ANTI-LGBTQ ANALYSIS ON TWITTER

(1488 words)
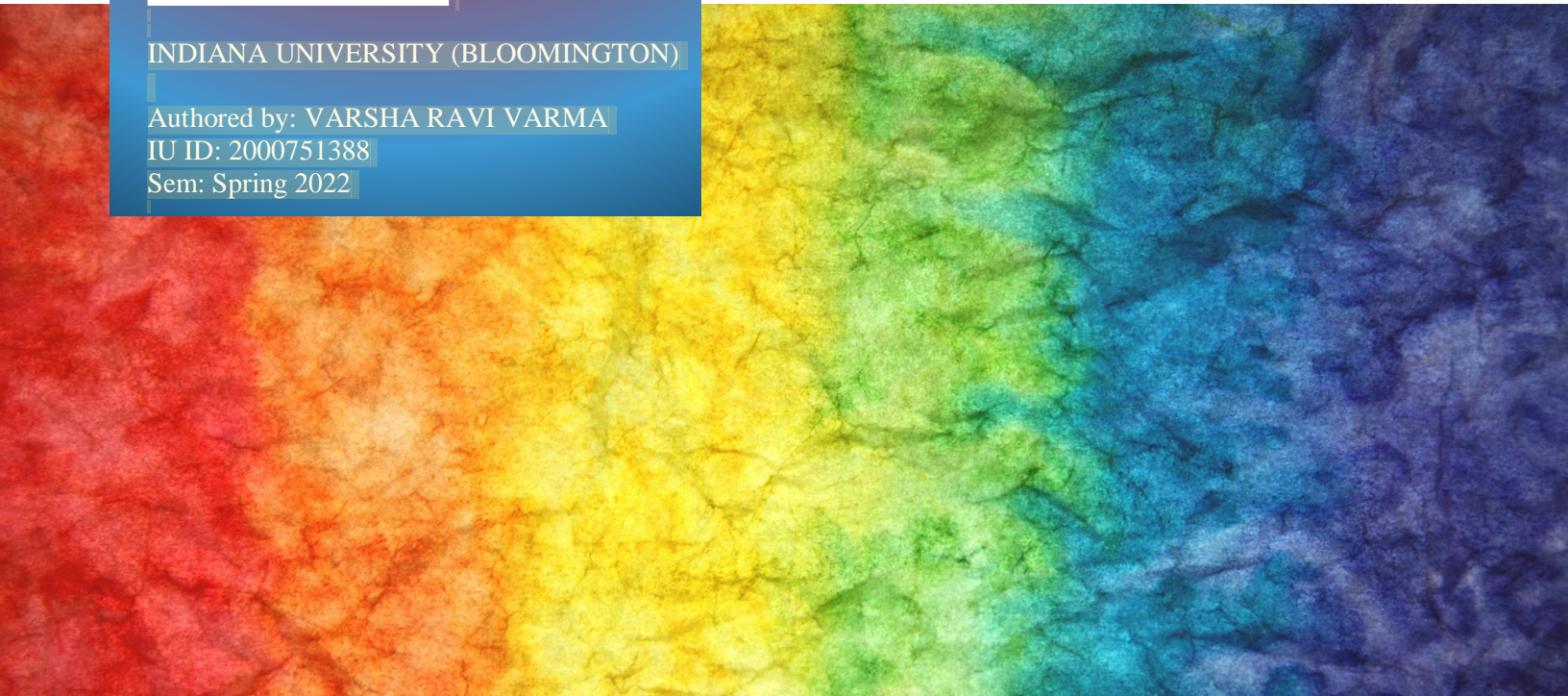
APRIL **31, 2022.**

INDIANA UNIVERSITY (BLOOMINGTON)

Authored by: VARSHA RAVI VARMA
IU ID: 2000751388
Sem: Spring 2022

1. Introduction

> *"Social oppression and discrimination towards the lesbian, gay, bisexual, transgender, and intersex community, popularly Known as LGBTQ community, is a perennial problem in the society. Receiving poor service at public places, such as hotels and restaurants, or getting unfair treatment from the employer is also common. "* [1]

The rapid growth of social media has led to more and more people expressing their opinions online. Anyone can freely express their opinions on social media. Thousands of submissions occur every day on every social media. Opinions can be positive or negative on a topic, with positive sentiments expressing a good opinion, while negative sentiments express a bad opinion. It is safe to say that the Anti-LGBT community attracted a lot of people's interest to be discussed. This is evidenced by the many comments on social media, especially Twitter. The LGBT community has been fighting for equal rights for a very long time and it is also safe to say that the newer generations have been increasingly supportive as time progresses. Given that most people in this generation support the LGBT community, it goes without saying that there are also those who are opposed to it. Homosexual activities and relationships have gained legal sanctity, but the intriguing question is whether this historical verdict will enhance the social acceptance of the LGBT community or still they have miles to go [2] [3].

