Machine Learning for Disaster Detection through Twitter Analysis

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Outline

- Introduction
- Implementation
- Results
- Discussion
- Future work

Our research work: Using Natural Language Processing accurately identify real-time disaster announcements amidst linguistic complexities.

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Why this research is important

How can machine learning frameworks be utilized to effectively distinguish between metaphorical language and genuine crisis-related information within tweets during critical events on Twitter?

What we know and don't know

The challenge lies in accurately identifying and differentiating metaphorical expressions from authentic crisis-related information within the vast amount of real-time data flowing through Twitter feeds during critical events. Metaphors, although powerful linguistic tools, introduce ambiguity and complexity, posing a considerable hurdle in the quest for reliable crisis detection.

Our research work: Using Natural Language Processing accurately identify real-time disaster announcements amidst linguistic complexities.

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Our experiment

Twitter has become a ubiquitous platform for event reporting, particularly during critical events such as disasters, facilitated by the widespread use of smartphones. This dynamic environment offers unparalleled opportunities for immediate and decentralized communication, underscoring the pressing need for effective crisis communication strategies to harness the potential of Twitter as a valuable tool for situational awareness and emergency response.

Our hypothesis

By developing a sophisticated machine learning framework that incorporates natural language processing (NLP) models to capture contextual nuances, it is possible to enhance the understanding of metaphorical language within tweets and accurately distinguish metaphorical expressions from genuine crisis-related information. Leveraging established machine learning classification algorithms and rigorous evaluation metrics, this framework can significantly contribute to improving crisis communication strategies in the digital age.

Implementation: binary classification tasks, where the goal is to predict a bi
disaster or non-disaster) based on input features (e.g., tweet text).

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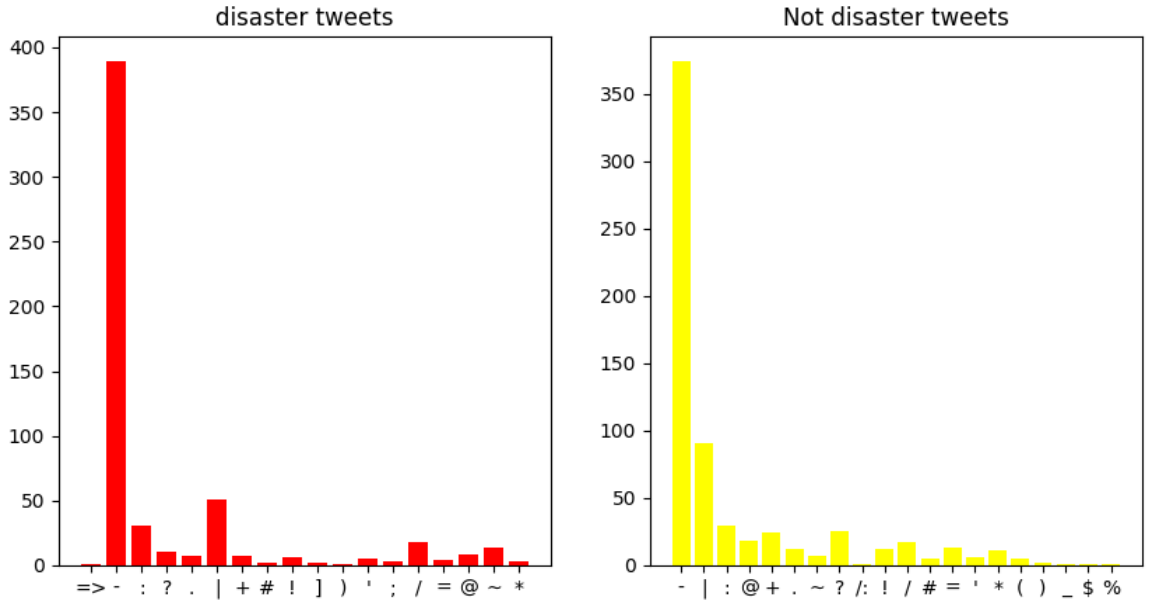
Exploratory Data Analysis

