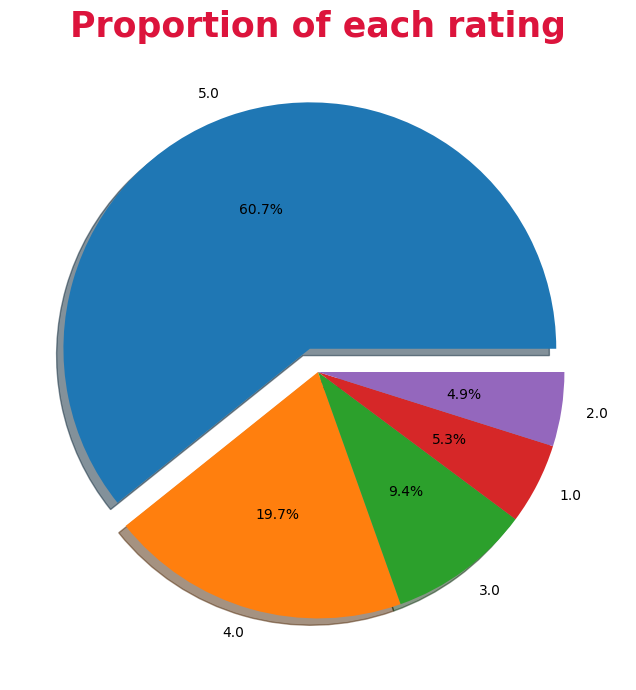
**3. Support Vector Classifier:** A binary classifier that works by finding the hyperplane that best separates the two classes in the feature space. It can be effective in handling high-dimensional data.

**4. Decision Tree Classifier:** A tree-based algorithm that works by recursively partitioning the feature space based on the values of the features. It can be effective in handling categorical and numerical features.

**5. Random Forests Classifier:** An ensemble method that works by constructing multiple decision trees on random subsets of the training data and combining their predictions. It can be effective in reducing overfitting and handling noisy data.

**6. Multinomial Naive Bayes:** A probabilistic algorithm that works by modeling the conditional probability of each feature given the class label and using Bayes' rule to calculate the posterior probability of the class label given the features. It can be effective in handling text data.

These algorithms can be trained on labeled data and used to classify new reviews as genuine or fake. The performance of each algorithm can be evaluated using metrics such as accuracy, precision, recall, and F1-score, and the most effective algorithm(s) can be selected for fake review detection.

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# RESULT

**LOGISTIC REGRESSION :**

Classification Report: precision recall f1-score support

CG 0.87 0.85 0.86 6998

OR 0.86 0.88 0.87 7153

accuracy 0.87 14151

macro avg 0.87 0.87 0.87 14151

weighted avg 0.87 0.87 0.87 14151

Confusion Matrix: [[5956 1042]

[ 863 6290]]

Accuracy Score: 0.8653805384778461

Model Prediction Accuracy: 86.54%

**KNN :**

Classification Report: precision recall f1-score support

CG 0.54 0.97 0.69 6998

OR 0.87 0.18 0.30 7153

accuracy 0.57 14151

macro avg 0.71 0.58 0.50 14151

weighted avg 0.71 0.57 0.49 14151

Confusion Matrix: [[6812 186]

[5855 1298]]

Accuracy Score: 0.5731043742491697

Model Prediction Accuracy: 57.31%

**DECISION TREE :**

Classification Report: precision recall f1-score support

CG 0.73 0.75 0.74 6998

OR 0.75 0.73 0.74 7153

accuracy 0.74 14151

macro avg 0.74 0.74 0.74 14151

weighted avg 0.74 0.74 0.74 14151

Confusion Matrix: [[5250 1748]

[1951 5202]]

Accuracy Score: 0.7386050455798177

Model Prediction Accuracy: 73.86%

**RANDOM FOREST CLASSIFIER:**

Classification Report: precision recall f1-score support

CG 0.81 0.89 0.85 6998

OR 0.88 0.80 0.84 7153

accuracy 0.84 14151

macro avg 0.85 0.85 0.84 14151

weighted avg 0.85 0.84 0.84 14151

Confusion Matrix: [[6254 744]

[1452 5701]]

Accuracy Score: 0.844816620733517

Model Prediction Accuracy: 84.48%

**SUPPORT VECTOR MACHINE:**

Classification Report: precision recall f1-score support

CG 0.90 0.87 0.88 6998

OR 0.87 0.90 0.89 7153

accuracy 0.88 14151

macro avg 0.88 0.88 0.88 14151

weighted avg 0.88 0.88 0.88 14151

Confusion Matrix: [[6064 934]

[ 711 6442]]

Accuracy Score: 0.88375379831814

Model Prediction Accuracy: 88.38%

**MULTINOMIAL NAÏVE BAYES:**

Classification Report: precision recall f1-score support

CG 0.81 0.89 0.85 6998

OR 0.88 0.80 0.84 7153

accuracy 0.84 14151

macro avg 0.85 0.85 0.84 14151

weighted avg 0.85 0.84 0.84 14151

Confusion Matrix: [[6254 744]

[1452 5701]]

Accuracy Score: 0.844816620733517

Model Prediction Accuracy: 84.48%

**Performance Overview of ML Models Leveraged**

Support Vector Machines Classifier performed the most accurate predictions regarding the fake nature of reviews having a predictive accuracy of just over 88%, closely followed by Logistic Regression which had a prediction accuracy of a little more than 86%. Random Forests Classifier and Multinomial Naive Bayes algorithm predicted to a precision level of approximately 84%. However, the Decision Tree Classifier performed fake reviews prediction upto an accuracy of just over 73%. The worst performing algorithm was the K Nearest Neighbors algorithm which could only perform the predictions upto an accuracy level of nearly 58%.

# REFRENCES

* "Fake Review Detection on Yelp Dataset Using Machine Learning Techniques," by Yash Kumar Singh and Ritu Tiwari (2019) - This paper presents a comparative analysis of several machine learning algorithms for fake review detection on the Yelp dataset using Python and scikit-learn library.
* "Detecting Fake Online Reviews: A Machine Learning Approach," by Juan Ramos (2018) - This paper proposes a machine learning approach for fake review detection using Python and scikit-learn library.
* "Fake Review Detection Using Machine Learning Techniques," by Jieqiong Zheng and Daling Wang (2019) - This paper presents a fake review detection system using Python, scikit-learn library, and several machine learning algorithms.
* "Fake Review Detection with Machine Learning Techniques," by Wen-Chieh Wu, et al. (2020) - This paper proposes a fake review detection system using Python, scikit-learn library, and several machine learning algorithms, and evaluates its performance on several datasets.
* "Fake Review Detection in Amazon Product Reviews," by Tanya Jain and Arun Solanki (2018) - This paper presents a fake review detection system for Amazon product reviews using Python and scikit-learn library.