The question is, what is the percentage of users on Twitter in the present who are anti-LGBTQ? We will use sentiment analysis of Twitter tweets to determine the percentage of anti-LGBTQ twitter users. Based on the tweets on Twitter, sentiment analysis can be carried out. As a result, we are encouraged to utilize Twitter social media as a source of data, which will then be analyzed via sentiment analysis, which is a method of assessing, extracting, and processing textual data automatically to determine the sentiment expressed in an opinion. Hence, this study is addressing the support factor by exploring the perception of social media users regarding the LGBTQ community on the Twitter platform. In short, in this study we are trying to classify our corpus into supporting tweets and opposing tweets. The algorithm used in conducting sentiment analysis in this study is Naïve Bayes and Random Forest.

2. Research question

The research question for this study can be phrased as follows:
Approximately what percentage of current twitter users are non-supporters of the LQBTQ community?

3. Method

3.1. Data

Data source: Twitter [4]

Data: Tweets related to the LGBTQ community

Data timeline: April 2022

"Developers must first register an application to gain access to the APIs of any of the available social network platforms. By default, applications can only access public info on the desired platform. End users of Twitter always receive the most up-to-date info directly from the platform itself" [5]

3.1.1. Training phase data:

To train the classification models to predict anti-LGBTQ tweets, we will use the manually labeled dataset containing around 500 tweets as the training data. Tweepy is used to manually retrieve this dataset of 500 tweet ids and its corresponding text tweets.

As a result, the final training csv file will contain three columns, namely tweet ID, tweet text linked to that id, and the label indicating positivity (1)/negativity (0) (shown in Fig 1).

Fig 1: View of the labeled LGBTQ tweets dataset after the retrieval of texts using the tweet id from the twitter platform used as training dataset.

3.1.2. Analysis phase data:

To analyze and get the results, we collect our own data from twitter using Tweepy again. This dataset also contains approximately 500 unlabeled tweets.

Using Tweepy, the dataset is retrieved with two columns, upon which the trained model analyzes and labels each tweet as either 0 or 1, where 1 indicates that the tweet is positive and 0 indicates negatively opinioned tweet. Based on the outputted dataset, one can calculate the magnitude of anti-LGBTQ tweets.

Fig 2: View of the initially retrieved unlabeled LGBTQ tweets testing dataset form twitter using Tweepy.

3.2. Analysis

With a dataset of 500 tweets as a training set, we train a model to classify tweets as 0 or 1 (where 1 indicates that the tweet is positively opinionated and vice versa) using the evaluate and predict functions. Our model is validated using this dataset and cross validation (n folds). Moreover, we use this trained model to label the testing dataset for analysis. Using this predicted labeled output dataset, we analyze the magnitude of hateful/negative opinions and views being spread on Twitter regarding the LGBTQ community.

As a part of this study, we will use Naive Bayes classifier and Random Forest to train and test our model to analyze and predict tweets. Text classification, for example, can use these two classifiers with discrete features.

3.2.1. Naïve Bayes

Library: https://scikit-learn.org/stable/modules/generated/sklearn.naive_bayes.GaussianNB.html

"In Statistics, naive Bayes classifiers are a family of simple probabilistic classifiers based on applying Bayes' theorem with strong (naïve) independence assumptions between the features. They are among the simplest Bayesian network models, but coupled with kernel density estimation, they can achieve high accuracy levels." – Wikipedia [6]