- **Number of Words in Tweets**
- **Common Words in Tweets**
- **Bigrams Analysis**
- **Punctuations**



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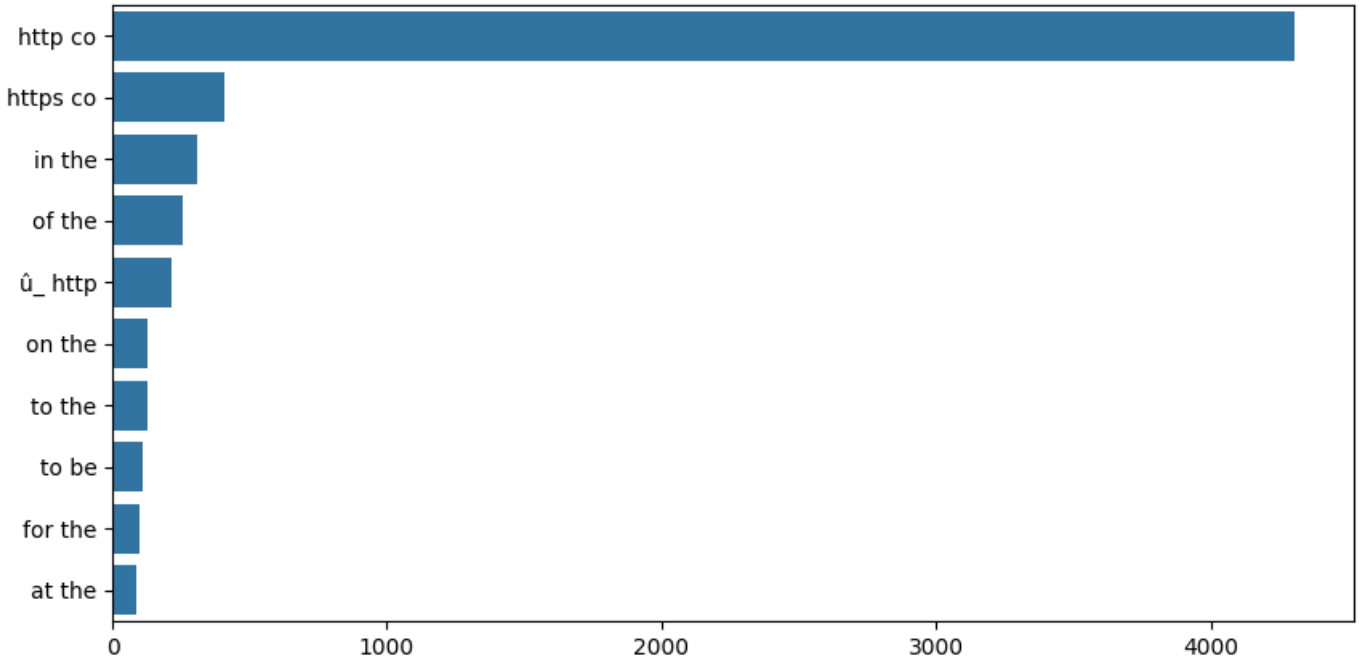

