

AUTOMATED HATE SPEECH DETECTION IN REDDIT PLATFORM



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Business Problem

Hate Speech Detection on Reddit Platform

- Social media platforms allow users to freely express themselves, but this freedom is often misused to spread abuse, offense, and hate.
- Hate speech detection involves identifying communication that contains hatred or encourages violence based on characteristics like ethnicity, gender, sexual orientation, religion, and age.
- Manual identification of hate speech is slow, tedious, and labor-intensive.
- Automatic hate speech detection is crucial for creating a safer online environment.

Solution

- Our solution involves developing an automated system to detect hate speech in Reddit comments and posts.
- The process included data collection, preprocessing, tokenization, encoding, model training and model evaluation.
- The automated detection system will enhance the safety and integrity of Reddit by quickly identifying and mitigating hate speech.
- It will reduce the reliance on manual moderation, saving time and resources.
- Improved user experience will result in higher engagement and retention rates on the platform.

Dataset Description

- The dataset, "A Benchmark Dataset for Learning to Intervene in Online Hate Speech," contains original 5,020 posts.
- **Link:** <https://github.com/jing-qian/A-Benchmark-Dataset-for-Learning-to-Intervene-in-Online-Hate-Speech>
- These post's comments were separated, resulting in a 22,841-sized dataset. Each comment is tagged:
 - 1 if they contain hate speech
 - 0 if they do not contain hate speech
- **Example 01:** “harvard working inclusive.” “oh, they’re accepting students next year?” “no, meant they’re literally racist asians.”

👉 Hate Speech

- **Example 02:** Hate seeing inexperienced cops work, but man do I love watching experienced cops handle situations like this. What a guy. **Not Hate Speech**
- **Example 03:** 1. A subsection of retarded Hungarians? Ohh boy. brace for a livid Bulbasaur coming in here trying to hate a hole in some of her stupider countrymen. **Hate Speech**

Original Dataset Description

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5020 entries, 0 to 5019
Data columns (total 4 columns):
 #   Column           Non-Null Count  Dtype  
--- 
 0   id               5020 non-null    object  
 1   text              5020 non-null    object  
 2   hate_speech_idx  3847 non-null    object  
 3   response          3847 non-null    object  
dtypes: object(4)
memory usage: 157.0+ KB
```

Restructured Dataset Description

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 22841 entries, 0 to 22840
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype  
--- 
 0   comment           22757 non-null    object  
 1   hate_speech      22841 non-null    int64  
dtypes: int64(1), object(1)
memory usage: 357.0+ KB
```