Bayes theorem is a formula that offers a conditional probability of an event A taking happening given another event B has previously happened. Its mathematical formula is as follows: –

$$P(A|B) = \frac{P(B|A).P(A)}{P(B)}$$

where, A and B are two events

$$P(y|X) = \frac{P(X|y).P(X)}{P(y)}$$

where, X = x1,x2,x3,.. x, y is the class label

The above equation may be extended as follows:

$$P(y|x1, x2, x3..xN) = \frac{P(x1|y).P(x2|y).P(x3|y)...P(xN|y).P(y)}{P(x1).P(x2).P(x3)...P(xN)}$$

3.2.2. Random Forest

Library: https://scikitlearn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html

> "Random forests or random decision forests is an ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time. For classification tasks, the output of the random forest is the class selected by most trees." – Wikipedia [7]
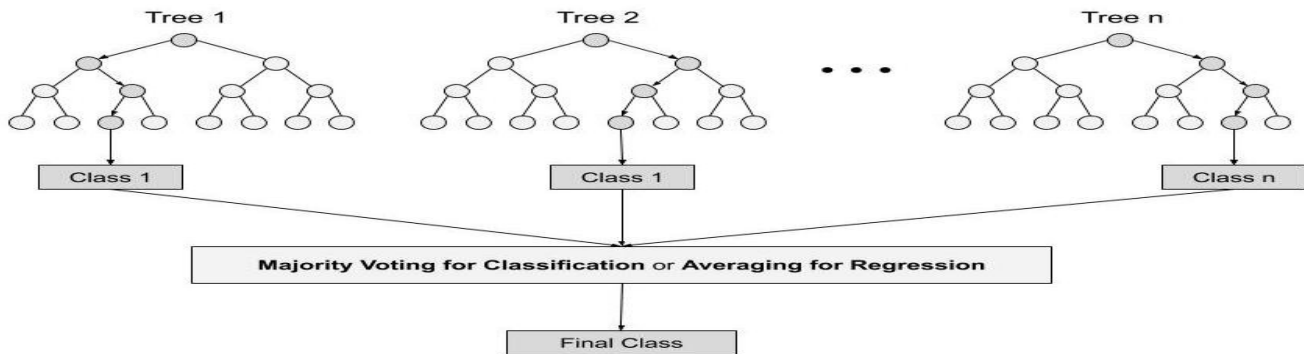
Steps involved in random forest algorithm:

- Step 1: In Random forest n number of random records are taken from the data set having k number of records.
- Step 2: Individual decision trees are constructed for each sample.
- Step 3: Each decision tree will generate an output.
- Step 4: Final output is considered based on Majority Voting or Averaging for Classification and regression respectively.

Sklearn is a simple and efficient tool used for predictive data analysis that is built on NumPy, SciPy and matplotlib. Matplotlib is used to visualize the analyzed data. "**sklearn.naive_bayes.MultinomialNB**" and "**sklearn.ensemble.RandomForestClassifier**" are used to train the model to classify the tweets into the two categories, i.e., positive (1) and negative (0). After training the model and labeling the tweets, matplotlib is used to plot a bar graph that represents the percentage of each type of information (whether positively or negatively opinionated). Note that there will be a few rows with null values due to reasons such as data retrieval failure, etc. and such rows will be removed from the dataset while training to avoid affecting the model accuracy. We use the evaluate and predict functions to train the model using various libraries and pipelines. We retrieve the best fitting model and the best parameters that acquires the best accuracy for that particular model as well.

```
import pandas as pd
import nltk
import numpy as np
from pprint import pprint
from time import time

from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.model_selection import train_test_split
from sklearn.datasets import make_classification
from sklearn.naive_bayes import MultinomialNB
from sklearn.multioutput import MultiOutputClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.metrics import accuracy_score
from sklearn.metrics import f1_score, precision_score, recall_score
from IPython.display import Image
from sklearn.model_selection import KFold

import seaborn as sns
import matplotlib
import matplotlib.pyplot as plt
%matplotlib inline
from nltk.corpus import stopwords
```

Fig 3: Glimpse of the python libraries used for the analysis.

4. Results

According to the analysis conducted, about **12%** of tweets about the LGBTQ community on Twitter are negative. This study clearly illustrates that the acceptance rate for the LGBTQ community has increased significantly with respect to a few years ago. Fig. 4 & Fig. 5 below presents the results of the trained prediction models, such as model accuracy, best parameters, number of valid and pipeline parameters.