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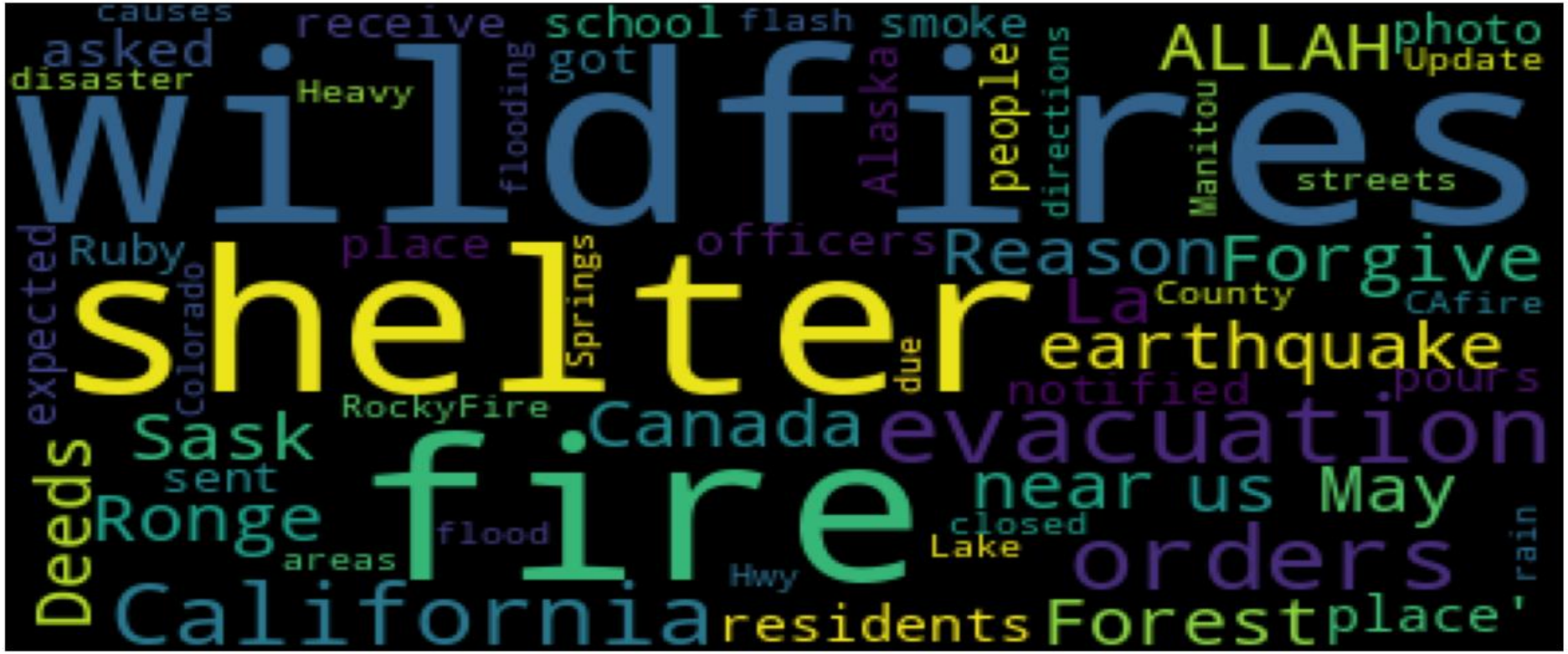
Data Cleaning

- **Removing Punctuations**
- **Removing URLS**



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Algorithms

- **Logistic regression for tweet classification**

  Logistic regression is a linear classification algorithm used extensively for binary classification.Linear classification is like drawing a straight line on a graph to separate things into different groups based on their characteristics. Imagine you have a bunch of dots on a piece of paper, and some of these dots are red and others are blue. If you can draw a straight line that neatly separates the red dots from the blue dots, that's what linear classification is about. It's a way for computers to learn how to categorize things by looking at their features and finding a simple rule (a straight line) to distinguish between different groups.

- **DistilBERT for tweet classification** BERT (Bidirectional Encoder Representations from Transformers) "DistilBERT Base Uncased" specifically refers to a smaller, faster version of the BERT model that does not differentiate between uppercase and lowercase letters in the input text. It's often used in various NLP tasks where a balance between performance and computational resources is desired.