Data Visualization

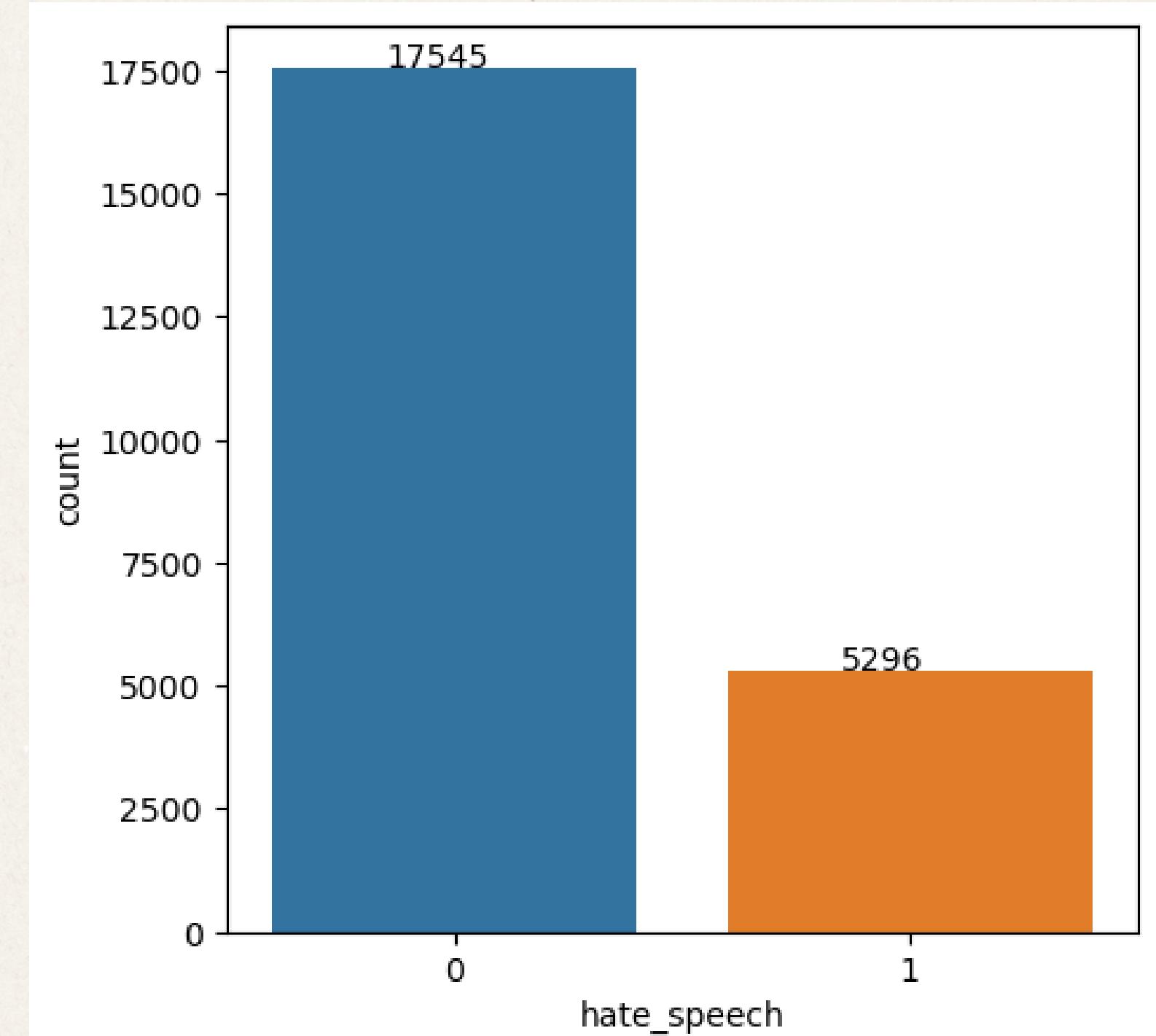
Dataset Size: 22,841

Dataset Distributions:

- Non-Hate Speech: 17,545
- Hate Speech: 5,296

Class Distribution:

- Training Count:
 - Non-Hate Speech (0): 13,553
 - Hate Speech(1): 4,230
- Testing Count:
 - Non-Hate Speech(0): 3,389
 - Hate Speech (1): 1,057



Data Preprocessing

Data Cleaning:

- Removed comments with NaN values.
- Dropped comments marked as [deleted] or [removed].

Data Preprocessing:

- Converted text to lowercase.
- Removed HTML tags and URLs.
- Eliminated stop words and punctuation.
- Handled numbers with special meaning
- Treated chat words.
- Managed emojis.

Data Sampling:

- Applied SMOTE to handle data imbalance.

Tokenization and Embedding Techniques

Tokenization:

- Performed sentence tokenization to split comments into sentences.
- Applied lemmatization to standardize words to their base form, enhancing text normalization.

Encoding Techniques:

- Experimented with One-hot encoding, Label encoding, and FastText embeddings.
- Selected FastText embeddings for its ability to capture semantic meaning effectively.

Application in Models:

- Utilized FastText embeddings across both machine learning (ML) and deep learning (DL) models for improved feature representation and model performance.

Modeling

Machine Learning Models:

- **Logistic Regression:** Effective in binary classification, suitable for hate speech detection.
- **Support Vector Machine (SVM):** Handles high-dimensional data well, effective in separating classes.
- **Naive Bayes Classifier:** Simple and efficient for text classification tasks.
- **Random Forest:** Ensemble method to mitigate overfitting and handle feature importance.
- **Voting Classifier:** Aggregates predictions from multiple models for improved accuracy.

Deep Learning Models:

- **Simple Neural Network:** Baseline model for hate speech detection.
- **Convolutional Neural Network (CNN):** Captures spatial dependencies in text data.
- **Long Short-Term Memory (LSTM):** Captures long-range dependencies and context in sequential data.

