

Anti-state comment detection on social media using NLP

Group Members:

- Arsalan Javed
- Raaz Khan
- Arsal Sana
- Daniyal Azfar

Supervisor:

Dr. Wasi Haider Butt



Presentation Outline

Contribution

Problem statement

Introduction

Relevant Work

Flow Diagram

System Level Diagram

Implementation:

- Data Gathering
- Data Pre-processing
- Feature Extraction
- Model Classifier
- Model run on Test Data
- GUI

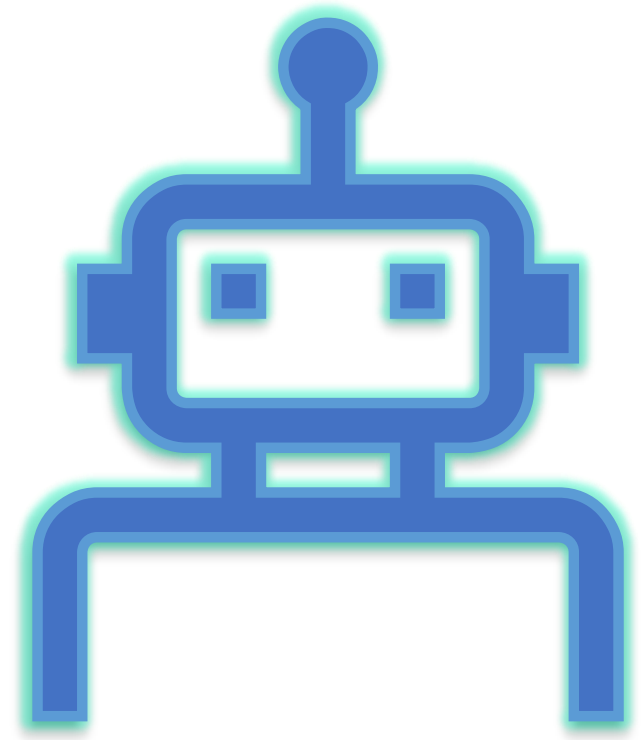
Future work

Conclusion

Reference

Group Member Contribution

- Data Gathering, Annotation and Documentation – All members
- **Daniyal Azfar**
Data extraction with web scraping
- **Raaz Khan**
Data Pre-processing
- **Arsal Sana**
Model testing and training
- **Arsalan Javed**
Features extraction, model deployment and GUI





Problem Statement

There is a dire need to have an automated approach to separate obnoxious content about the state from normal to identify state insider enemies

Introduction

- Social networking platforms; a recent attraction for all
- Many use social sites to express their emotions, beliefs or opinions about things, places or personalities.
- Anti-state comments including the hate comments and tweets against the country badly effect the country image



Relevant Work

Sentiment Analysis on Imran Khan Tweets ,a research paper in which they gather and analyzed sentiment of tweets made by Imran Khan in one year time. Polarity of Imran Khan's tweet was analyzed with help of R's studio. Polarity result shows all three positive, neutral and negative tweets.

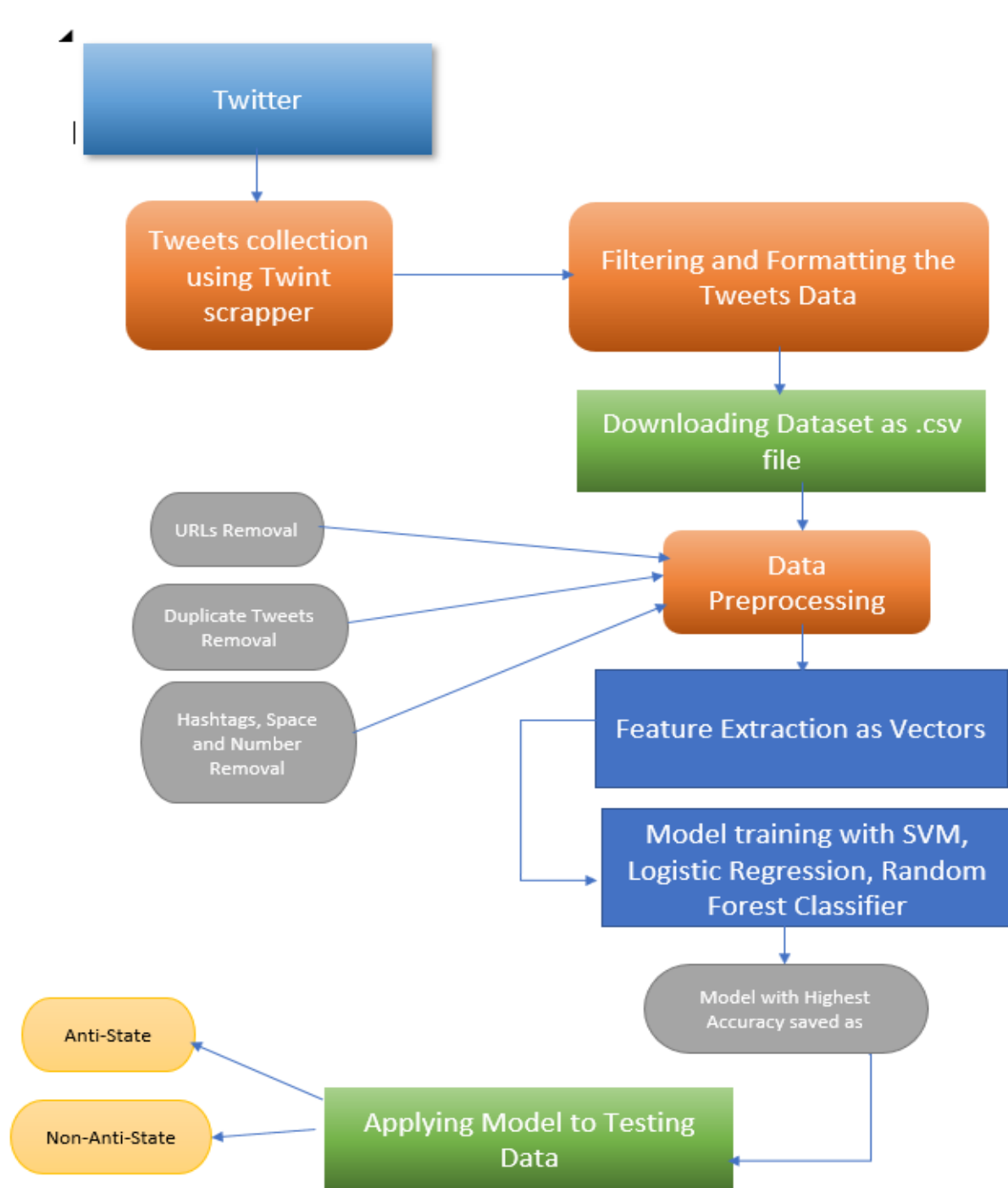
DOI:[10.33824/pjpr.2021.36.3.26](https://doi.org/10.33824/pjpr.2021.36.3.26)

Sentiment Analysis for Urdu News Tweets Using Decision Tree, a research paper in which sentiment analysis is done on Urdu data. The approach uses dataset creation and then classification, which classifies tweets as positive, negative and neutral.

