



Predicting Social Unrest: User Guide

INTRODUCTION

This handbook tours subscribers through the application functions on each page. In the following handbook, sections are organised according to each page because of the unique nature of what is represented and the functionality on each page.

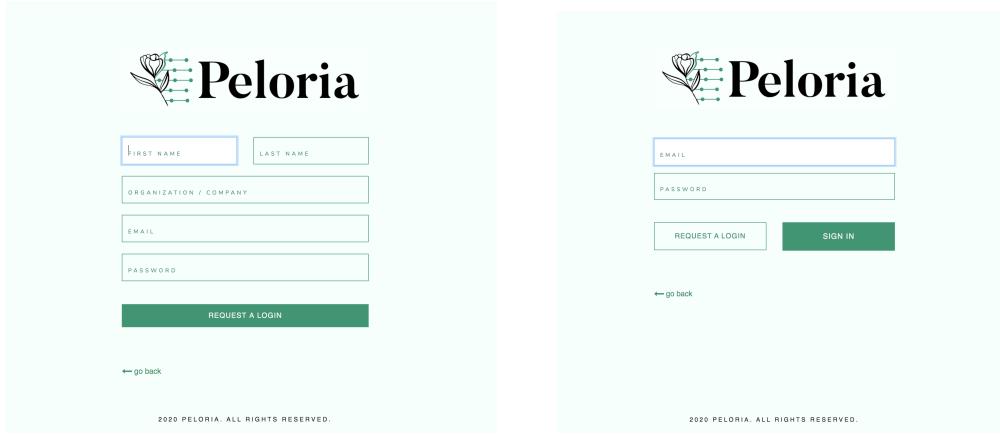
1 BACKGROUND RESEARCH

Peloria's qualitative, statistical and data science methodological capacity firstly explores the historical and contemporaneous factors, actors and dynamics that have driven violence in the past. This rigorous weighing of the proposed explanations of violence and the empirical and theoretical rigor of the data, modeling and methodology supporting them. We then consider the multidimensional nature of risk by attempting to identify how exogenous shocks like natural disasters interact with structural risks. We engage with leading authorities on the territory under examination to vet our findings and approach to selecting phenomena for consideration, the data representing that phenomena, and its planned use.

2 APPLICATION FLOW

2.1 LOGIN

If you are using the application for the first time, you need to click the "Request A Login" button. Clicking this button takes you to the page shown on the left. Once registered, you will be approved in the system after which you can go back to the Login page(shown on the right) and enter your credentials.



The figure displays two screenshots of the Peloria application interface. The left screenshot, labeled (a) Registration, shows a registration form with fields for First Name, Last Name, Organization / Company, Email, and Password. It includes a 'REQUEST A LOGIN' button at the bottom. The right screenshot, labeled (b) Login, shows a login form with fields for Email and Password, along with 'REQUEST A LOGIN' and 'SIGN IN' buttons. Both screens feature the Peloria logo at the top and a footer with copyright information.

(a) Registration

(b) Login

Figure 1: Registration and Login pages

2.2 DASHBOARD

The dashboard depicts the predictions of events in different regions of Kenya. The map of Kenya is divided into four regions - Rift Valley, Capital, Coastal and All Kenya. The events predicted in the region can belong to either of the three categories - Armed Conflict and Terrorist Attacks, Riots and Protests or Political and Extrajudicial Violence.

There is a calendar available to select a date to view the predictions made on that date. The predictions are made every Sunday, however new predictions are updated every Thursday. Available predictions go back to 1st December 2019. There is a slider available to pick a lookahead period i.e. number of days in the future for which you want to view the predictions. You can choose from 30, 45, 60, 75, 90, 105 and 120 days.



Figure 2: Predictions for lookahead slider set to 75

When the page first loads, the default predictions presented are the latest and most optimal i.e. the ones with highest accuracy of event prediction. The optimal predictions can also be viewed by clicking the "Select" button below the text "OPTIMAL LOOKAHEADS".

