Data Stream project

Racist tweets analyzer

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Outline

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Objective of the project

Background

During 2022 FIFA world cup, french football players have been targeted with racist insults. FFF expressed its desire to make a complaint. To do so, one should be able to identify and collect racist tweets so that it can file a complaint.

Objective

Identify racist tweets amid a tweet stream, display trends in real-time and keep a record of suspect users.

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Classification of tweets

General architecture

Logical sequence

In order to identify tweets, we proceed in three successive steps:

- First, we build a classifier with two different data set
- Then, we identify tweets with negative polarity
- Finally, we identify tweets with racist terms

Principles

- Explainable
- Fast
- Adaptive

Classification of tweets

Model used

- Tokenize tweets from a labelled dataset with `cleaner()`
- Convert tokens into features with TfidfVectorizer (statistical approach) to do keywords extraction (big corpus needed)[1]
- Fit the model with them (`LogisticRegression()`) to make predictions:
  - "*[...]this study uses five algorithms: [SVM, k-NNN, LR, NB & RF]. It is revealed from the results that out of the developed models,[...] LR model surpasses the other models in the IMDB dataset with an accuracy of 85.8% using the proposed system.*[2]"

[1] Gupta, Er. Tanya. "KEYWORD EXTRACTION : A REVIEW." (2017).

[2] Sayar Ul Hassan, Jameel Ahamed, Khaleel Ahmad. (2022). Analytics of machine learning-based algorithms for text classification. Sustainable Operations and Computers.

Classification of tweets

Datasets used

Desired features

- Possibility to switch between En & Fr (for further development)
- Cleaned from anything but tweets and label

Data sets

- Pos/Neg tweets: sentiment140[3] (tweets with emoticons)
- Racist/non-racist tweets: MLMA[4] (made with DL)

[3] Go, Alec & Bhayani, Richa & Huang, Lei. (2009). Twitter sentiment classification using distant supervision. Processing. 150.

[4] Multilingual and Multi-Aspect Hate Speech Analysis (Ousidhoum et al., EMNLP-IJCNLP 2019)

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Architecture of the algorithm

Initialize the algorithm

To initialize the algorithm, we do:

- Initialize the application (multi-threading)
- Obtain API keys from `Secret()`
- Initialize the LR model with the init data-set

Multi-threading is done with `multiprocessing` and `App()` :

```
class App():
    def __init__(self, query, topic, lang, nb_tweets):
        # Class constructor
        # @param [...]
        self.secrets = secret.Secret()
        self.ctx = mp.get_context('spawn')
[...]
# Create the application
application = app.App(query, language[:2] + "_" + topic.lower() + "_tweets",...
# Start the application
application.run()
```

Architecture of the algorithm

Multi-threading

application.run() :

```
def run(self):
  try:
    # Start by training the classifier
    racism_hatred = analyser.Racist("./datasets/hatred_init_en.csv")
    racism_racist = analyser.Racist("./datasets/racist_init_en.csv")
    # Get tweets
    process_data_from_tweeter = self.ctx.Process(target=self.tweeter_to_kafka)
    process_data_from_tweeter.start()
    # Racist analysis
    process_analyse_racism = self.ctx.Process(target=self.analyse_racism_tweet,
                                        args=(racism_hatred,racism_racist))
    process_analyse_racism.start()
    # Clouds
    process_clouds = self.ctx.Process(target = self.generate_clouds)
    process_clouds.start()
[...]
```

Architecture of the algorithm

Retrieve tweets

To retrieve tweets, we do:

- Instantiate `Ingestor` class & collect tweets from Twitter API
- With `Ingestor`, send tweets to Kafka through a producer
- Instantiate `Retriever` class & retrieve tweets

Retrieving is done with `Retriever()` :

```python
class Retriever():
    # Class to retrieve tweets from a kafka topic as a dictionary
    def __init__(self, topics):
        # Class constructor
        # @param topics : the topics to retrieve the tweets from
        self.consumer = KafkaConsumer(
            bootstrap_servers=['localhost:9092'],
            auto_offset_reset='earliest',
            value_deserializer=lambda x: loads(x.decode('utf-8')))
        self.topics = topics
        self.consumer.subscribe(self.topics)
```

Architecture of the algorithm

Ingesting tweets continuously

get_data_continuously() :

```
def get_data_continuously(self, query, limit, topic, lang,
                                timeLimit=0, verbose=False):
    # Get the tweets continuously from the twitter API
    # Send them to the kafka topic
    # Make a pause of 10 seconds between each request
    # @params [...]
    is_time_true = True if timeLimit == 0 else False
    true_end_time = datetime.datetime.utcnow() +
                        datetime.timedelta(seconds=timeLimit)
    start_time = datetime.datetime.utcnow() - datetime.timedelta(seconds=40)
    end_time = datetime.datetime.utcnow() - datetime.timedelta(seconds=30)

    while is_time_true or not true_end_time < datetime.datetime.utcnow():
       tweets = self.get_recent_tweets(query, limit, start_time, end_time)
       self.send_to_kafka(tweets, topic, lang, verbose)
       start_time = end_time
       end_time = start_time + datetime.timedelta(seconds=10)
       time.sleep(10)
```

Architecture of the algorithm

Classify & stream tweets

To stream racist tweets, we do:

- Apply the classifier to the tweet that has been "cleaned"
- Select hatred/racist tweets depending on a threshold
- Stream and display tweets, collect users' pseudos

Classifying tweets is done with `tweet_to_racism()` :

```python
def tweet_to_racism(self, tweet):
    # Racist tone analysis of a tweet
    # Returns True if the tweet has a racist tone, and the probability
    cleaner = Cleaner(tweet, self.lang, self.stoplist)
    tweet = cleaner.to_tokens()
    new_features = self.vectorizer.transform([tweet])
    proba = self.model.predict_proba(new_features)[0][1]
    racist = False
    if proba > self.threshold + 0.3 :
        racist = True
    return racist, proba
```

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Outlooks

Difficulties, results and possible outlooks

Difficulties

- Find the good datasets
- Make the algorithm real-time

Results

- Effective algorithm, correct distribution but high FPR
- Real-time display

Outlooks

- Reduce FPR
  - Use a prefilter (`Afinn()`?)
  - Change the vectorizer (`GloveEmbedding`?)
- Use MLMA for homophobic tweets, switch to french...

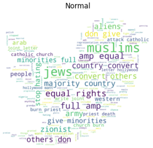
Outlooks

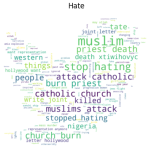
Results : Wordcloud words distribution

- Correct distribution, less obvious in real-time
- trade off between window_size (memory) & distribution

Hatred tweets
gauchiste
mongol
attardé
violence
fait
plus
bien
faire

Racist tweets
renoi
rebeu
mongol
arabe
migrant
gauchiste
attardé





Racist
muslim
jews
fundamentalists
illegal aliens
white
american
people

Outlooks

- Program demonstration
- Questions answers