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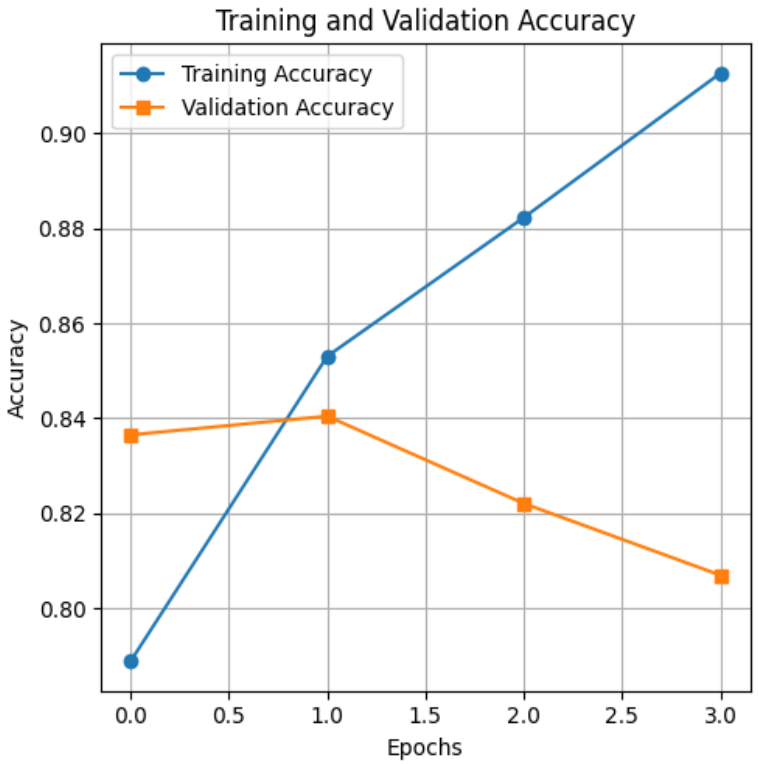