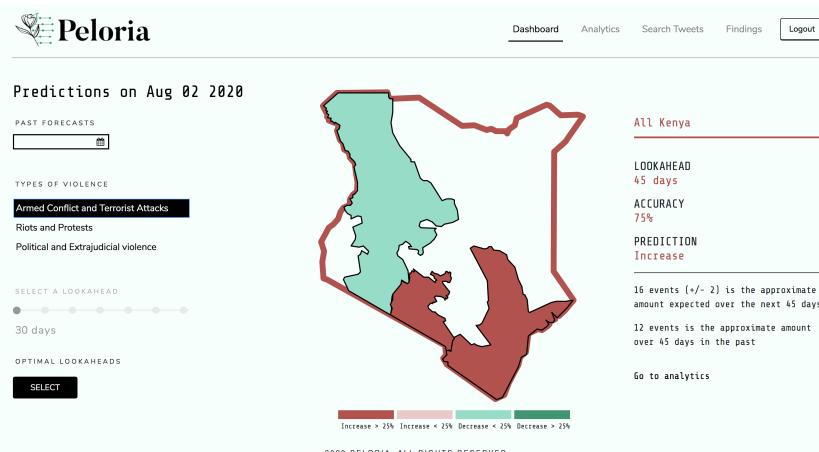


Figure 3: Default predictions on page load

To the right side of the map, you can see the descriptions of predictions based on the selections made on the left and in the map.

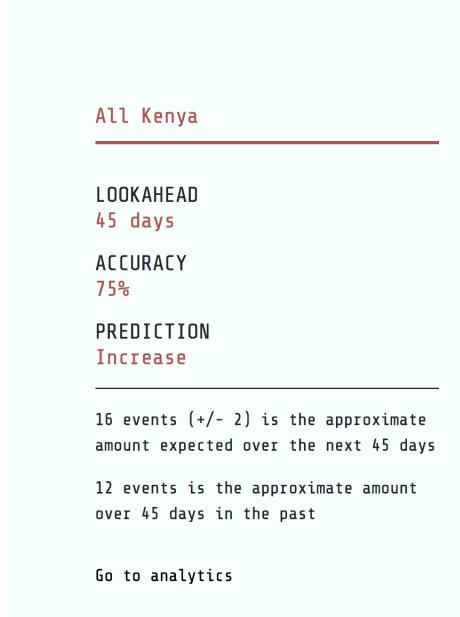


Figure 4: Descriptions of the predictions

2.3 ANALYTICS

The analytics page can be viewed either by selecting the "Analytics" menu option at the top right of the page or by clicking the "Go to analytics" link on the Dashboard page.

The analytics page displays two graphs. The top graph denotes the number of events that took place in each of the three categories. This graph updates every Tuesday with the data up to the previous Sunday. The buttons can be used to navigate to the events belonging to a particular Kenyan region. The curtain at the bottom of the graph can be used to control the time period over which historical events are viewed.



Figure 5: Violence events graph

The bottom graph represents the sentiment trends of social media data used. The sentiment falls into either of the eight themes mentioned on the left - Climate, Resources, Displacement, Terrorism, Governance, Identity, Crime and Public Health. For each of the categories, there are 3 lines - green for positive sentiment, red for negative sentiment and yellow for the count of samples present in a particular theme(the number/volume of tweets about that theme). Similar to the above graph, this graph has a curtain at the bottom that can be used to control the time period over which historical events are viewed.

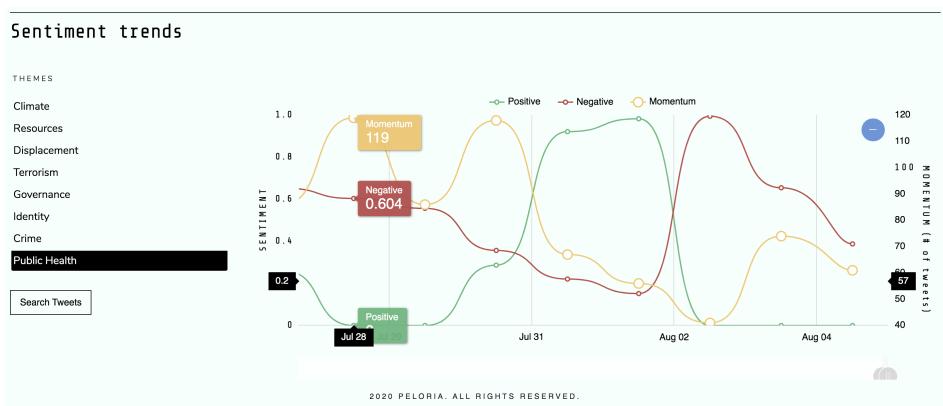


Figure 6: Sentiment trends graph

2.4 SEARCH TWEETS

The search page can be viewed either by selecting the "Search Tweets" menu option on the top right menu or by clicking the "Search Tweets" button on the "Analytics" page. To apply the selections, click the "Submit" button. The facets available for configuring a search are :

