Sentiment Analysis of Public's Opinion on Amber Alert using Twitter

Chun Yin Yan
Hongshuo Zhou

Problem Description

- **An Amber Alert is a message** which informs the public that a child has been abducted. When an Amber Alert is received on a mobile device, a loud sound is played and the device vibrates. Some devices do not have the ability to turn off Amber Alerts.
- Controversies:
  - **Disrupt People's daily activity (e.g. sleeping, driving)**
    - **<u>We experienced this once at 4am!</u>**
  - **Alert messages are vague or delayed**
- **We didn't find any related research on this topic.**

Motivation

We want to identify tweets which are informational and tweets which are opinion-based regarding Amber alert.

The dataset

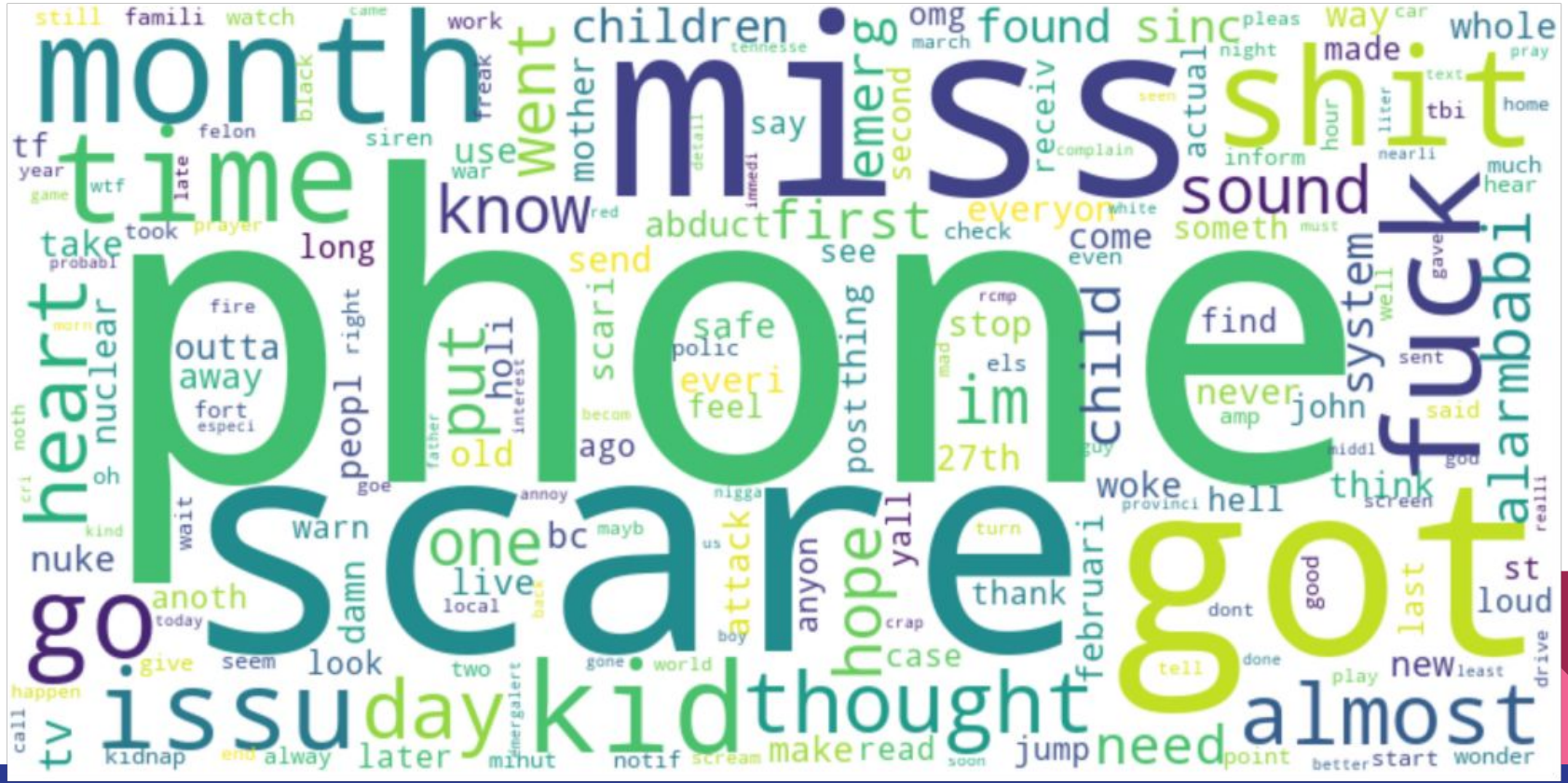
- Extract 2837 tweets mentioning “Amber Alert” from Twitter
  - The raw dataset includes date and time, the full tweet
- Tweets collected are from 2022-03-25 to 2022-04-01
- Retweets (reposting other people’s Tweet) are filtered and removed.
- An example of a raw sample data:

datetime	full_tweet
25/3/2022 23:23	@TBInvestigation @FranklinTNPD How come the Amber alert is just coming out today if the baby has been missing since the 27th of February? Serious question.

Labelling the data

- We manually labelled the sentiment of 1223 tweets.
  - 0 means a **negative opinion** on the Amber Alert/Amber Alert System
  - Example: **@TBInvestigation @FranklinTNPD How come the Amber alert is just coming out today if the baby has been missing since the 27th of February? Serious question.**
  - 1 means a **neutral opinion or an purely informative** tweet on the Amber Alert
  - Example: **2 teen girls arrested in connection with Milwaukee Amber Alert https://t.co/kovgksdlud**
  - 2 means a **positive opinion** on the Amber Alert/Amber Alert System
  - Example: **Amber Alert ftw. Good news story that.**

Common tokens in negative tweets



Common tokens in neutral tweets

Common tokens in positive tweets

Interesting findings of the Tweets

There are several interesting findings when we analysed the tweets:

1. Amber Alert has two meanings:
    a. A message which informs the general public that a child has been abducted
    b. A weather alert indicating severe weather conditions (US)

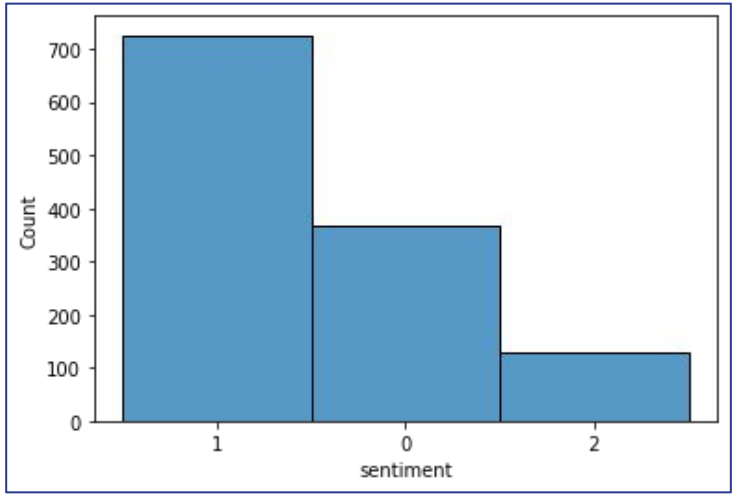
However, based on our inspection, only two tweets in the labelled data are talking about the weather alert.

Interesting findings of the Tweets

There are several interesting findings when we analysed the tweets:

2. Nearly half of the tweets are neutral or purely informational, and most of the other tweets contain negative opinion about Amber Alert.

It is a reasonable distribution because **the authority usually uses Twitter (and other platforms) to spread information**. **People are more likely to complain** the inconvenience brought by these Amber Alert than praising that the system works because everyone receives a message when Amber Alert is created but NOT when the alert is cancelled.



Neutral Negative Positive

Interesting findings of the Tweets

There are several interesting findings when we analysed the tweets:

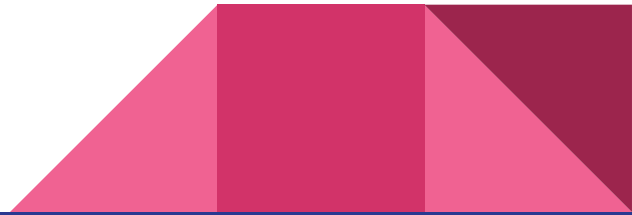
3. Tweets which are in favour of Amber Alerts often do not use positive words to express their opinion, but instead use sarcasm to mock people who are against Amber Alerts. For example:

Let me guess, people are complaining about receiving the amber alert. What a world we live in. Someone's kids are missing and need help and people don't want to hear an alarm go off on their phones

Processing the tweets

We took the following steps to process the data so that we can train our machine learning models on them:

1. Removes replies (@user), URLs (https://…), hashtags (#AmberAlert)
2. Remove non-alphanumeric unicode characters and punctuations
3. Turn all alphabets to lowercase
4. Tokenization
5. Remove stopwords from the tokens
6. Stemming



Machine Learning Models

Multiclass supervised learning

Baselines:

Naive Bayes Classifier (Generative, Probabilistic)

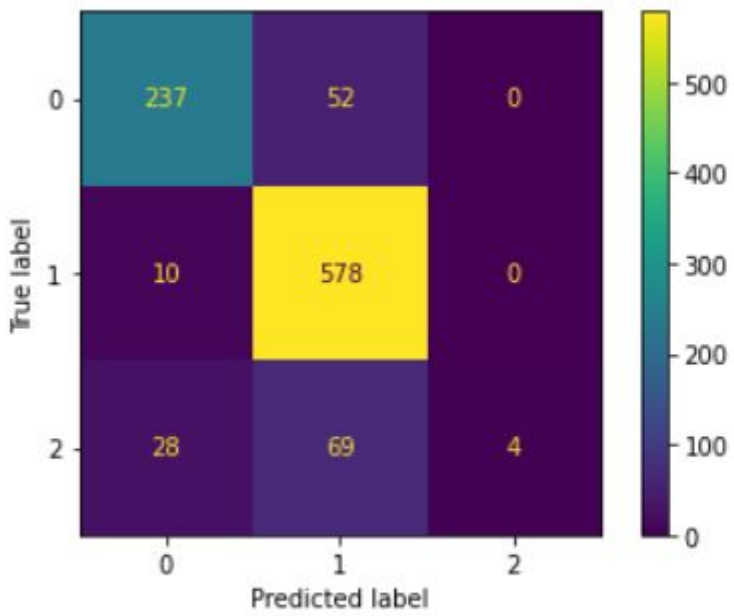
Non-baselines:

Multiclass Logistic Regression (Discriminative, Probabilistic)

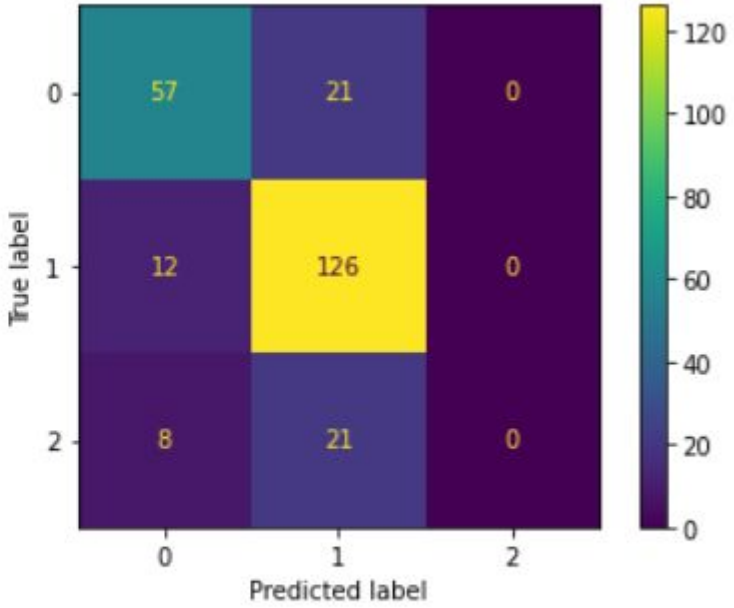
Linear Discriminant Analysis (Generative, Probabilistic)

Support Vector Machine (Discriminative, Non-probabilistic)

