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Twitter Sentiment Analysis

Submitted to

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1. Introduction

In this project, we explore sentiment analysis, a powerful tool for understanding people's emotions and opinions in text. Our focus is on Twitter data, where users express their feelings on various topics. The goal is to build a machine learning model that can accurately predict whether a tweet's sentiment is positive or negative.

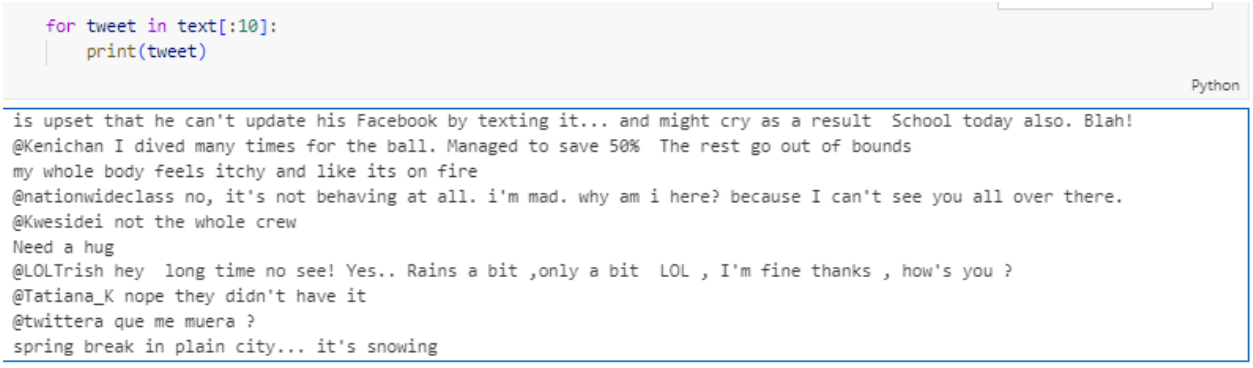
To achieve this, we preprocess the tweets, removing unnecessary elements like URLs and usernames, and converting words to their base forms. We then use TF-IDF to create meaningful feature vectors representing the importance of each word.

We'll compare the performance of different machine learning algorithms, such as Naive Bayes, Support Vector Machines (SVM), and Logistic Regression, to find the best model. By evaluating accuracy, precision, recall, and F1-score, we aim to achieve reliable sentiment analysis results.

2. Data Collection

We gathered our data from Kaggle, a reliable platform for accessing datasets. The dataset was specifically designed for sentiment analysis, containing a variety of tweets with positive and negative sentiments. Kaggle ensures data quality and relevance, saving us time on data collection and cleaning.

By using this pre-processed dataset, we could concentrate on model development and analysis without worrying about data complexities or user privacy. It provided a solid starting point for our sentiment analysis project.



```
for tweet in text[:10]:
    print(tweet)
```

Python

```
is upset that he can't update his Facebook by texting it... and might cry as a result  School today also. Blah!
@Kenichan I dived many times for the ball. Managed to save 50%  The rest go out of bounds
my whole body feels itchy and like its on fire
@nationwideclass no, it's not behaving at all. i'm mad. why am i here? because I can't see you all over there.
@Kwesidei not the whole crew
Need a hug
@LOLTrish hey  long time no see! Yes.. Rains a bit ,only a bit  LOL , I'm fine thanks , how's you ?
@Tatiana_K nope they didn't have it
@twittera que me muera ?
spring break in plain city... it's snowing
```

Figure 1 Data Set Sample

3. Methodology

Data Preprocessing

During the data preprocessing phase, we took several important steps to ensure the text data's quality and relevance for sentiment analysis. These steps involved carefully cleaning and refining the text to create a more meaningful and informative dataset. Here is the each of these steps:

1. Removing Stop Words: In this step, we got rid of common and non-informative words like "the," "is," "and," and others that don't carry much sentiment-related meaning. These words often appear frequently in text but do not provide much information to the sentiment analysis process.
2. Removing Special Characters: Special characters and punctuations were eliminated to ensure that the text is as clean and clear as possible. Removing unnecessary characters helps us focus on the essential content and prevents potential confusion during analysis.
3. Removing URLs: Since URLs or web links are not relevant to sentiment analysis, we replaced them with the word "URL."
4. Removing Mentions(User ID): User mentions, such as "@username," were replaced with the word "USER." While mentions are essential for communication on social media, they are not significant in determining sentiment, so removing them helps us focus on the actual content.
5. Removing Hashtags: Hashtags like "#sentimentanalysis" were excluded from the text during preprocessing. While hashtags are vital for categorizing and indexing social media content, they are not relevant to sentiment analysis, and excluding them improves the accuracy of our sentiment predictions.

```
# Preprocessed Data
for tweet in processedtext[:10]:
    print(tweet)
```

```
upset update facebook texting might cry result school today also blah
USER dived many time ball managed save 50 rest go bound
whole body feel itchy like fire
USER no not behaving mad see over
USER not whole crew
need hug
USER hey long time no see yes rain bit bit lol fine thanks
USER nope didn
USER que muera
spring break plain city snowing
```

Figure 2 Data set after preprocessing

After preprocessing our data, we created word clouds to visualize the most frequent words in both negative and positive tweets. Word clouds are graphical representations that display the most commonly occurring words in a dataset, with word size indicating frequency.

Word Cloud for Negative Sentiments:

Negative word like “bad”, “suck”, “sad” etc are shown on the word cloud picture.

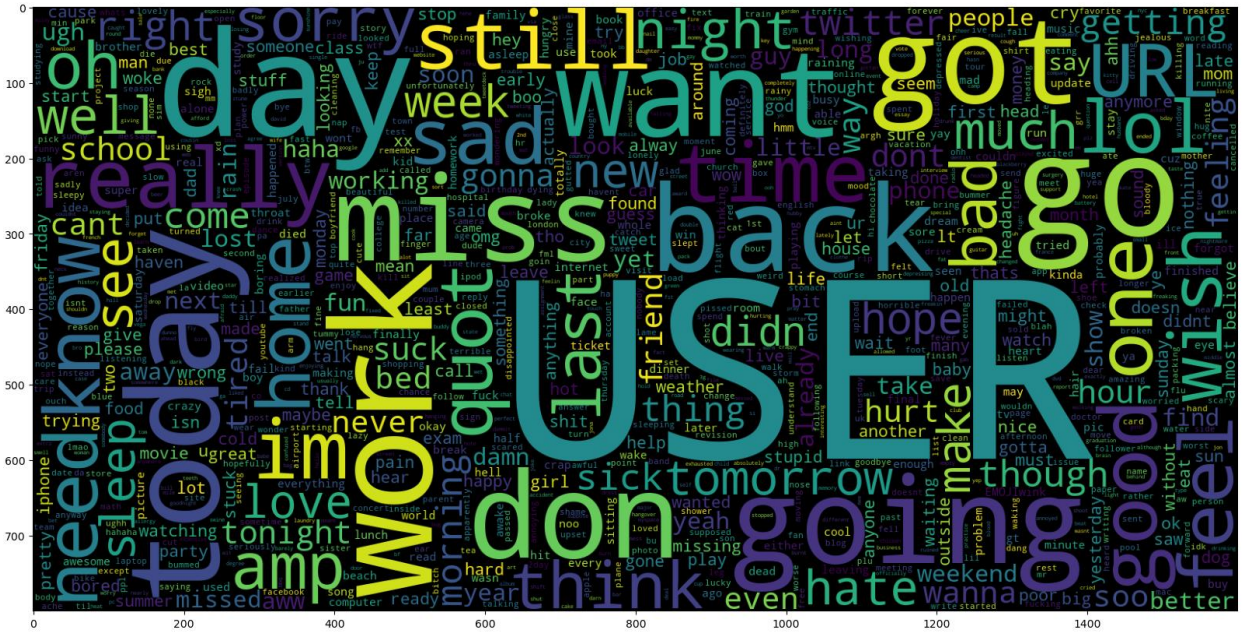


Figure 3 Word Cloud based on Negative Tweet

Word Cloud for Positive Sentiments:

Positive Words like "love," "happy," "good," and "great" are shown in the word cloud.