DOI: <https://ieeexplore.ieee.org/document/8886788>

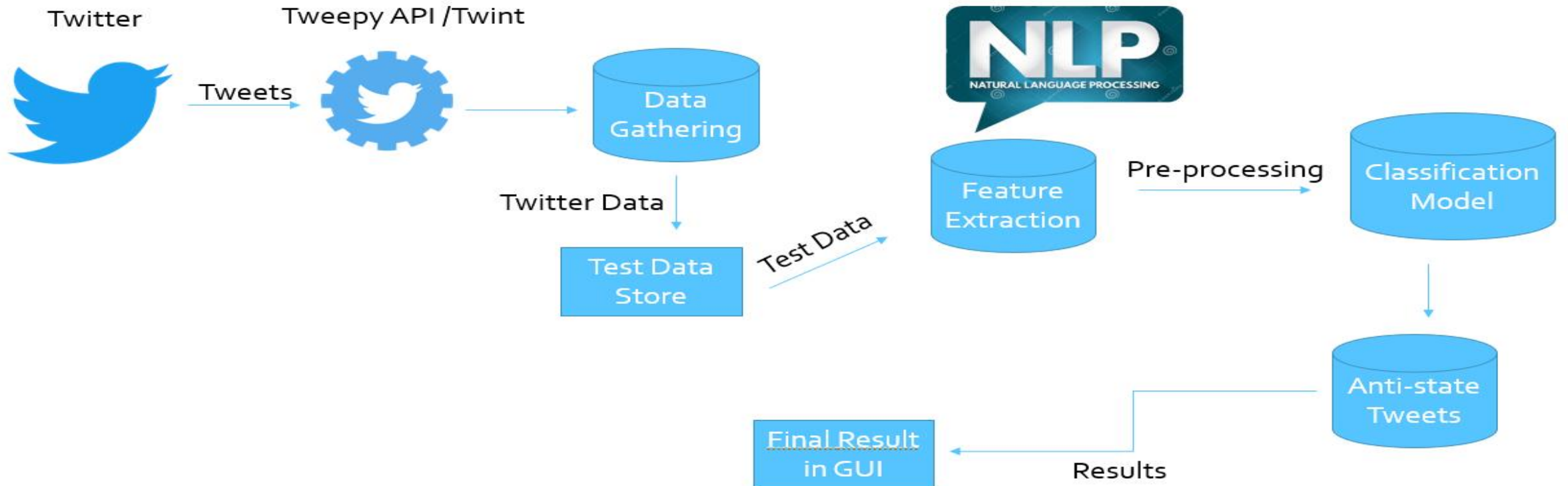
TOOLS/LIBRARIES USED





Flow Diagram

System Level Diagram



Implementation

- **SVM, Logistic Regression and Random Forest** classification model used.
- Selected the highest accuracy setup for testing the dataset.
- Training is done on the **custom-made dataset** using Twint and Tweepy
- Total of **1640 tweets** extracted and labelled for the training dataset.
- **Train/Test split- 80% training, 20 % testing set.**
- **Pre-processing** steps done on the dataset to clean the unstructured data of the text
- Features extracted from the dataset as vectors on basis of frequency of word occurrence using the **Count vectorizer**
- Developed a **GUI using Flask, Html, and CSS** in python



Data Gathering

- Use of Twint, for scrapping twitter
- Tweepy also used but due to the limited version of API keys limited data can be extracted only

```
F:\8th semester\FYP(6)\FYP-FINAL\twint>twint -s PTIOfficial -o file.json --json
1533891352152395776 2022-06-07 00:19:31 +0500 <SulihaShujaat> @PTIOfficial @FaisalJavedKhan #00000000_000000 00000000
1533891339657564162 2022-06-07 00:19:28 +0500 <muawiz_khan> @PTIOfficial 0000 0000 000000 000000 000 0000 00 0000 00 0000
000 00 0000 00 https://t.co/eW90kYCaOr
1533891287966883840 2022-06-07 00:19:16 +0500 <trendingmnister> @_amumair @chowdaryvishru @PTIOfficial U create memes &a
mp; we created this 0 0 https://t.co/KwU2vGUCqF
1533891261521854466 2022-06-07 00:19:09 +0500 <muawiz_khan> @PTIOfficial 0000 0000 000000 000000 000 0000 00 0000 00 0000
000 00 0000 00 https://t.co/eW90kYCaOr
1533891194765205504 2022-06-07 00:18:53 +0500 <CumminsPopa> @ATabbusam @Salamhaider37 @PTIOfficial Ye gandu vahi h na Jo
kutte ki maut mara tha Isliye tum bhi samajh jao aukaat se bahar jaoge to koi aise hi kutte ki tarah pel dega tumhe
1533891192336928768 2022-06-07 00:18:53 +0500 <Muhibbaan> @PTIOfficial @javibqbal09 @ImranKhanPTI @AbrarUlHaqPK 0000 0000
000 00 #00 0000_00
1533891182874566663 2022-06-07 00:18:50 +0500 <Farooq8703> 0000 000000 00 0000 0000 00 000000 000 00 0000 0000 000 0000 00
00 0000 000000 0000 000 0000 0000 000000 00 000 0000 0000 0000 00 0 @ImranKhanPTI @PTIOfficial @FarooquiJamee
l https://t.co/kqon07fmGK
1533891173823090688 2022-06-07 00:18:48 +0500 <sarah_khan> @PTIOfficial #000 0000 0000 00 0000
1533891100053733377 2022-06-07 00:18:31 +0500 <Mishii_afzal> @BOLNETWORK @PTIOfficial @MuradSaeedPTI 000000 00000 (0) 000
000 000 00000 00 ! #000000 0000 00000000
1533891097486692352 2022-06-07 00:18:30 +0500 <mafzalbh> @saubuttpmln007 @MaryamNSharif @ZeshanMalick @Atifrauf79 000 0
00 @PTIOfficial 00 0000000 000 00000 00
1533891008693510145 2022-06-07 00:18:09 +0500 <Mishii_afzal> @BOLNETWORK @MuradSaeedPTI @PTIOfficial 0000 000000 00 00000
0 00000 00000 00 000 00 00000 0000 00 0000 0000 00 000 0 00000 00 000 000 00000 00000 00 0000 00 00000 00 00000 0
0000 00 00 000000 (0000 0000)
1533890991165526018 2022-06-07 00:18:05 +0500 <Muhamma75378871> @FaizanFayzi @AkramMahar12 00 000 0000 00000 00000 000 000
0 00000 000000 00 00000 00 000000 00000 00000 00000 00000 00000 00000 0000 00 000 00 000 000000 00 0000 000000 00 0
000 00 0000 0000000 000 0000000 00 00000000 00 00000 0 000000 000 000 0000 000 0000 000 0000 000 0 @SIHN92 @AsadKharal @PTIOfficial @e
W90kYCaOr https://t.co/kWU2vGUCqF
```

FYP

Comment detector-FYP-NLP

SettingsKeys and tokens

Consumer Keys

API Key and Secret ⓘ

Reveal API Key hintRegenerate

Authentication Tokens

Bearer Token ⓘ

Generated June 1, 2022

RevokeRegenerate

Access Token and Secret ⓘ

Generated June 5, 2022
For @Arsalan39716407

RevokeRegenerate

Created with [Read and Write](#) permissions

OAuth 2.0 Client ID and Client Secret

Dataset Creation

- Tweets gathered were saved in a .csv file
- Dataset contains “Tweets”, “User Id”, “Retweets”, “Labels” etc.
- Extracted tweets were cleaned using a filter code in python in which all irrelevant columns like “Re-tweets” etc. were removed for simplicity
- Label “0” means Non-Anti State and “1” means “Anti-State”
- Tweets are collected using hashtags and only contains Tweet related to Pakistan