Facet	Description
Calendar	Select start and end date to view tweets belonging to a range
Themes	Eight themes which are the same as those displayed on the "Analytics" page
Handle Names	Twitter handle names belonging to 500 influential people or accounts
ML Ranking	We have asked the AI to sort all twitter users into 5 buckets according to how impactful their language is in making accurate predictions. Bucket 5 is the most impactful, bucket 1 is the least impactful. This facet provides an either ascending or descending sorting mechanism.
Correlation	We have asked the AI to identify how a twitter user's language sentiment, in aggregate, is correlated to future events. For example, if a user's language goes from positive to negative, and future occurrences of violence increase, then that user's past language has a positive correlation to future violence events. If, instead, the language goes from positive to negative, but future violence events declines, then the correlation is negative.
Correlation Intensity	We have asked the AI to score each twitter user according to how impactful their language is in making accurate predictions. 100 is most impactful, 0 is not impactful. Unlike dividing the users into buckets, as done for ML Rankings, here we are assigning scores for each twitter handle in the range 0-100 to determine the impact of their tweets to future violence events. This facet provides an either ascending or descending sorting mechanism.
Sentiment	Positive, Negative or Neutral
Expert Ranking	We have asked a network of local and international Kenya experts, including Historians, Political Scientists, Economists, Sociologists, and Anthropologists, to sort all twitter users into 5 buckets according to how influential they believe the twitter user is in their region or nationally, including over change in levels of peace/violence. Bucket 5 is most influential, bucket 1 is least influential. This facet provides an either ascending or descending sorting mechanism.
Keyword	Search for tweets based on any keyword

Note : For facets with sorting options(ML Ranking, Correlation Intensity and Expert Ranking), you can select just one facet at a time. Until this selection is present, the remaining 2 facets will remain disabled.

Date	Name	Tweet	Sentiment	Intensity	Theme	Expert Ranking	ML Ranking	Correlation	Intensity
2020-08-01	Kenya Red Cross (@KenyaRedCross)	Yesterday in partnership with Simpatic Foundation was continued with the food donation in Laikipia North, targeting persons with disabilities. The food was distributed to their caretakers in Naigando and Keriyo. #LeaveNoOneBehind https://t.co/J3UQWgBHW	neutral	0	climate	1	2	positive	1
2020-08-01	Kenya Red Cross (@KenyaRedCross)	Additionally, our teams in Laikipia West, focused on the elderly who face the most challenges of the pandemic by ensuring that they were part of the target for the food distribution. We are leaving no one behind in our efforts to assist communities in the area in #COVID19 prevention practices. https://t.co/7CmK6kLs	neutral	0	climate	1	2	positive	1
2020-08-01	Kenya Red Cross (@KenyaRedCross)	Kenya Red Cross appreciates the support of @LaikipiaCourtIV and the donation by Parkslands Matress, Food for Life, Last Resort & Cycle for food, who continue to change the lives of different communities. #LeaveNoOneBehind	neutral	0	climate	1	2	positive	1
2020-08-01	John Gitonga (@johngitonga)	Small-scale farming accounts for roughly 75% of the total agricultural output in Kenya. Agriculture is the backbone of the country; therefore, test in safeguarding small-scale farmers; however, Kenya's agricultural policies are focused on large-scale agriculture. https://t.co/9gDQZ9HnU	neutral	0	climate	2	2	positive	1

Figure 7: Search Tweets

2.5 FINDINGS

2.5.1 Methodology

Each week, the models use data from the previous 30 days to predict the average number of violence events in the next N number of days in the future where N is the “look-ahead” period in the dashboard. We have classified two types of predictions: (i) increase in the average number of events and (ii) decrease in the average number of events. Both of these are relative to the average over the past 90 days.

We trained the models using data between May 2018 and November 2019, and validated the efficacy of the models by comparing the predictions against the actual event occurrences between December 2019 and July 2020.

For all experiments, we use the following input data: (i) two years of ACLED data describing historical event occurrences, (ii) language sentiment of 500+ individual person of interests (POI) via their Twitter handles in Kenya, (iii) Google Trends data, (iv) economic indicators, (v) climate data, and (vi) commodity prices for six types of commodities. The POIs were selected based on feedback from a network of local and global Kenya experts including historians, political scientists, anthropologists, sociologists, and economists. Peloria’s internal qualitative expertise guides the curation of relevant, effective and unbiased data sources specific to a given territory.

For classifying tweet sentiment, we incorporate an aspect based sentiment analysis model based on BERT(Bidirectional Encoder Representations from Transformers) neural embeddings. For event prediction, we leverage recurrent neural networks (Gated Recurrent Units). We experimented with five models for each location, look-ahead period, and type of violence.

The final results, in terms of accuracy, recall, and support are provided on the Findings page. Across all the location, type of violence, and look-ahead periods, we achieved an average test accuracy of 81%. For the best look-ahead periods across all the locations and types of violence we achieve an average test accuracy of 89%.

