Sentiment Analysis for Mental Health Monitoring

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Abstract

Mental health is a critical concern, especially among students. This project aims to develop a binary classification model for sentiment analysis, evaluating mental health status based on textual data. The model classifies entries as either **"normal"** or **"abnormal"**. This paper discusses the dataset, preprocessing steps, model development, and results.

1 Problem Statement

Undiagnosed mental health issues can lead to severe consequences, particularly for students. The objective of this project is to create a sentiment analysis model to evaluate mental health statuses using textual data like tweets or posts. The model categorizes entries into:

- **Normal**
- **Abnormal** (e.g., depression, anxiety, stress)

This system can enable schools to identify students requiring mental health support proactively.

2 Dataset Description

2.1 Data Overview

The dataset contains textual statements related to mental health, labeled with one of seven categories:

- Normal
- Depression
- Suicidal
- Anxiety
- Stress
- Bipolar Disorder

- Personality Disorder

2.2 Data Sources

The data originates from social media platforms such as Twitter and Reddit. Preprocessing ensures its relevance and accuracy. This dataset is suited for:

- Training intelligent mental health chatbots.
- Conducting sentiment analysis.
- Exploring mental health trends.

2.3 Key Features

- **unique_id**: Unique identifier for each entry.
- **Statement**: The textual content of the post.
- **Mental Health Status**: Annotated mental health status of the statement.

3 Approach Explanation

3.1 Data Preprocessing

- **Cleaning:** Removed noise, special characters, and irrelevant data.
- **Tokenization:** Split text into smaller tokens for analysis.

3.2 Exploratory Data Analysis (EDA)

- Analyzed class distribution for balanced representation.
- Created word clouds to visualize common terms.

3.3 Feature Engineering

Mapped mental health statuses into two classes:

- **Normal**
- **Abnormal**

Text features were extracted using:

- **Bag-of-Words (BoW)**
- **TF-IDF (Term Frequency-Inverse Document Frequency)**

3.4 Model Building

Implemented and trained two models:

- **Naive Bayes**

- **Logistic Regression**

3.5 Model Evaluation

Evaluated using:

- **Metrics:** Precision, recall, F1-score, and accuracy.
- Performance was assessed on a held-out test dataset.

4 Results and Discussion

4.1 Naive Bayes Model Results

- **Confusion Matrix:**

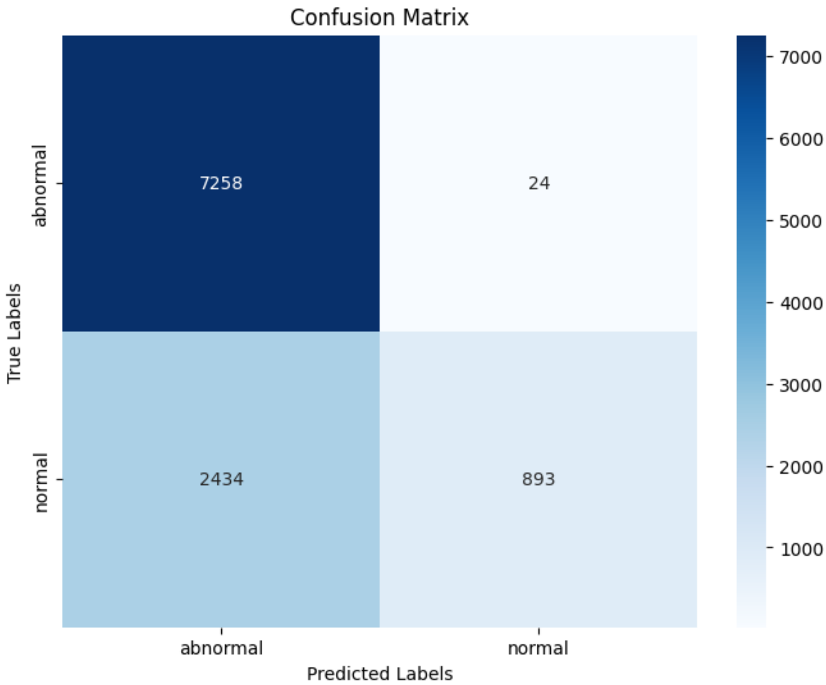

Figure 1: Naive Bayes Confusion Matrix

- **Classification Report:**

Classification Report:

	precision	recall	f1-score	support
abnormal	0.75	1.00	0.86	7282
normal	0.97	0.27	0.42	3327
accuracy			0.77	10609
macro avg	0.86	0.63	0.64	10609
weighted avg	0.82	0.77	0.72	10609