Unstructured Data of
Tweets Gathered

```
{
  "id": 1532957336104538112,
  "conversation_id": "1532957336104538112",
  "created_at": "2022-06-04 10:28:04 Pakistan Standard Time",
  "date": "2022-06-04",
  "time": "10:28:04",
  "timezone": "+0500",
  "user_id": 272064747,
  "username": "rz_khattak",
  "name": "Rizwan",
  "place": "",
  "tweet": "This is the Reality. Bajwa is slave. This person replaced our love with army into hate.",
  "language": "en",
  "mentions": [
    {
      "screen_name": "officialdgispr",
      "name": "dg ispr",
      "id": "811505937911517184"
    }
  ],
  "urls": [],
  "photos": [
    "https://pbs.twimg.com/media/FUYokb2XEAAIVcj.jpg",
    "https://pbs.twimg.com/media/FUYokrCXEA9_zR.jpg"
  ],
  "replies_count": 0,
  "retweets_count": 0,
  "likes_count": 0,
  "hashtags": [
    "coas",
    "وہ_کون_تھا"
  ],
}
```

Data simplified for Training

	tweet	length	label
0	Pakistani Terrorist Intelligence ISI and MI re...	245.0	1.0
1	Pakistani Terrorist Intelligence ISI and MI re...	245.0	1.0
2	Pakistani Terrorist Intelligence ISI and MI re...	264.0	1.0
3	Pakistani Terrorist Intelligence ISI and MI re...	239.0	1.0
4	Pakistani Terrorist Intelligence ISI and MI re...	242.0	1.0
...
1635	In sha Allah wo difah i Pakistan k liayay hom...	70.0	0.0
1636	Imran khan ne sabit kar deya hsi k wo allam a...	169.0	0.0
1637	Ameen	6.0	0.0
1638	You are face of GilgitBaltistan You are pride...	59.0	0.0
1639	Aap b kin ko keh rahay hein ye opn jang ha au...	173.0	0.0

Our Dataset

We have worked on a tweet's dataset extracted directly from a Twitter

Dont worry about Kashmir its our baby Pakistan is declared by FATF as Terrorist state amp not India In the name of Kashmir ISI amp rouge Pak Army is taking you guys through garden path In India people have the power to throw out a Govt	fanpageofirk	1453533
The world knows that Pakistan is in itself a terrorist state run by the toons of the ISI and the Pakistan Army Kashmir went to flames at the behest of Pakistan in 1989 when BJP was not anywhere near power of Delhi and is still burning and shall keep so till Pak fuels it	alichghulam984	1453534
We do not need your sympathy but controlling THUGs	a_proudcivilian	1453535
Pakistan is a terrorist state yesterdays terrorist TTP is going to reconcile with ISI we highly condemn all relations among states and terrorist groups ISIPak Army ISITerrorist	pakiswift	1453536
was brought to the power by Pak Army and ISI to destroy Pashtoons Thats why he won in KPK first and then in Federal for Pakistan is a terrorist state	hinam74457396	554453
A country who harbours nurtures helps terrorists since ages is a terrorist state ISI PAK ARMY help terrorists infiltrate Bottomline pakistan is a terrorist state and is a TERRORIST	ibrarkhansafi	554454
American strategists thought they can defeat Taliban in partnership with Pakistan 3 trillion was wasted on a duplicitous Pak Army n ISI If they asked Tajikistan for supply routes it wouldve worked out better Declare Pak terrorist state Impose sanctions	ronnyinblack	554455
This is the real face of Terrorist state now its time to revert back and a strong reply should be given to Army This of Pak army amp ISI only understand one language that is Brutal war	khannn108	554456
ISI Taliban are the ISI amp Pak army murdering machine to kill Pashtuns	meme_sonambulo	554457
Instead of declaring PAK a terrorist state Indian Government is giving lifeline to Pak Army ISI n Terror groups Pakistan was is n will be an enemy to India n ally to China	pakistai_boy	554458
The rapist Pak army and ISI are doing genocide in Balochistan They are kidnapping innocent and raping their womens Plz raise the voice for my brothers stuck in terrorist state Pakistan	mhd_binasghar	554459
Pakistan zindabad ISI zindabad Pak army zindabad we are the only airforce to have shit down Israeli airforce Israel is a terrorist state	uraa47	554460
Get lost loser Your drama of saying Terrorism in Pakistan is over Terrorists like Kalbhushan and other RAW and RSS Now save your Terrorist state of India frm RSS and other Terrorist groups Pakistan Zindabad PakArmy Zindabad ISI Zindabad	notcoas	554461
Dont worry about Kashmir its our baby Pakistan is declared by FATF as Terrorist state amp not India In the name of Kashmir ISI amp rouge Pak Army is taking you guys through garden path In India people have the power to throw out a Govt	kingofempire369	554462
India bombed terrorist camps in POK in retaliation against Pulwama But real master is pak army Long term Solution Economic sanctions Baluchistan govt in exile FATF blacklisting Diplomatic isolation Terrorist list to include pak army ISI Pakistan declared Terrorist state	uraa47	554463

Dataset Pre-processing

Removal of Duplicate Tweets

Determine Balance Notion of Dataset with both labels

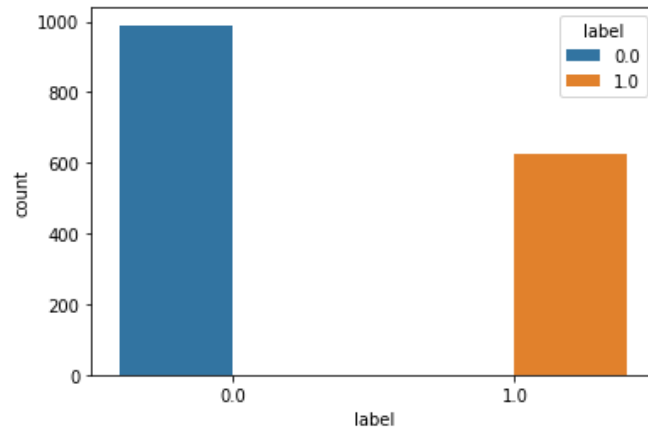
Removing spaces, digits, URLs, Hashtags and images from tweets

```
Total Tweets in Dataset that are not duplicate: 1326  
Total Tweets in Dataset that are duplicate: 289
```

```
data=data.drop_duplicates()
```

```
print('Total Tweets in Dataset that are not duplicate after dropping:',(data.duplicated()).sum())  
print('Total Tweets in Dataset that are duplicate after dropping:',(data.duplicated()).sum())
```

```
Total Tweets in Dataset that are not duplicate after dropping: 1326  
Total Tweets in Dataset that are duplicate after dropping: 0
```



```
0      Pakistani Terrorist Intelligence ISI and MI re...  
1      Pakistani Terrorist Intelligence ISI and MI re...  
2      Pakistani Terrorist Intelligence ISI and MI re...  
3      Pakistani Terrorist Intelligence ISI and MI re...  
4      Pakistani Terrorist Intelligence ISI and MI re...  
...  
1635   In sha Allah wo difah i Pakistan k liayay home...  
1636   Imran khan ne sabit kar deya hsi k wo allam a ...  
1637                                         Ameen  
1638   You are face of GilgitBaltistan You are pride...  
1639   Aap b kin ko keh rahay hein ye opn jang ha aur...  
Name: tweet, Length: 1326, dtype: object
```

Dataset Pre-processing



```
import re
from nltk.corpus import stopwords
def cleanText(x):
    import re
    from nltk.corpus import stopwords
    x=x.encode('ascii','ignore').decode()
    x=re.sub(r'https*\S+', '', x) # remove urls
    x=re.sub(r'@\S+', '', x) #remove mentions
    x=re.sub(r'#\S+', '', x) # remove hashtags
    x=re.sub(r'\W+', '', x)
    x=[i for i in x if i not in string.punctuation] # remove punctuations
    x=''.join(x)
    return ''.join(x)
```


Feature Extraction

Machines cannot understand characters and words, so need to convert text into numbers when dealing with text data

Count vectorizer is a method to convert text to numerical data. It is used to transform a given text into a vector based on the frequency (count) of each word that occurs in the entire text

Each input is pre-processed, tokenized, and represented as a sparse matrix. By default, Count vectorizer converts the text to lowercase and uses word-level tokenization.

