Using Sentiment Analysis to Detect Hate Speech

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Problem

- Millions of people use social media platforms like Youtube and Twitter every day
- Such platforms oftentimes have hateful and offensive language, which can influence impressionable youth.

Problem (cont.)

Project Goals:

- To identify hateful/offensive comments so they can be removed on these platforms
- Develop a user-friendly tool that utilizes our model’s results to classify comments

What makes this challenging?

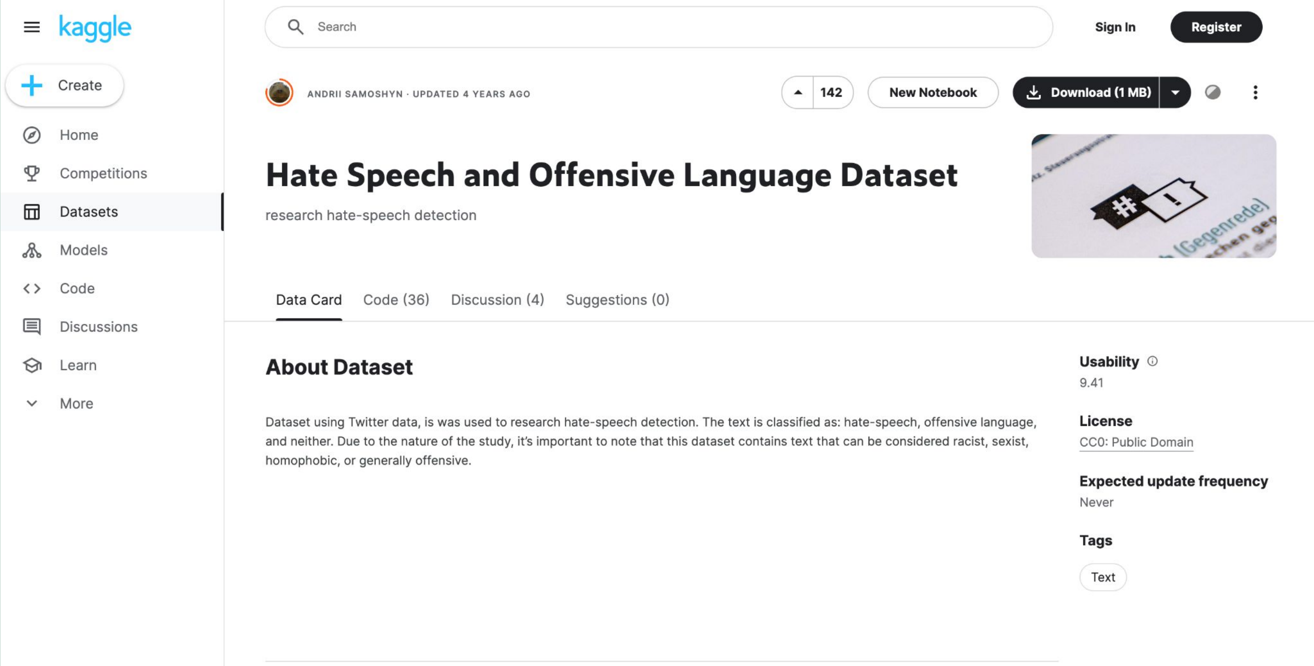
- Hate speech can be subtle and heavily context-dependent
- Language is constantly evolving and new phrases are being coined all the time
- We need to balance sensitivity and specificity—overly aggressive models may result in high false positives, impacting free speech and causing user dissatisfaction.

Word Cloud

“Neither Hate Speech nor Offensive Language”:

Dataset

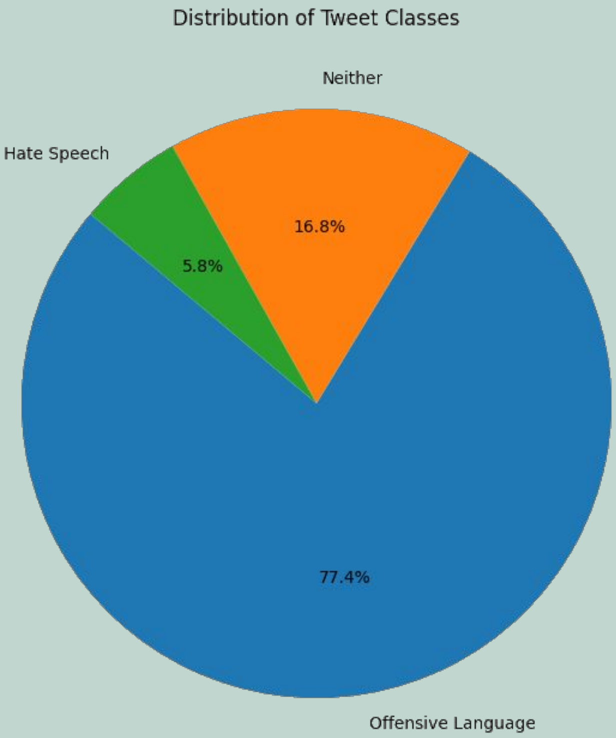
Hate Speech and Offensive Language Dataset from Kaggle:

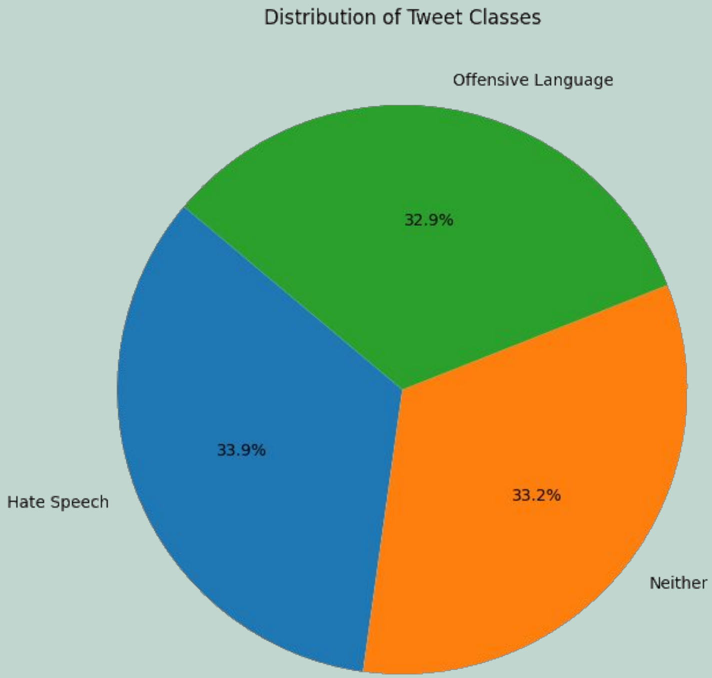


Approach / Methods

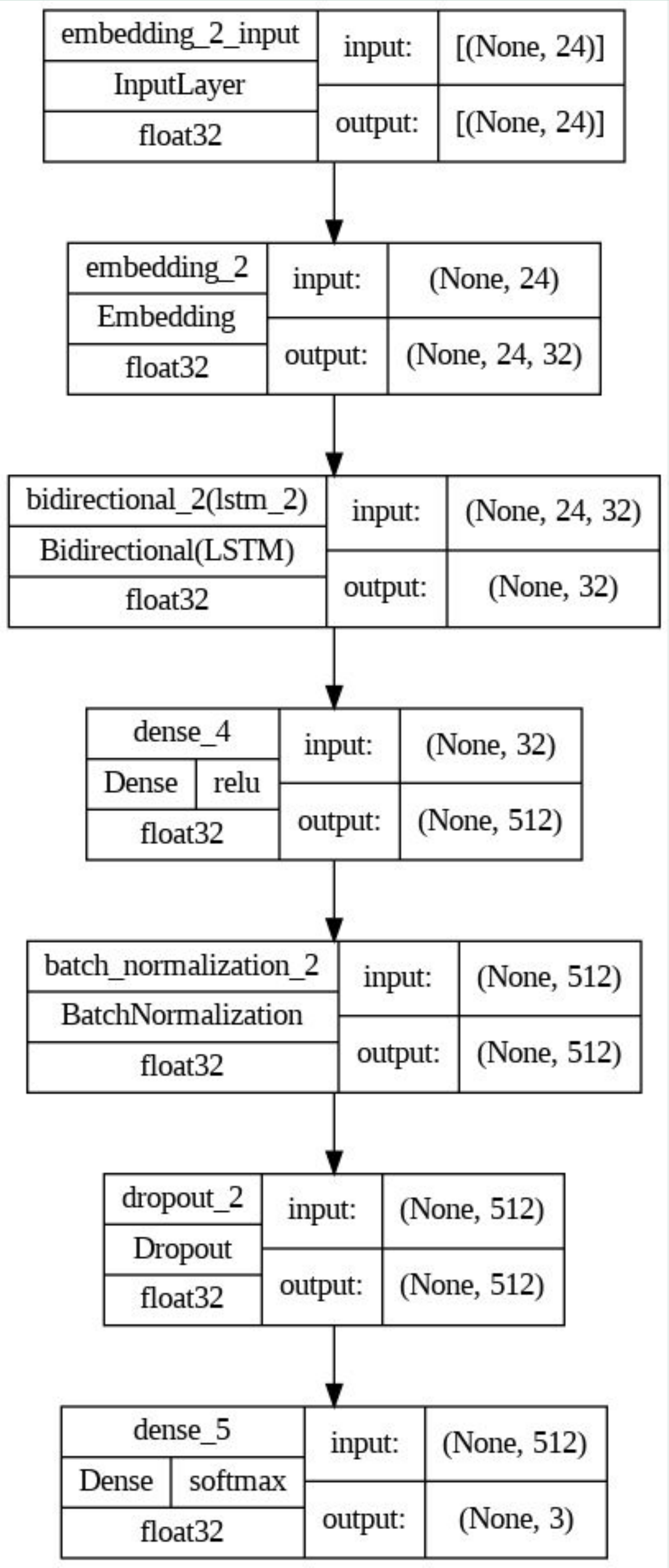
- Libraries: Tensorflow, Keras, Numpy, Pandas, Nltk, Sklearn, matplotlib
- Data preprocessing (for Tweet column)
  - balancing dataset by upsampling hate speech & downsampling offensive speech
  - removing punctuation & stop words
  - splitting text into words
  - tokenizing, converting to integers
  - padding sequences to have same length
- Bi-Directional LSTM Model
  - Input: 1D Sequence of Padded Tokens
  - Output: Classifies as Hate Speech and/or Offensive Language, or Neither
- Training & Testing Model
- Plotting Accuracy and Loss for Training & Validation Data over Epochs
- Calculating Accuracy Precision, Recall, and F1 Score for Test Data