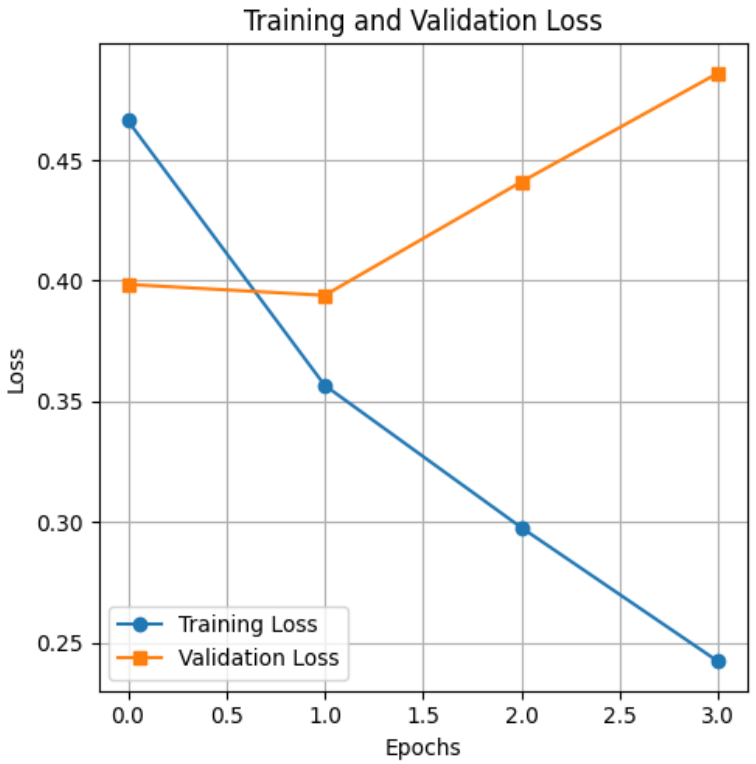

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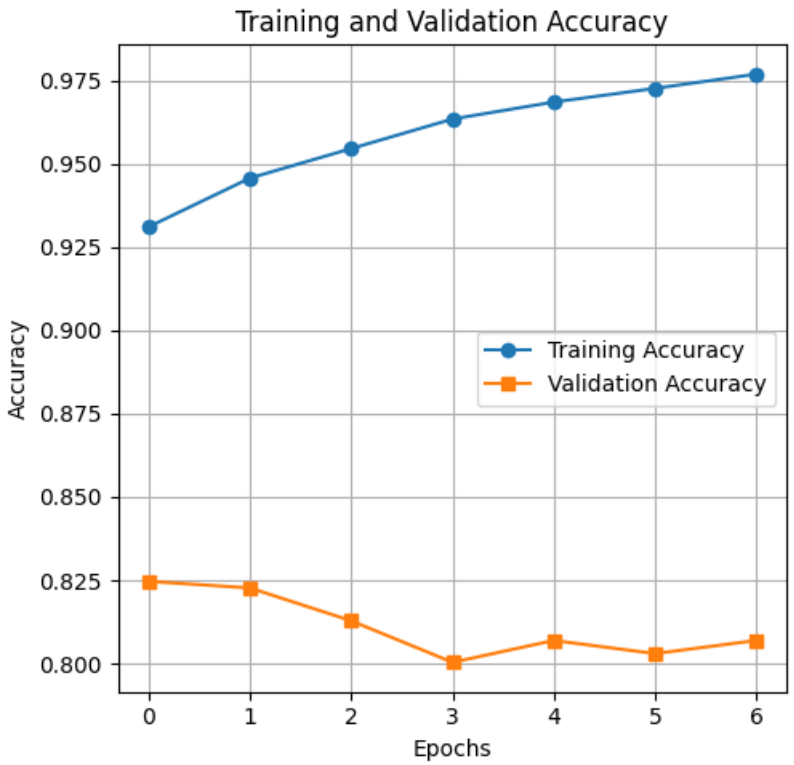