Naïve Bayes:

```
Performing grid search...
pipeline: ['vect', 'tfidf', 'clf']
parameters:
{'clf__alpha': (0.001, 0.01, 0.1),
 'tfidf__norm': ('l1', 'l2'),
 'tfidf__use_idf': (True, False),
 'vect__max_df': (0.5, 0.75, 1.0),
 'vect__max_features': (None, 200, 500),
 'vect__ngram_range': ((1, 1), (1, 2))}
Fitting 3 folds for each of 216 candidates, totalling 648 fits
done in 2.485s

Best score: 0.629
Best parameters set:
        clf__alpha: 0.1
        tfidf__norm: 'l1'
        tfidf__use_idf: False
        vect__max_df: 0.5
        vect__max_features: 200
        vect__ngram_range: (1, 2)
(array([0, 1]), array([ 18, 132]))
-----------------------------------------------------------
Micro-average quality numbers
Precision: 0.6000, Recall: 0.6000, F1-measure: 0.6000
Macro-average quality numbers
Precision: 0.5568, Recall: 0.5250, F1-measure: 0.4802
-----------------------------------------------------------
(array([0, 1]), array([ 73, 277]))
[0 1] [ 99 401]
```

Fig 4: Results of the training model showing best parameters, accuracy and other model information for Naïve Bayes model.

Random Forest:

```
Performing grid search...
pipeline: ['vect', 'tfidf', 'clf']
parameters:
{'clf__criterion': ('gini', 'entropy'),
 'clf__max_depth': (5, 10),
 'clf__min_samples_leaf': (3, 10),
 'clf__min_samples_split': (5, 10),
 'clf__n_estimators': (10, 100),
 'tfidf__norm': ('l1', 'l2'),
 'tfidf__use_idf': (True, False),
 'vect__max_df': (0.5, 0.75, 1.0),
 'vect__max_features': (None, 200, 500),
 'vect__ngram_range': ((1, 1), (1, 2))}
Fitting 3 folds for each of 2304 candidates, totalling 6912 fits
done in 86.392s

Best score: 0.611
Best parameters set:
        clf__criterion: 'entropy'
        clf__max_depth: 5
        clf__min_samples_leaf: 3
        clf__min_samples_split: 5
        clf__n_estimators: 10
        tfidf__norm: 'l1'
        tfidf__use_idf: False
        vect__max_df: 0.5
        vect__max_features: 500
        vect__ngram_range: (1, 1)
(array([0, 1]), array([  5, 145]))
-----------------------------------------------------------
Micro-average quality numbers
Precision: 0.6067, Recall: 0.6067, F1-measure: 0.6067
Macro-average quality numbers
Precision: 0.6034, Recall: 0.5139, F1-measure: 0.4206
-----------------------------------------------------------
(array([0, 1]), array([ 24, 326]))
[0 1] [ 99 401]
```

Fig 5: Results of the training model showing best parameters, accuracy and other model information for Random Forest model.

There is no doubt that **Naive Bayes gives a better accuracy** here, and therefore we will use the results of Naïve Bayes for this study. Fig. 6 below represents the best model's results, which shows the percentage of anti-LGBTQ content (0) versus LGBTQ community supportive content. The following are the clear findings of the analysis of anti-LGBTQ tweets:
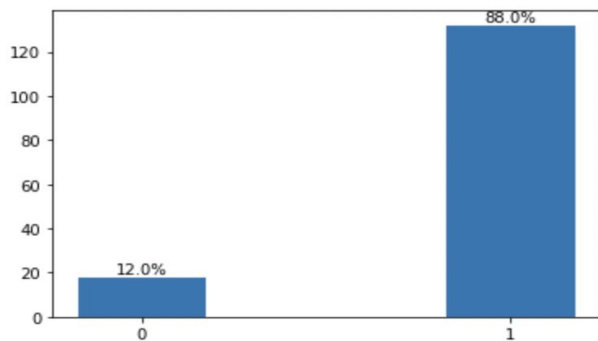
Fig 7: Bar graph showing the percentages of both negative (0) and positive (1) tweets.

Magnitude of anti-LGBTQ tweets on twitter platform: 12%

Magnitude of supportive tweets towards LGBTQ on twitter platform: 88%

5. Conclusions and Limitations

It is possible to detect LGBTQ opinions on social media platforms using machine learning models. According to the most fitting model for this study, Naive Bayes, **12%** of the tweets related to the LGBT community express anti-LGBTQ opinions.