Features Corpus and Its occurrence

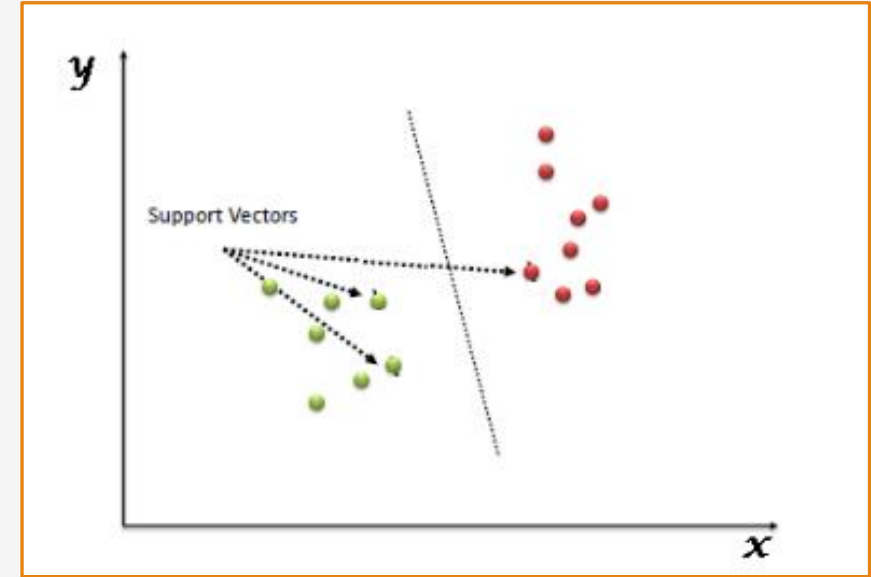
```
{'pakistani': 4548, 'terrorist': 6114, 'intelligence': 3001, 'isi': 3058, 'and': 300, 'mi': 3995, 'register': 5145, 'coup': 1389, 'fir': 2164, 'on': 4425, 'jai': 3140, 'sindh': 5682, 'freedom': 2241, 'movement': 4105, 'twenty': 6358, 'female': 2131, 'workers': 6715, 'more': 4084, 'than': 6130, 'hundred': 2795, 'named': 4215, 'fifty': 2143, 'jsfm': 3256, 'have': 2598, 'bee': 699, 'forcibly': 2213, 'disappeared': 1729, 'by': 1000, 'isisohail': 3069, 'abro': 45, 'chairman': 1089, 'jeay': 3196, 'sohail': 5754, 'they': 6158, 'are': 382, 'innocent': 2963, 'civilian': 1194, 'teachers': 6077, 'yet': 6789, 'you': 6793, 'sympathize': 5988, 'with': 6693, 'terrorists': 6116, 'attacks': 473, 'like': 3702, 'this': 6176, 'one': 4428, 'pakistan': 4540, 'army': 398, 'will': 6679, 'continue': 1342, 'to': 6225, 'eradicate': 1954, 'bla': 818, 'until': 6443, 'there': 6148, 'no': 4325, 'left': 3653, 'the': 6140, 'lota': 3783, 'dg': 1679, 'has': 2582, 'concern': 1285, 'of': 4400, 'terror': 6110, 'incident': 2898, 'occurring': 4397, 'greater': 2446, 'frequency': 2246, 'nor': 4338, 'does': 1774, 'he': 2618, 'care': 1034, 'about': 42, 'promoting': 4913, 'themselves': 6144, 'social': 5749, 'media': 3952, 'hes': 2660, 'only': 4434, 'concerned': 1286, 'propping': 4923, 'up': 6446, 'puppet': 4971, 'regime': 5141, 'showbaz': 5637, 'sharif': 5596, 'ap': 346, 'logo': 3753, 'ko': 3501, 'khuda': 3442, 'ka': 3282, 'wasta': 6601, 'ha': 2491, 'khan': 3407, 'wapis': 6586, 'lai': 3582, 'or': 4460, 'in': 2892,
```

```
text = ["Pakistan is a peaceful state",  
"Terrorism is spread by Pakistan Army and It is a terrorist state"]
```

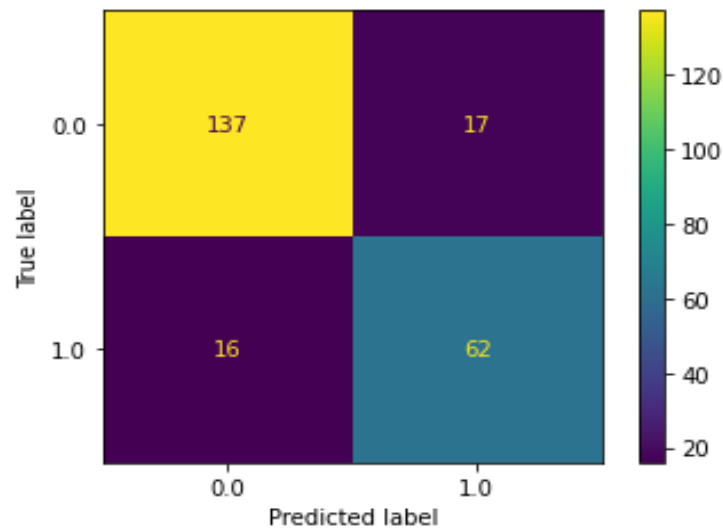
army	pakistan	peaceful	spread	state	terrorist	terrorism
0	1	1	0	1	0	0
1	1	0	1	1	1	1

Support Vector Machine (SVM)

- SVM is the machine learning classifier that best separates the two classes
- It uses kernel in its implementation. We used a **'linear'** **kernel**. Kernel transforms data space into the required form. My kernel trick technique converts data from low dimensional space to high dimensional space



Confusion Matrix of SVM:

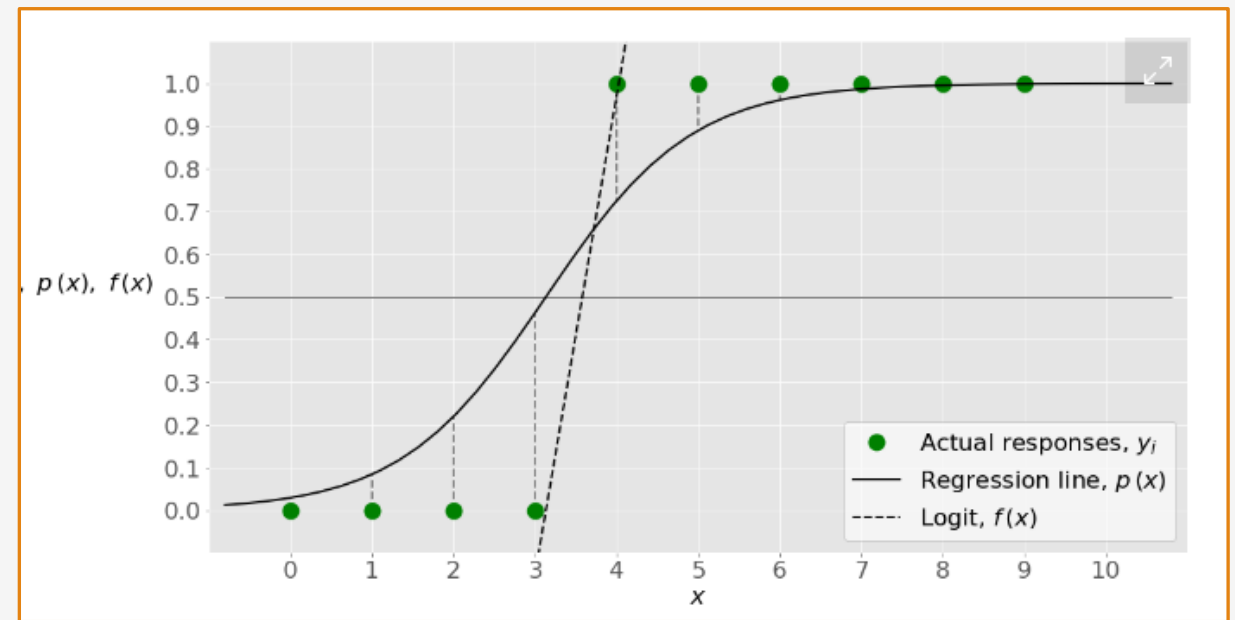


SVM classification report:

	precision	recall	f1-score	support
0.0	0.89	0.90	0.89	153
1.0	0.79	0.78	0.79	79
accuracy			0.86	232
macro avg	0.84	0.84	0.84	232
weighted avg	0.86	0.86	0.86	232

Logistic Regression

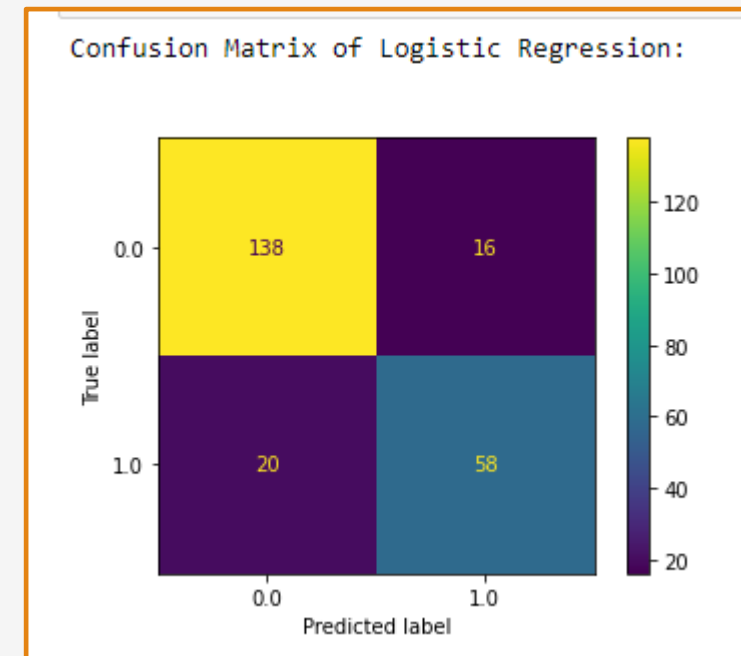
- Logistic Regression is a classification algorithm which predicts the probability of class dependence.
- The dependent variable is the binary variable. In our project, it is 0: Non-Anti State 1: Anti-State
- The logistic regression function $p(x)$ is the **sigmoid function of $f(x)$** : $p(x) = 1 / (1 + \exp(-f(x)))$.



```
Logistic Regression classification report:
              precision    recall  f1-score   support

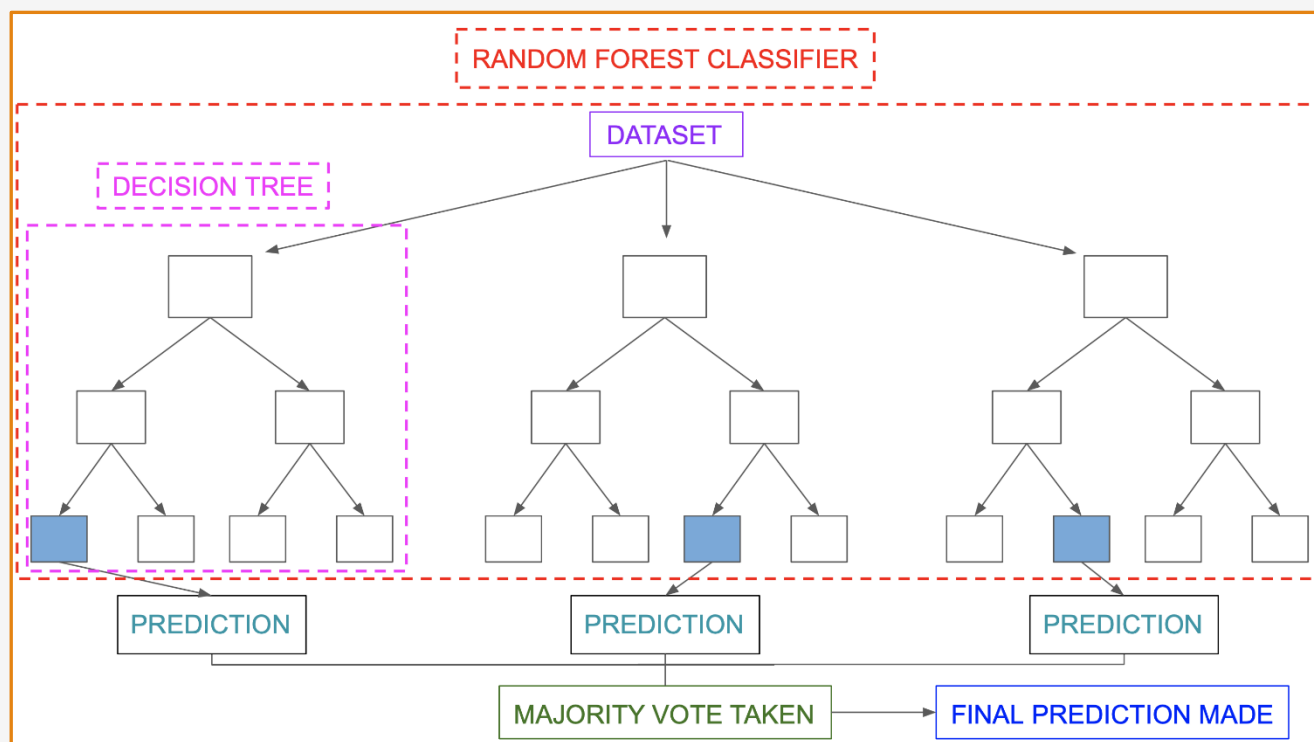
    0.0         0.90      0.87      0.88        158
    1.0         0.74      0.78      0.76         74

 accuracy              0.84        232
 macro avg              0.82        232
 weighted avg           0.85        232
```

