

# Social Big Data Mining Framework for extremist content detection in Social Networks

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**Abstract**— Social networks provide the platform for flows of ideas and affordable and global online communications. Many people use social networks to communicate and express their opinions in supporting or opposing different causes, with most of this user-generated content being textual information. As there are a lot of raw data of people posting real time messages about their opinions on a variety of topics in daily life, it is a worthwhile research endeavor to collect and analyze these data, which may be useful for government to make informed decisions or to monitor public opinion. Data available in social media is obviously only one type of information that can be of interest when trying to detect a possible terrorist or radical group, there are several cases for example in which the social media has been used by radical thinkers to act as influencers and encourage fanatics with the same radical views to take violent action. Therefore, in this paper, we propose a framework for opinion mining and extremist content detection in on line social media data. Social media data targeted in this work to analyze, is the public text post on Facebook, the most popular social networking site. With this framework, machines can learn how to automatically extract the set of messages from Facebook public pages, using API graph calls, filter out non-opinion messages, determine their sentiment regarding the issue of interest directions (i.e. positive, negative) and detect violent or extremist content. The purpose of this model is to build a Big Data application that gets stream of public data from Facebook social network, which can help law enforcement and cybercrime analysts with analyzing and monitoring social media, in the search of digital trace of violence or radicalism, that can be exploited in further digital forensic investigation.

**Keywords**— Social Networks, Opinion Mining, Big Data

## I. INTRODUCTION :

### A. Social Networks:

Social media have gained popularity in general public due to their ease of use. With millions of messages appearing daily, Social media, applications or that allow users to interact online, has risen in prominence in recent years. Sites that are widely accessed range from those whereby users can post comments in near-real time to social networking services. An advantage of social media analysis is that data is made publicly available as the actors participate with this environment in complete view of active and passive users. This is in contrast to user interaction through other digital communications media, such as email or Internet and telephony, where analysts must adhere to relevant laws to protect the privacy of the users.

Social media has become such a popular medium for expressing our opinions that it can actually be used as a live focus group, from which invaluable insights can be drawn even the most radical ones. Whether we're talking about political elections, religions, or the winner of a reality show,

social media can play a vital role in determining public opinion. It's a platform where people are sharing their views in real time, giving organizations and intelligence invaluable vision into public opinion. As social media continues to play an important role in our everyday lives, its use as a way of understanding and reacting to public sentiment should not be underestimated.

### B. Facebook:

Facebook is the world's most popular social networking site, launched in February 2004, operated and privately owned by Facebook Incorporation [1]. Its goal is to give people the power to share, and make the world more open and connected [2]. Facebook users may create a personal private or public profile, add other users as friends, and exchange messages (including automatic notifications when updating their profile information). Additionally, users may share their photos, videos, status, news stories, notes, and allow their friends to comment on them. Furthermore, users may join groups, or create fans pages for a workplace, a school, or even a brand or organize event. However, it is obvious that this platform may also provide incentives for extremist user to carry out various illegal activities.

The Facebook Graph API is an application programming interface that allows application developers to access data from a user's Facebook account. In addition to accessing data, the API can also be used to automate the posting of data to a user's account. The API is based on a Representational State Transfer (REST) web service design [14]. The REST design architecture is independent of any specific networking technology, the REST web service allows a developer to read and write information from a service provider using standard HTTP methods such as GET POST, UPDATE.

### C. Big Data Analytics :

Big Data Analytics is a technology-enabled strategy for gaining richer, deeper, and more accurate insights in unstructured user generated data. The three main characteristics of Big Data that define the major issues IT needs to address are volumes, variety and velocity.

- **Volume** :90% of the world's data was generated in the last few years, the massive scale and growth of unstructured data OutSpace traditional storage and analytical solutions.
- **Variety** :Big Data is collected from new sources that haven't been mined of insight in the past. Traditional data management processes can't cope with the variable nature of Big Data, which comes in heterogenic formats as different as e-mail, social media post, videos, images, blogs as well as access journals and Web search histories.