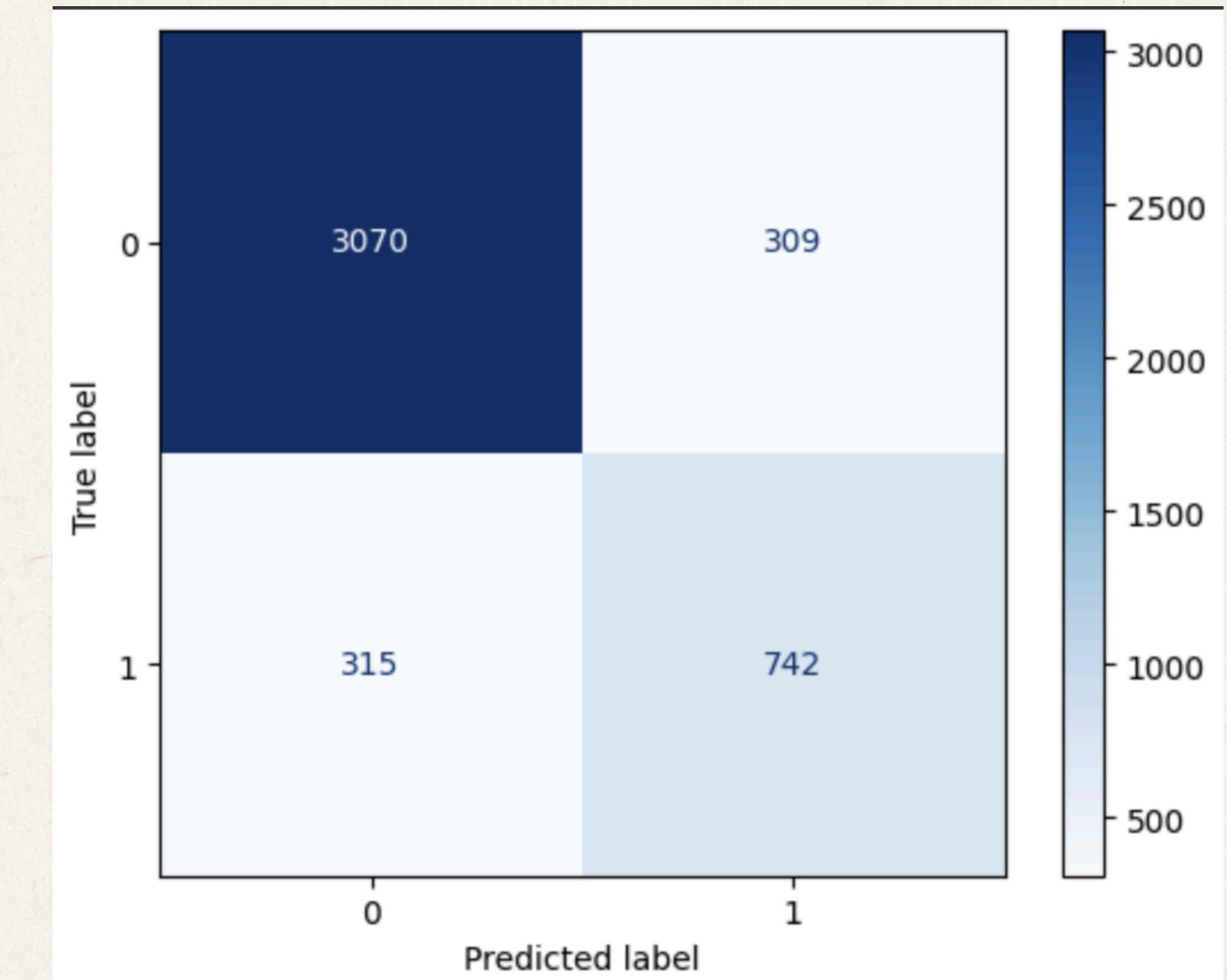
Determined LSTM as the best-performing model.

Evaluation Metrics

- **Accuracy:** Measures overall correctness of predictions.
- **F1 Score:** Harmonic mean of precision and recall, effective for imbalanced classes.

LSTM Performance

- Accuracy: 0.8537
- Precision: 0.6726
- Recall: 0.7521
- F1 Score: 0.7101



Thank You