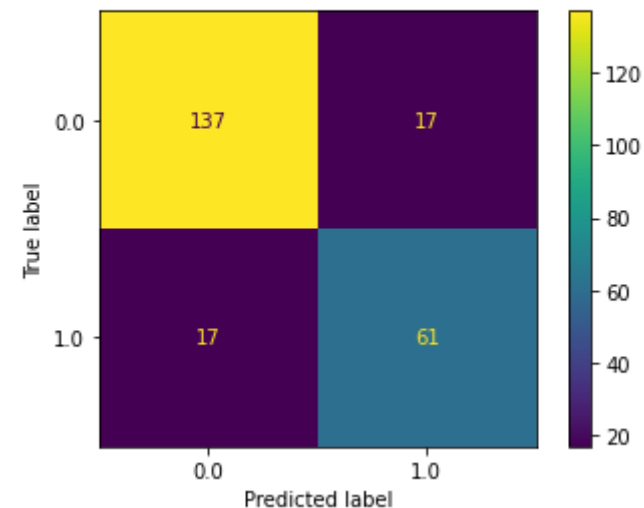


Random Forest

- A random forest is a classifier that uses several decision trees on a sub-sample of datasets and calculates the average to increase the accuracy of test data prediction this process controls the over-fitting of the dataset



Confusion Matrix of Random Forest:



Random Forest classification report:

	precision	recall	f1-score	support
0.0	0.89	0.89	0.89	154
1.0	0.78	0.78	0.78	78
accuracy			0.85	232
macro avg	0.84	0.84	0.84	232
weighted avg	0.85	0.85	0.85	232

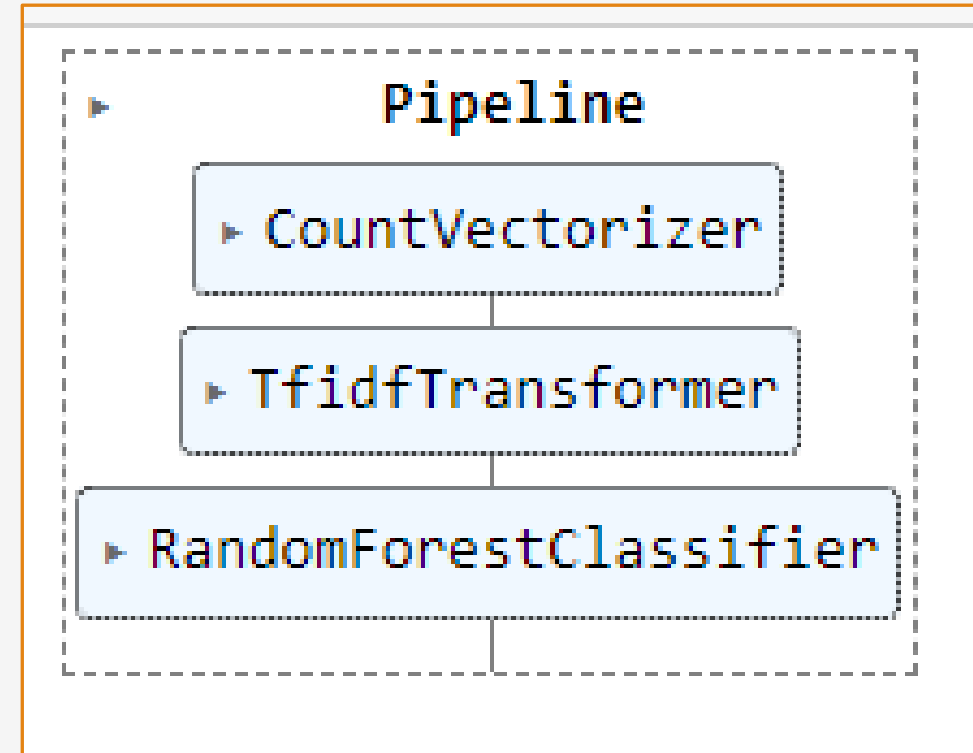
Accuracy of Classifiers

Classifier	Accuracy
Support Vector Machine (SVM)	86.0%
Logistic Regression	84.7%
Random Forest	86.4%

We choose Random Forest Classifier for building or model

Building Pipeline model

- A machine learning pipeline created
- The pipeline created by putting the features involved in training the model that was intended to be used for our dataset and the classifier in sequenced steps.
- This process automated the workflow of machine learning.
- After creating the pipeline, we saved our pipeline model using the **pickle python library** to be reused afterwards



GUI Functioning

➤ Admin use

- Sign-in /Sign-up
- Logout

➤ Home Page

- Twitter Information
- Objectives
- Coding platform used

➤ Get Started

- File input of Test data
- No. of tweets to display in output
- Table showing info of tweet its labels and user information

GUI run on Flask python on <http://127.0.0.1:5000/>



GUI Functioning

➤ Flask

- Small/lightweight python web framework
- Development server and debugger

➤ Jinja2 templates

- To create HTML, markup formats are returned to the user via an HTTP request.