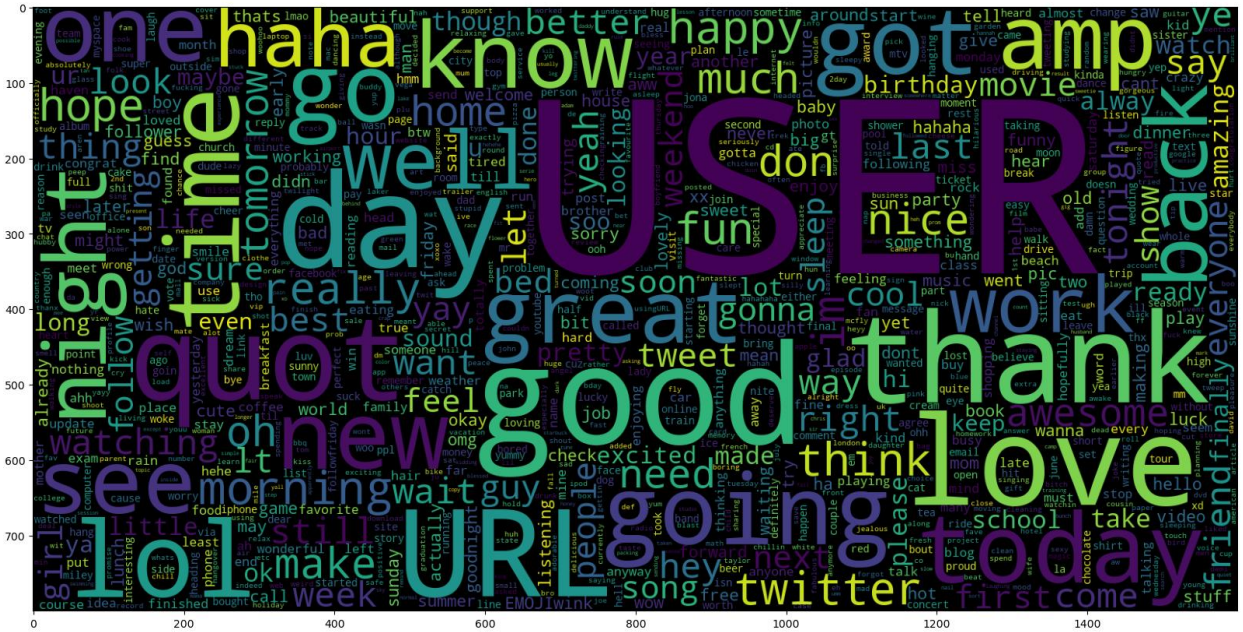


Figure 4 Word Cloud based on Positive Tweet

Feature Extraction

During the feature extraction phase, we use **TfidfVectorizer** to convert preprocessed tweets into numerical values, allowing our sentiment analysis models to understand and predict sentiments accurately. It calculates word importance based on frequency and uniqueness across the dataset. This transformation is crucial for an effective sentiment analysis system.

Results

SVM: In SVM model, we have got 90% on training while 81% on testing data set.
Linear Regression (LR): In LR model, we got 85 on training while 82 on testing.
Naive Bayes: In Naïve Bayes model 82% and 80% for training and testing respectively.

	Training Accuracy	Testing Accuracy
SVM Model	90%	81%
Naive Bayes Model	82%	80%
Logistic Regression	85%	82%

```
Tweet Sentiment Predictions:
=======================================
Tweet                                Sentiment
---------------------------------------
I hate twitter                       Negative
May the Force be with you.           Positive
I like her                           Positive
This is an amazing tool!             Positive
=======================================
```

Figure 5 Prediction on unseen data set.

Model Evaluation

In conclusion, the SVM model achieved the highest accuracy on the training data (90%) but slightly lower accuracy on the testing data (81%), indicating some degree of overfitting. The Linear Regression (LR) model performed well on both training (85%) and testing (82%) data, showing better generalization compared to SVM. The Naïve Bayes model also exhibited reasonable performance, with 82% accuracy on the training data and 80% on the testing data. Overall, the LR model appears to be the most balanced and suitable choice, as it demonstrated competitive accuracy on both training and testing datasets without significant overfitting.