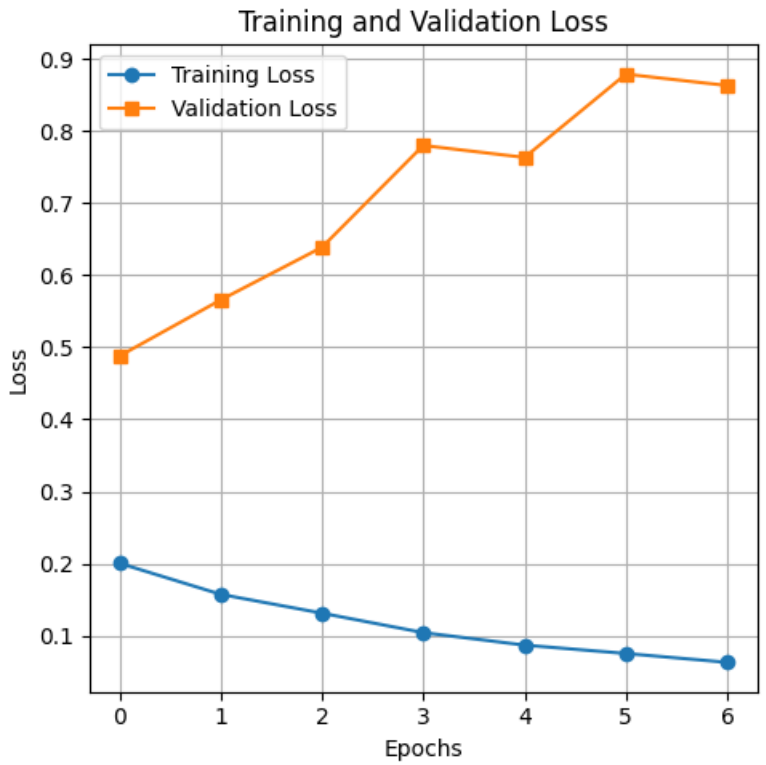

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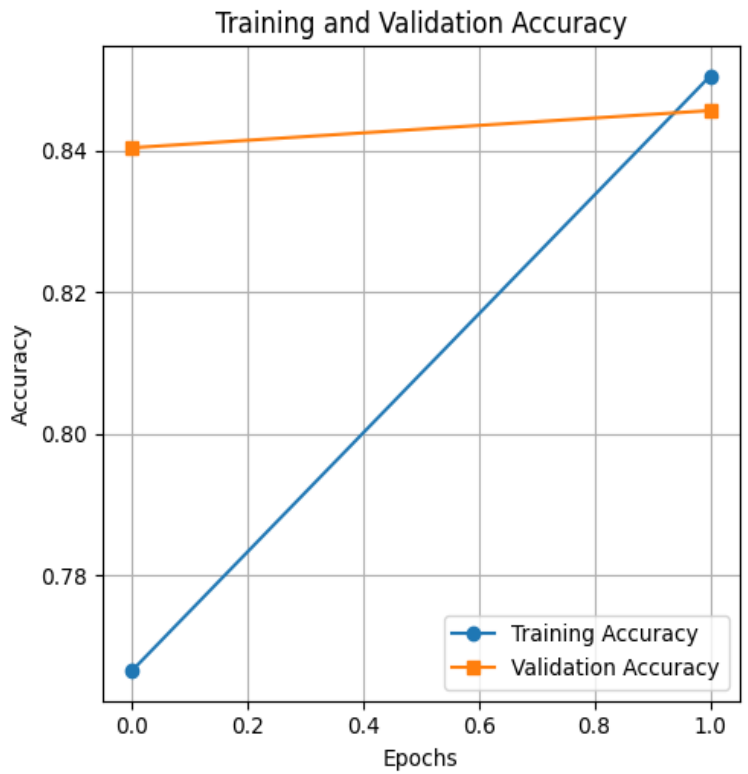

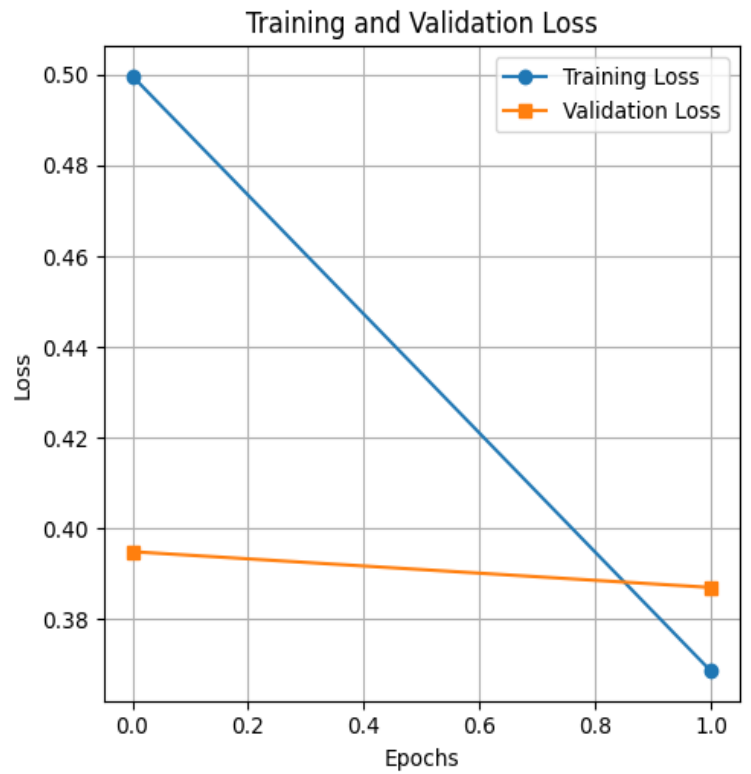

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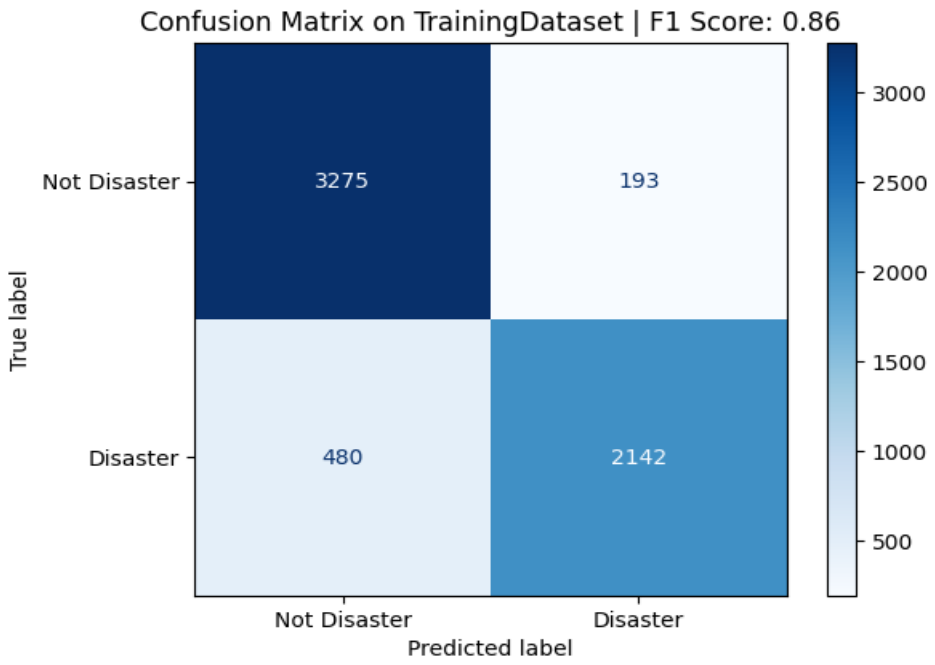