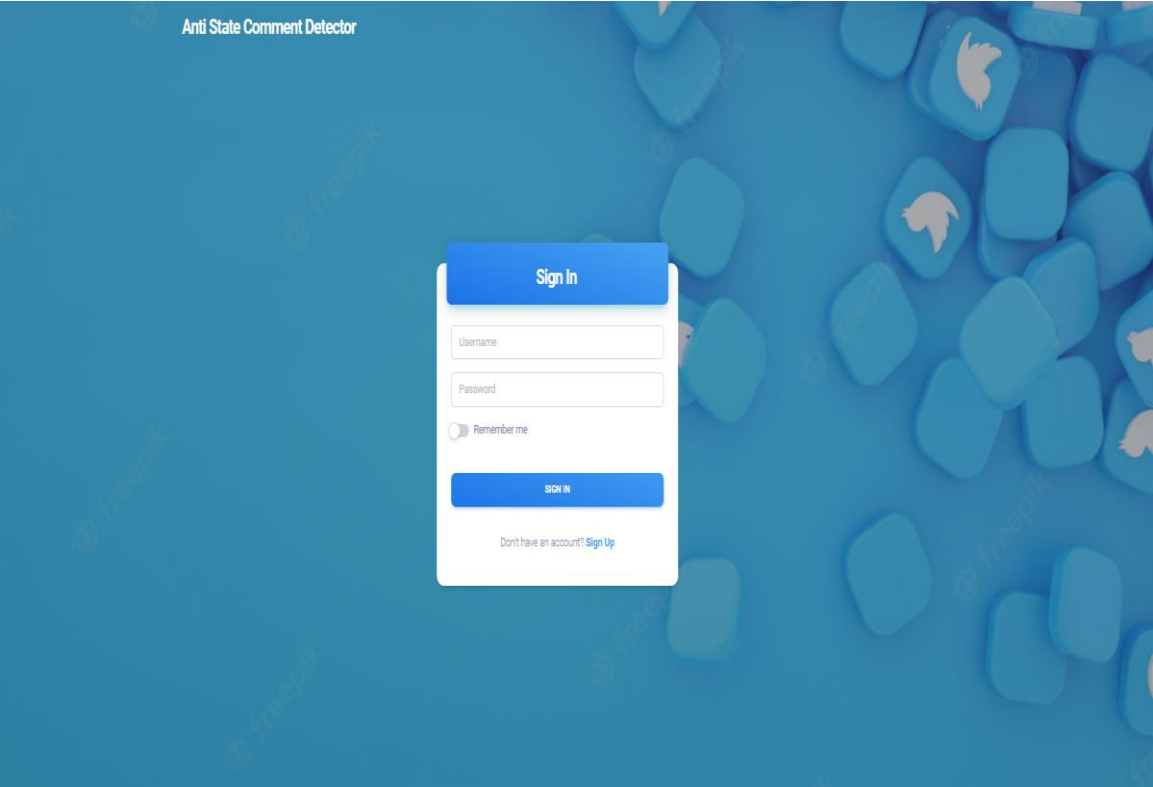
➤ WSGI

- Interface between web servers and web apps

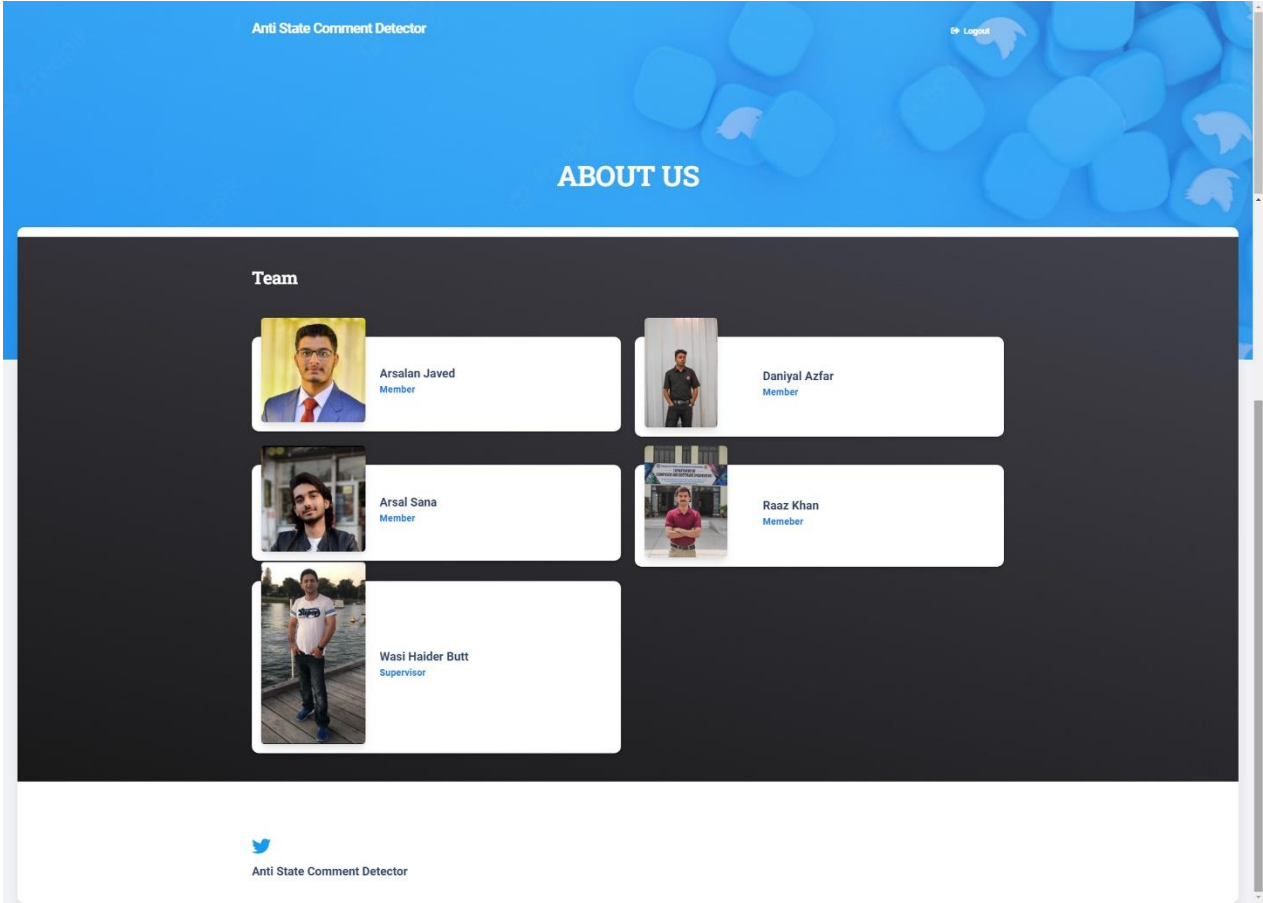


GUI Functioning

Sign-in/Sign-up

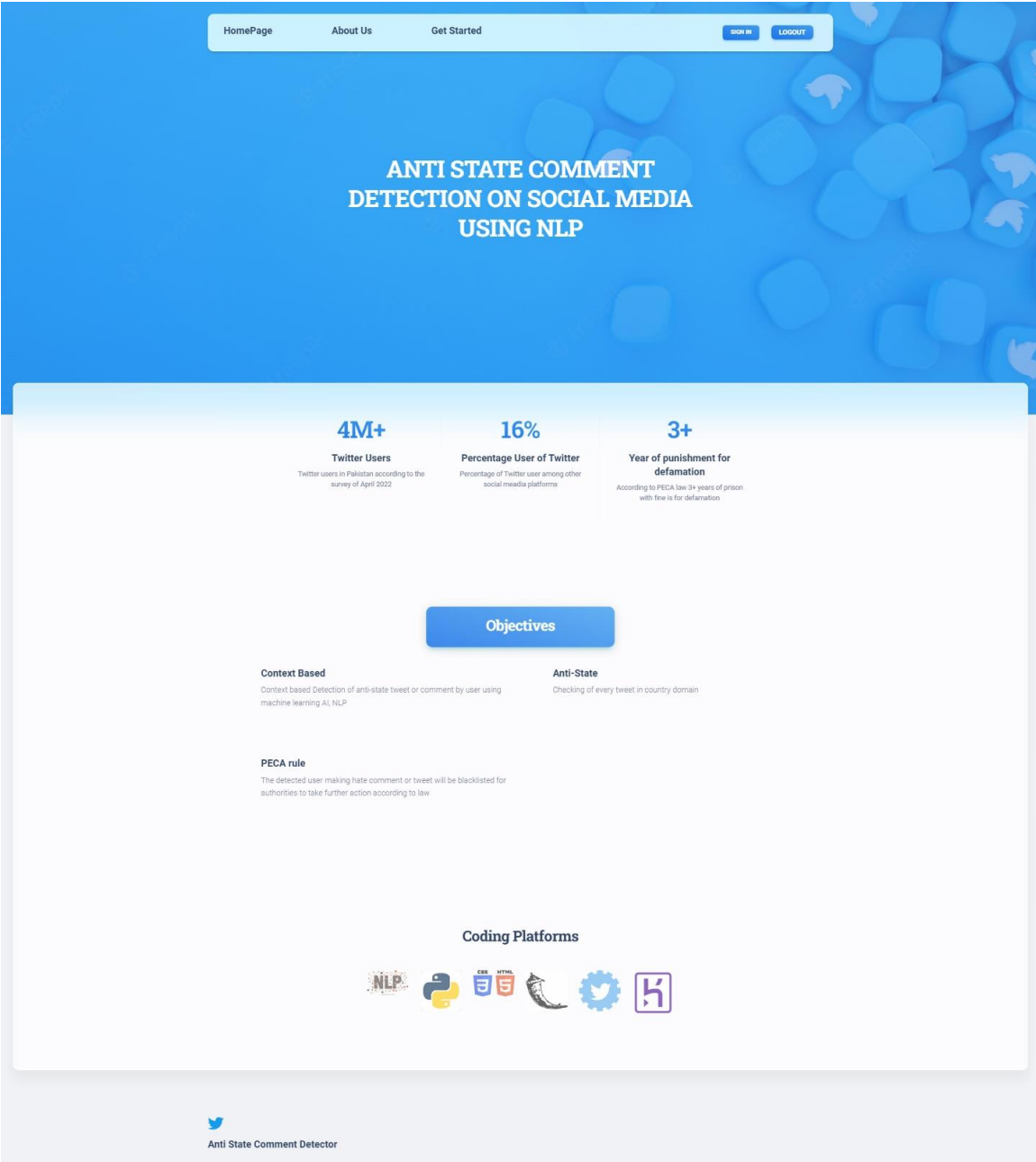


About Us



GUI Functioning

Home Page



GUI Functioning

Get Testing Data

Anti State Comment Detector

Logout

Anti-State Detection Using Dataset

Note:
Enter your dataset below your data should be clean and
processd after uploading your dataset specify the
number of tweet you want to predict.


Enter Dataset

Choose File

No file chosen

No. of Tweets

Submit

 Anti State Comment Detector

GUI Functioning

Output Showing

Homepage

Tweets	Username	Id	Predictions
Dont worry about Kashmir its our baby Pakistan is declared by FATF as Terrorist state and not India In the name of Kashmir ISI and rouge Pak Army is taking you guys through garden path In India people have the power to throw out a Govt	fanpageofirk	1.51e+18	Anti State
The world knows that Pakistan is in itself a terrorist state run by the toons of the ISI and the Pakistan Army Kashmir went to flames at the behest of Pakistan in when BJP was not anywhere near power of Delhi and is still burning and shall keep so till Pak fuels it	alichghulam984	1.39e+18	Anti State
We do not need your sympathy but controlling THUGs	a_proudcivilian	1418868272.0	Non-AntiState
Pakistan is a terrorist state yesterdays terrorist TTP is going to reconcile with ISI we highly condemn all relations among states and terrorist groups ISIPak Army ISITerrorist	pakiswift	1.12e+18	Anti State
was brought to the power by Pak Army and ISI to destroy Pashtoons Thats why he won in KPK first and then in Federal for Pakistan is a terrorist state	hinam74457396	1.49e+18	Anti State
A country who harbours nurtures helps terrorists since ages is a terrorist state ISI PAK ARMY help terrorists infiltrate Bottomline pakistan is a terrorist state and is a TERRORIST	ibrarkhansafi	1.46e+18	Anti State
American strategists thought they can defeat Taliban in partnership with Pakistan trillion was wasted on a duplicitous Pak Army n ISI If they asked Tajikistan for supply routes it wouldve worked out better Declare Pak terrorist state Impose sanctions	ronnyinblack	1.47e+18	Non-AntiState
This is the real face of Terrorist state now its time to revert back and a strong reply should be given to Army This of Pak army and ISI only understand one language that is Brutal war	khanmn108	1.43e+18	Non-AntiState
ISI Taliban are the ISI and Pak army murdering machine to kill Pashtuns	meme_sonambulo	1.52e+18	Anti State
Instead of declaring PAK a terrorist state Indian Government is giving lifeline to Pak Army ISI n Terror groups Pakistan was is n will be an enemy to India n ally to China	pakistai_boy	1.53e+18	Anti State
The rapist Pak army and ISI are doing genocide in Balochistan They are kidnapping innocent and raping their womens Plz raise the voice for my brothers stuck in terrorist state Pakistan	mhd_binasghar	1.48e+18	Anti State

Conclusion

It is a world of social media warfare, and everyone have freedom of expiring their thoughts and opinion on topics