Class Distribution After Upsampling and Downsampling





Model Architecture



Results

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Accuracy on test data: 0.9067562222480774
F1 Score: 0.9007254838943481
Precision: 0.9020119905471802
Recall: 0.8994792103767395
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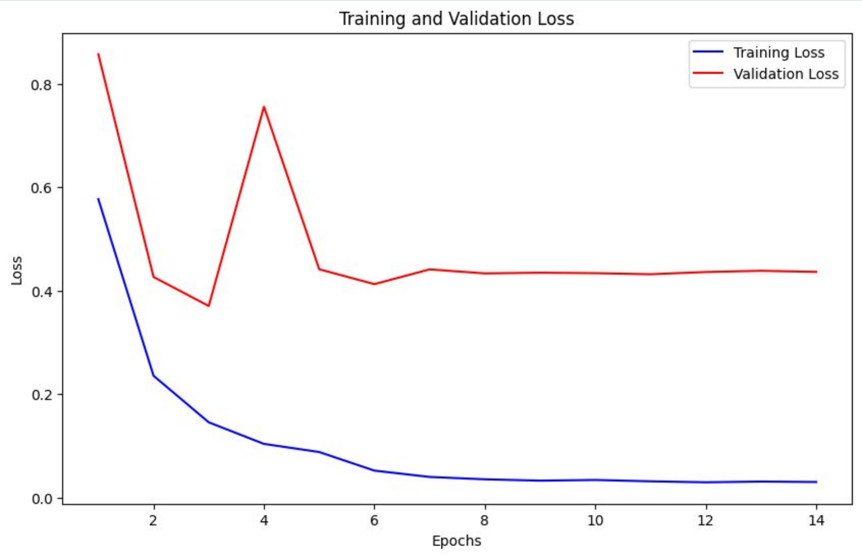
- We achieved a validation accuracy of nearly 91%
- Precision, Recall, F1 score of nearly 90% → algorithm returns more relevant results