Figure 2: Naive Bayes Classification Report

Accuracy: 77%

4.2 Logistic Regression Model Results

- **Confusion Matrix:**

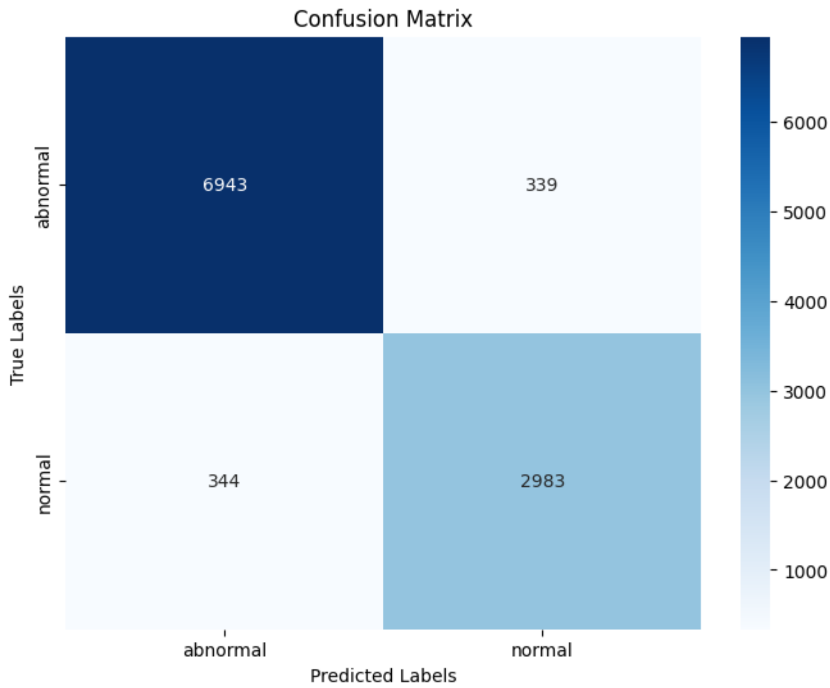

Figure 3: Logistic Regression Confusion Matrix

- **Classification Report:**

Classification Report:

	precision	recall	f1-score	support
abnormal	0.95	0.95	0.95	7282
normal	0.90	0.90	0.90	3327
accuracy			0.94	10609
macro avg	0.93	0.93	0.93	10609
weighted avg	0.94	0.94	0.94	10609

Figure 4: Logistic Regression Classification Report

Accuracy: 94%

5 Performance on Unseen Data

This section evaluates the performance of the models on unseen data.

5.1 Naive Bayes Model Predictions

```
Post: I feel like my heart is racing, and I can't catch my breath.
Prediction: abnormal

Post: One moment I'm laughing uncontrollably, and the next I'm crying for no reason.
Prediction: abnormal

Post: Nothing excites me anymore, and even getting out of bed feels like a chore.
Prediction: abnormal

Post: I had a great day at work and treated myself to some ice cream afterward!
Prediction: normal

Post: Sometimes I feel like I'm living someone else's life, and it's confusing.
Prediction: abnormal

Post: The constant deadlines are crushing me; I can't keep up.
Prediction: abnormal

Post: No one would even notice if I disappeared.
Prediction: abnormal
```

Figure 5: Naive Bayes Model Predictions on Unseen Data

5.2 Logistic Regression Model Predictions

```
Post: I feel like my heart is racing, and I can't catch my breath.
Prediction: normal

Post: One moment I'm laughing uncontrollably, and the next I'm crying for no reason.
Prediction: normal

Post: Nothing excites me anymore, and even getting out of bed feels like a chore.
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Post: I had a great day at work and treated myself to some ice cream afterward!
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Post: Sometimes I feel like I'm living someone else's life, and it's confusing.
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Post: The constant deadlines are crushing me; I can't keep up.
Prediction: normal

Post: No one would even notice if I disappeared.
Prediction: normal
```

Figure 6: Logistic Regression Model Predictions on Unseen Data

6 Conclusion and Next Steps

The Logistic Regression model outperformed Naive Bayes with higher accuracy but bad unseen data predictions. However, both models exhibited unique strengths:

- **Naive Bayes:** Achieved Better performance on unseen data which means its a better Model overall.

- **Logistic Regression:** Achieved Greater accuracy but was not successful in detecting unseen data correctly as Naive Bayes .

6.1 Future Work

1. Incorporate Transformer Models (e.g., BERT, RoBERTa).
2. Explore hybrid model combinations.