To summarize, the following workflow was used for the analysis:
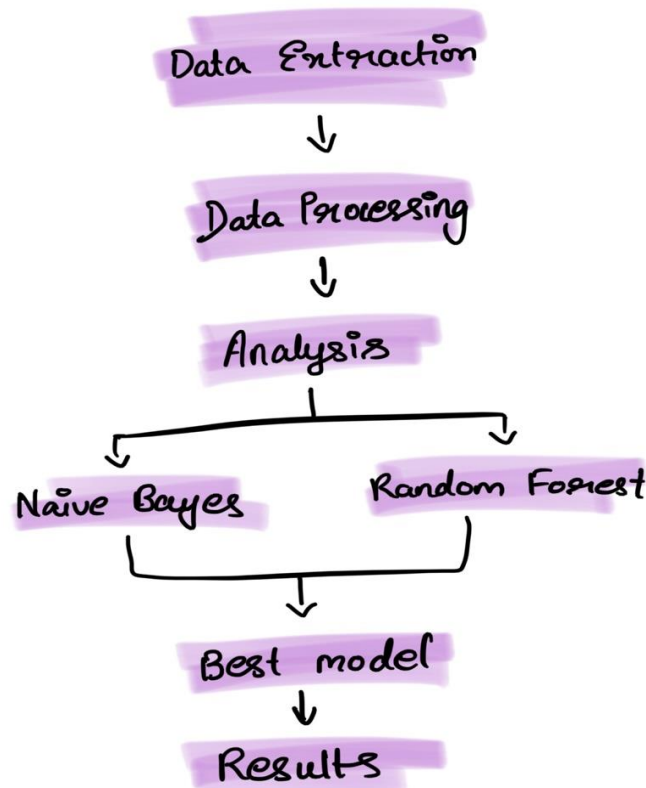
The following limitations apply to this study:

- As the dataset for the study was collected manually, its size is much smaller than that proposed in the study.
- Manually labeling a dataset may lead to opinionated results.
- By using feature engineering and tuning hyperparameters, models can be improved.

It The LGBTQ community has certainly gained support with time. Compared with even a decade ago, the progress for the community in society has been significant. They have been fighting for their rights across the globe for a long time and as the results indicate, their social acceptance rate has never been higher than at present. Throughout the world, harassment, abuse, bullying, hateful behavior, and detest for the community are at an all-time low and that is something that we all should be proud of.

6. References

Cover page image credits:
- https://www.photowall.com/us/lgbt-grungy-heart-wallpaper
- https://unsplash.com/photos/Ur_NzyKfCo4

Introduction:
[1] "C Tweeting in Support of LGBT? A Deep Learning Approach", https://www.sentic.net/tweeting-in-support-of-lgbt.pdf

[2] "Sentiment Analysis of Social Media Twitter with Case of AntiLGBT Campaign in Indonesia using Naïve Bayes, Decision Tree, and Random Forest Algorithm", Veny Amilia Fitri*, Rachmadita Andreswari, Muhammad Azani Hasibuan.

[3] Fahrur Rozi, Imam, Sholeh Hadi Pramono, and Erfan Achmad Dahlan. (2012) "Implementasi Opinion Mining (Analisis Sentimen) untuk Ekstraksi Data Opini Publik pada Perguruan Tinggi [Title in English: The Implementation of Opinion Mining to Extract Public Opinion Data in Higher Education]." Jurnal EECCIS 37.

Data:
[4] Twitter website, https://twitter.com/

[5] "How do I get twitter data set?", https://www.researchgate.net/post/How-do-I-get-twitter-data-set

Analysis:
[6] "Naïve Bayes Classifier", https://en.wikipedia.org/wiki/Naive_Bayes_classifier

[7] "Random Forest", https://en.wikipedia.org/wiki/Random_forest

[8]"Understanding random forest", Analytics Vidhya, https://www.analyticsvidhya.com/blog/2021/06/understanding-random-forest/

[9] Ghiassi, M., and S. Lee. (2018) "A Domain Transferable Lexicon Set for Twitter Sentiment Analysis." *Expert Systems With Applications*. pp. 197-216