Discussion

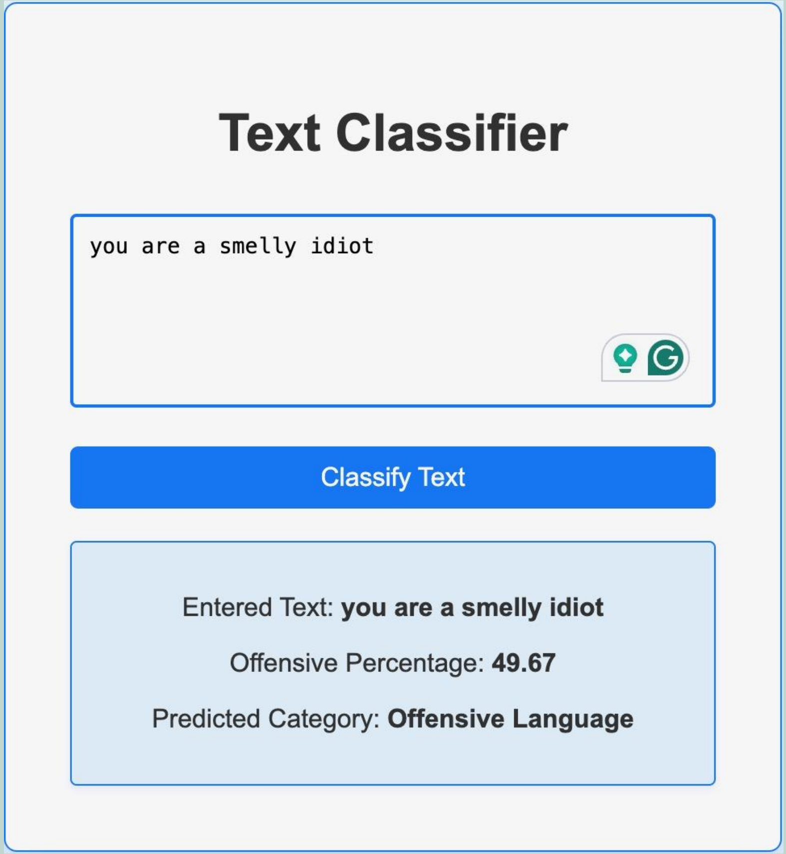
Success Criteria

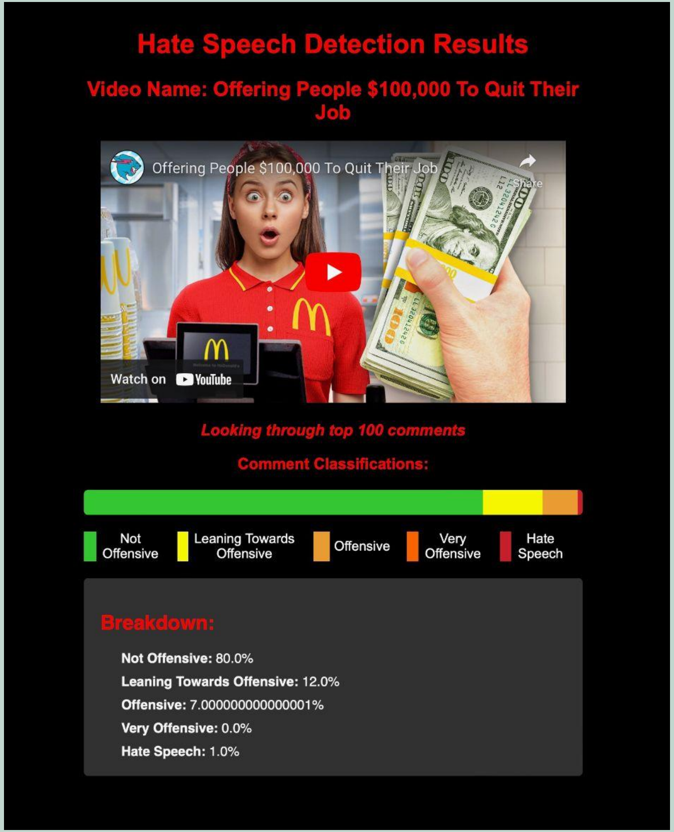
- The model accurately identifies hate speech, offensive language, and neutral speech
- We achieved a high accuracy and built two user-friendly tools that allow us to analyze individual comments or an entire YouTube video section

Roadblocks

- Initial dataset improperly labeled hate speech values as “neutral”
- New dataset had more nuance—it differentiated between “offensive language” and “hate speech”

Applications





Our Solution

Limitations

- Profanity and true hate speech is classified well
- Friendly and supportive text is classified well
- Strong real-world applications

Future Work

- Gather more data or improve on size of data with more augmentation
- Improve Accuracy of model in general
- Classify mildly offensive text more accurately
- Provide a more detailed text classification rather than just “offensive language”, “hate speech”, or “neither”