Some social media users try to spread negativity and hate among other for country, institution or person. Defamation of any kind is not acceptable in our law and is punishable

Finding such users and restricting their use of social media for spreading negativity and hate can be achieved to some extent in our project

Future Work

01

Adding more tweets to the dataset.

02

By applying for v1 Twitter API key, real-time analysis and training on tweets can be made.

03

Extended project to detect defamation not only of the state but instead also detect Racism, sexism, homophobia, religious extremism, and conspiracy theories.

04

Can implement it using run-time search of single tweet instead of uploading file

Challenges

- **Tweepy Account access**

Got the Tweepy essential access account but needed elevated access but couldn't get in on time

Elevated account has a limit of 200 tweets per search

If you use the same keyword for the tweets extraction the keys expire

- **Data Augmentation**

We tried to use data Augmentation for the training data but created chunks of data that were not good for our model

1604	cm solution separate land farmersbill sfj khalistan	51	1 b'vjonarjun'				
1605	cm make change farmer bill not solution solution	48	1 b'Balwind97445676'				
1606	cm make change farmer bill not solution sol	43	1 b'Jaspal13649680'				
1607	cm not believe word solution	28	1 b'ncbipindra'				
1608	b cm dont want anything except want live life	45	1 b'THE18SIKH'				
1609	b account withhold india response legal demand learn	52	1 b'NetizenParo'				
1610	cm gherao modi truck rally th sept solution farmersbill sfj khalistan	69	1 b'Jaspal13649680'				
1611	cm gherao modi truck rally th sept solution farmersbill sfj khalistan	69	1 b'TheInjun'				
1612	cm gherao modi truck rally th sept solution farmersbill sfj khalistan	69	1 b'TarunBh57539300'				
1613	farmersbill already supressed fa	33	1 b'AjitPra48031176'				
1614	cm farmer bad debt not	22	1 b'vKulwinderSingh'				
1615	b cm every life important cruelty isnt	38	1 b'HIMANSHUJ656'				
1616	want farmer commit suicide farmersbill	38	1 b'harshitratnoo'				

- **Deployment on Heroku**

The free size on Heroku which was given was much less than our project size for deployment.

References

- **Twitter survey report**
<https://datareportal.com/reports/digital-2022-pakistan>
- **PECA article**
<https://mediacommissionreview.org/article-19-19-a-of-the-constitution-of-pakistan/>
- **Defamation Law,**
<https://rsf.org/en/online-defamation-pakistan-now-punishable-five-years-prison>
- **Sentiment Analysis on Imran Khan's tweet,**
https://www.researchgate.net/publication/355071921_Sentiment_Analysis_of_Imran_Khan's_Tweets
- **Sentiment Analysis on Urdu News Tweets using Decision Tree**
[R. Bibi, U. Qamar, M. Ansar, and A. Shaheen, "Sentiment Analysis for Urdu News Tweets Using Decision Tree," 2019 IEEE 17th International Conference on Software Engineering Research, Management and Applications \(SERA\), 2019, pp. 66-70, doi: 10.1109/SERA.2019.8886788.](#)
- **Sentiment Analysis of Pakistani Twitter,**
<https://nayadaur.tv/2020/03/sentiment-analysis-of-pakistani-twitter-dg-ispr-cm-murad-more-popular-than-pm/>



Thank you