Findings page contains 12 tiles representing the region and violence types. Clicking on any tile will redirect you to a new page comprising of three graphs, the description of which is in the following section.

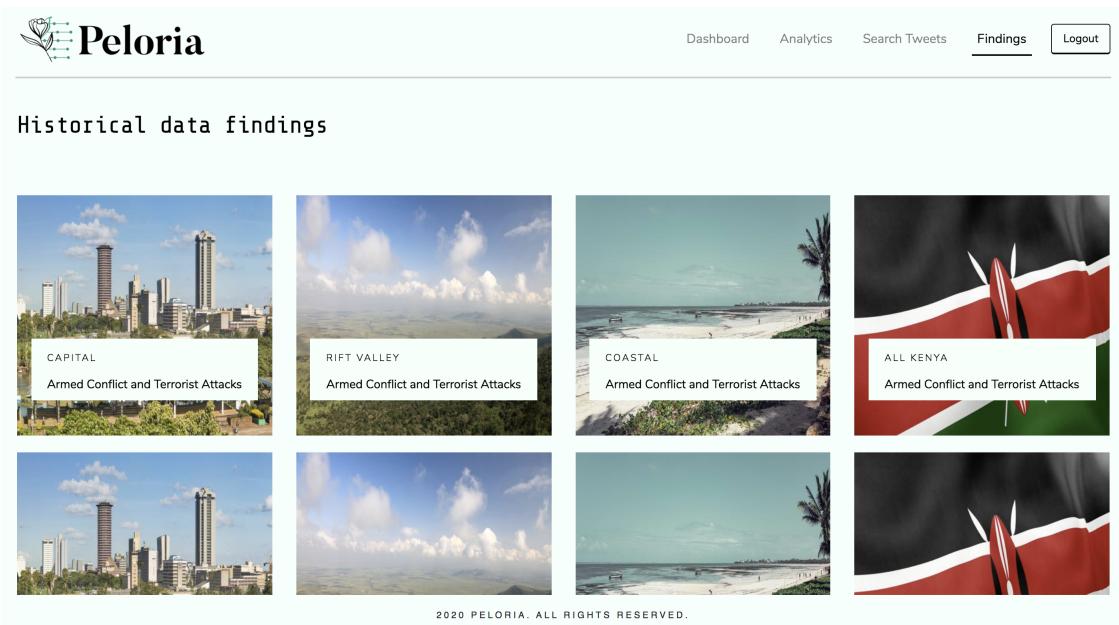


Figure 8: Findings page

2.5.2 Graphs

The first graph denotes accuracy. Accuracy measures the number of times we are able to predict the correct future outcome on data in the validation time frame. It measures the ratio of samples for which the model was able to correctly predict an increase or decrease, compared to all the samples. The range of accuracy lies between 0 and 1, where 0 signifies lowest accuracy, and 1 signifies highest or 100% accuracy.

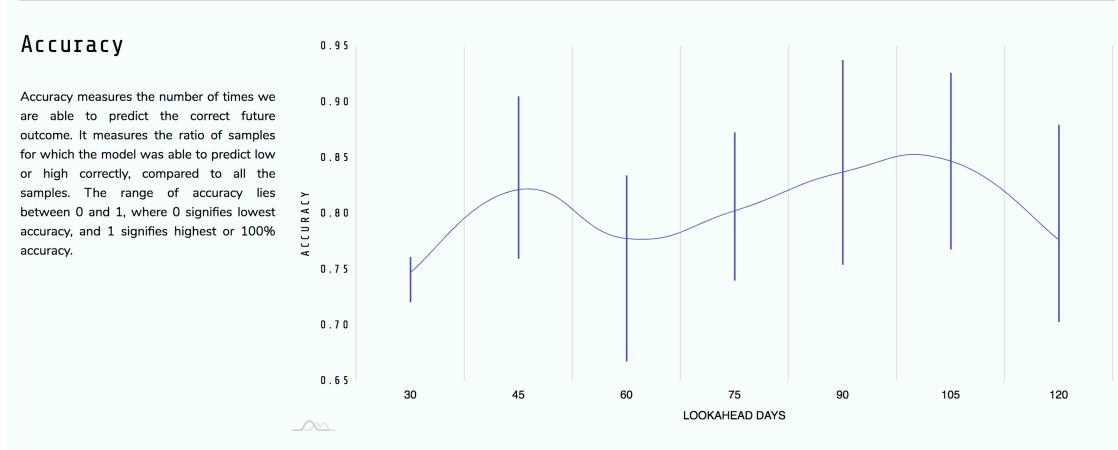


Figure 9: Accuracy Graph

The second graph denotes recall. The overall accuracy is further segregated for each class. Recall measures the number of times we are able to predict the correct future outcome for each of the classes(increase/decrease). The range of recall lies between 0 and 1, where 0 signifies lowest accuracy, and 1 signifies highest or 100% accuracy.