Results: Naive Bayes Classifier

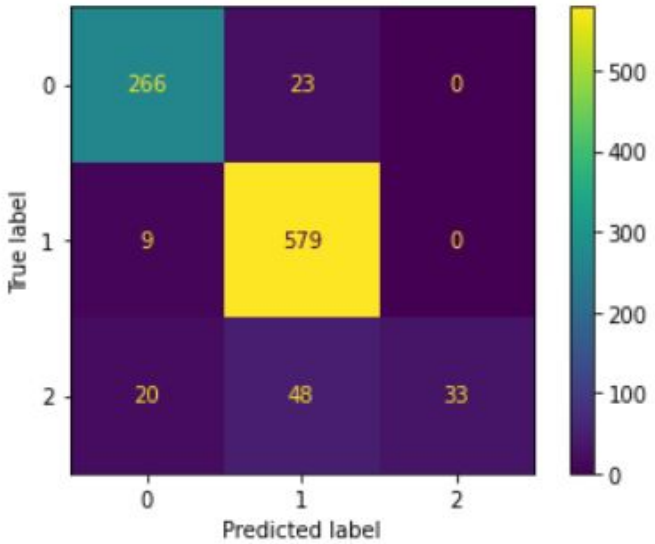


Train accuracy with simple Naive Bayes: 0.837

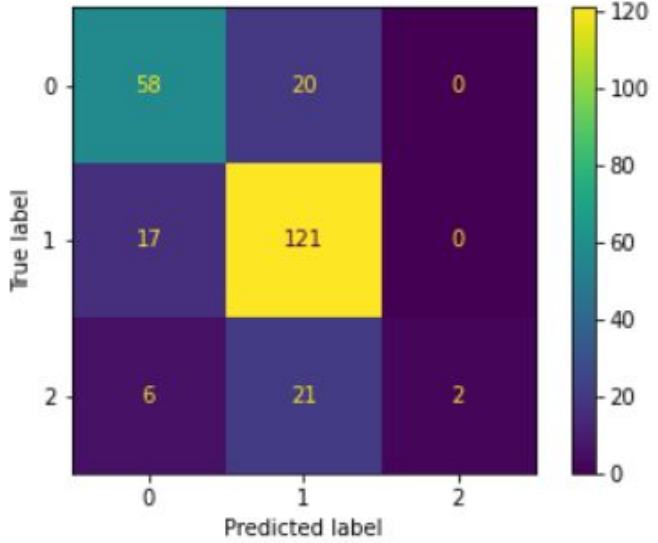


Test accuracy with simple Naive Bayes: 0.746

Results: Multiclass Logistic Regression

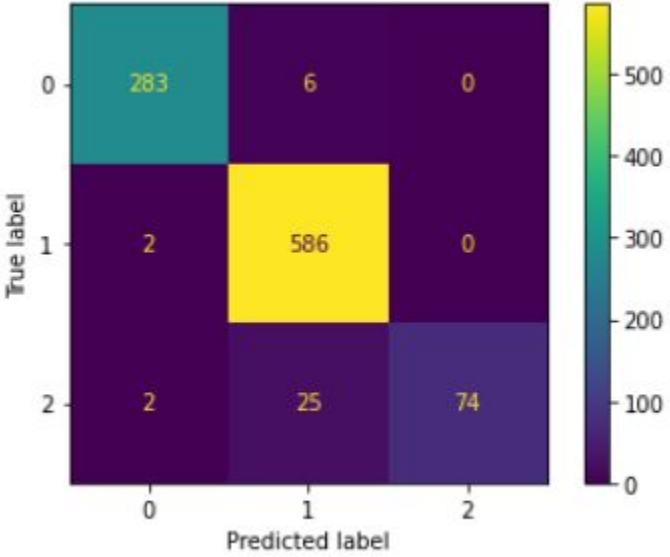


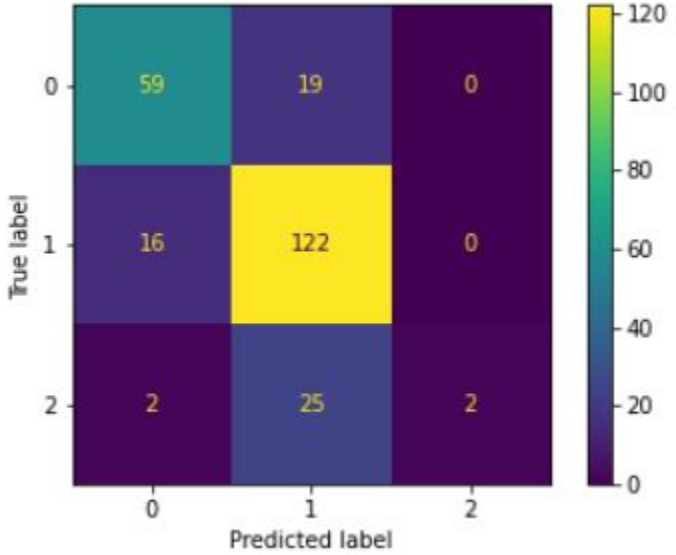
Train accuracy with Multiclass Logistic Regression: 0.897