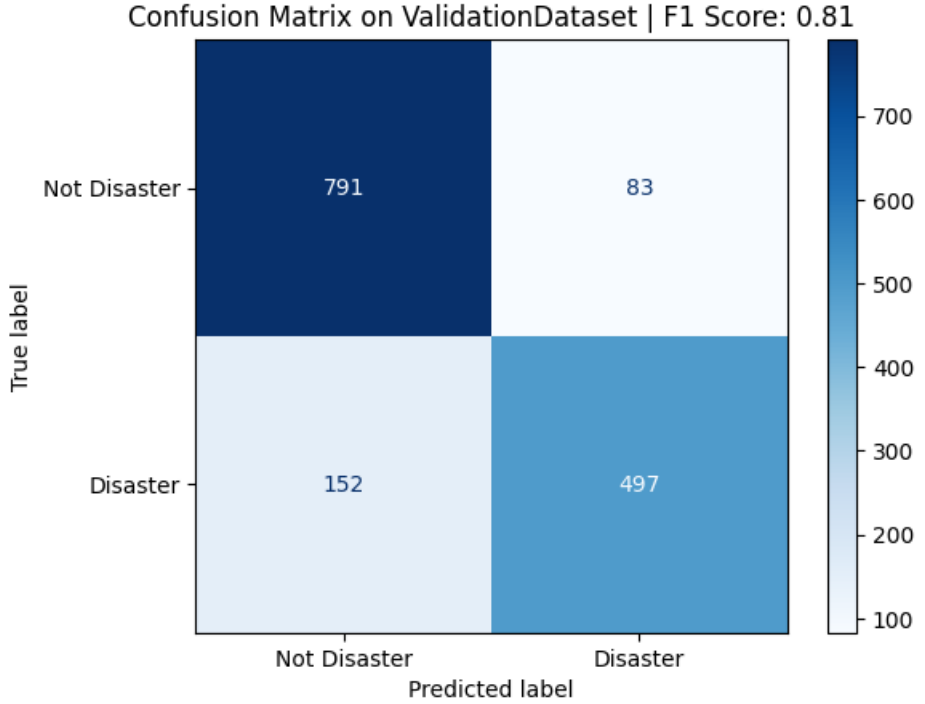

Result:

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Table 4.1: Performance Comparison of Different Models

model	Traning score	Validation score
Logistic regression	96	75
Distilbert with EPOCH=4	93	77
Distilbert with EPOCH=7	98	78
Distilbert with EPOCH=2	86	81

Future Work:

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- **Analyze different models**
- **Implementing MLOPS**

Continuous Model Monitoring: Implementing automated monitoring tools to continuously track the performance of the deployed machine learning models. This includes monitoring metrics such as accuracy, precision, recall, and F1-score in real-time, detecting any drift or degradation in model performance, and triggering alerts for timely intervention.

Automated Retraining Pipelines: Developing automated pipelines for model retraining using fresh data. This involves integrating data pipelines that fetch new tweet data, preprocess it, and feed it into the retraining process. Automated retraining ensures that the model remains up-to-date with evolving language patterns and crisis-related trends on Twitter.