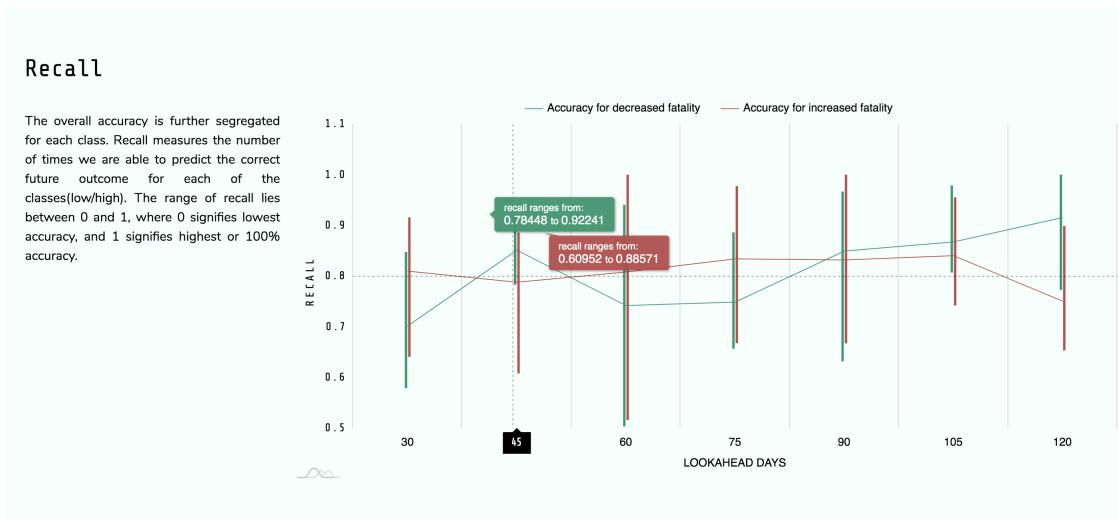


Figure 10: Recall Graph

The third graph denotes the support. Support represents the number of samples in each class, for which recall is measured. "Support" means the number of historical events in the testing data set upon which prediction accuracy of increase or decrease is based.

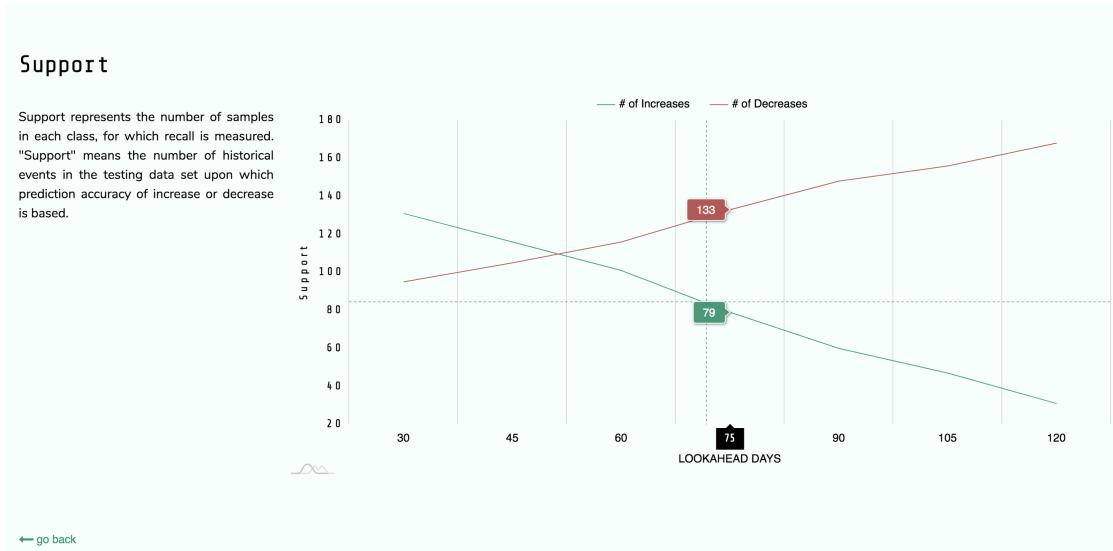


Figure 11: Support Graph