Test accuracy with Multiclass Logistic Regression: 0.738

Results: Support Vector Machine

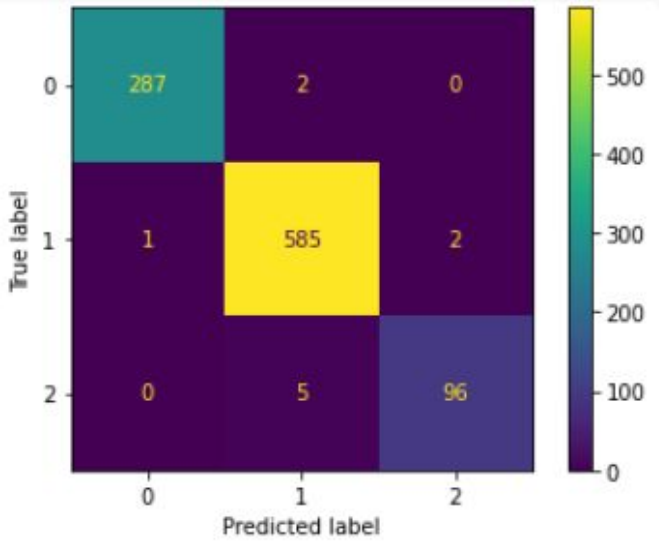




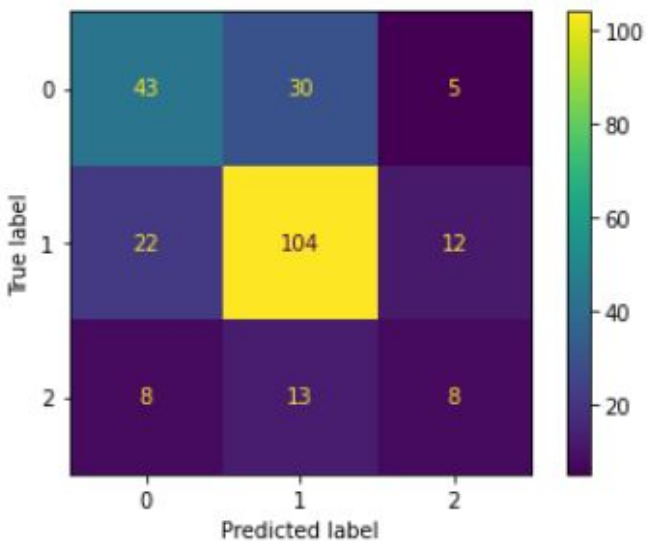
Train accuracy with Support Vector Machine: 0.964

Test accuracy with Support Vector Machine: 0.746

Results: Linear Discriminant Analysis



Train accuracy with Linear Discriminant Analysis: 0.989



Test accuracy with Linear Discriminant Analysis: 0.632

Results

Machine Learning Model	Training Accuracy	Testing Accuracy
Naive Bayes	0.837	0.746
Multiclass Logistic Regression	0.897	0.738
Support Vector Machine	0.964	0.746
Linear Discriminant Analysis	0.989	0.632

Limitations and Further Research

Limitations

- Location keywords (e.g. “Tennessee”) taken account in ML models
- Limited data with similar wordings (Only a few Amber Alerts each week)
- Tweets are mostly informational

Further Research

- Analyse data over a long period
- Remove certain tokens (e.g. locations)
- Try to solve the overfitting in LDA and SVM
- Gain more data and balance the distribution of the labels.

Conclusions

- Naive Bayes Classifier and Multiclass Logistic Regression offers very fine predictive power for identifying the sentiment of Tweets about Amber Alerts.
- Our recommendations: Take into consideration of time and location to send amber alerts.

Thank you