- **Velocity** :Data is generated in real time with demands for information to be served up as needed.

By processing a steady stream of real-time data ,government and law enforcement can make time-sensitive decisions faster than ever before, monitor crisis and emerging trends, course-correct rapidly and jump on opportunities.

Big data analytics allow to data analyst and digital forensic investigator to examine large amounts of social media-generated data to uncover hidden patterns, correlations, text mining, sentiment and sentiment analysis and other insights. With today's technology, it's possible to detect if some individual is planning to commit an act of violence based on analysis of the content of his Facebook public post.

#### D. Hadoop/HBase:

Hadoop is an open source tool from the Apache Software Foundation. It provides an efficient framework for parallel computing on multiple nodes of clusters. The entire Apache Hadoop "platform" is now commonly considered to consist of the Hadoop kernel, MapReduce and Hadoop Distributed File System (HDFS), as well as a number of connected projects including Apache Hive, Apache HBase, and others. Hadoop works in master – slave mode. There is a master node and there are n numbers of slave nodes .Master manages, maintains and monitors the slaves while slaves are the actual worker nodes. Master just saves the metadata (data about data) while slaves are the nodes which store the data. Data is stored distributed in the cluster. The client connects with master node to perform any task.

HBase is an open source; non-relational, distributed database modelled written in Java. It is developed as part of Apache Software Foundation's Apache Hadoop project and runs on top of HDFS (Hadoop Distributed File system), providing Bigtable-like capabilities and fault- tolerant way of storing large quantities of sparse data.

## II. SOCIAL WEB MINING :

In order to build systems that can help analysts with analysing and monitoring social media, there are various Natural Language Processing (NLP) techniques for content analysis. Here we propose an overview of several text analysis methods:

#### A. Translation Services

Most people will have noticed the progress that has been made in the area of machine translation, with free services such as Google. A factor that strongly contributes to these developments is the combining traditional linguistic-based methods with methods based on statistics. This type of machine translation can be very useful for translating texts from extremist websites, and gives an analyst the opportunity to process text written in nearly any language.

The results obtained from this kind of automatic translation service are rarely as good as if a human expert had translated the content of a website, but the great advantage with automatic translation is obviously the speed, making it possible to analyse many more websites than if the process had been done fully manually.

The cyber intelligence analysts are daily using this services for the analysis of extremist content in social media or in jihadist websites for example.

#### B. Websites Mapping:

Text mining can also be used for automatic discovery of potentially suspicious websites (e.g., violent ,extremist), and for creating networks of such websites. Computer algorithms can be used to identify radical content, in order to identify users (web aliases) that express themselves in such a way that human analysts may want to do detailed investigations.

#### C. Authorship attribution:

In this research area, the algorithms used extract lexical features, word classes and syntactic features, and use them to identify the author of the text. The idea is that the writing style of each individual is unique. The techniques are today not good enough to be used for determining who out of a large number of potential authors has written a piece of text. The discovery of someone who expresses violent radical behaviour does not necessarily mean that the police can identify whom to investigate further. There are good opportunities for users to create web aliases without any traceable connection to themselves. Even when the users identities is verified with a valid email address, nothing prevents users from creating an email address only for this objective. Even though the actual IP address used for the creation of the email account may be stored, the individual can make use of various types of anonymous surfing services.

Author recognition or author identification may become relevant in the future for connecting an alias to a physical person. Nevertheless, the research is progressing quickly in this area, and we think that these methods will become much more useful in the next few years. The recent paper by Narayanan et al [16], show promising results for Internet-scale author identification.

#### D. Sentiment Analysis:

Sentiment analysis or opinion mining have become a popular way for organizations to determine what opinions regarding themes have been expressed in social media. An important part of sentiment analysis is to detect relevant posts and make a classification of whether it contains positive, negative, or neutral opinions regarding the topic of interest. This Natural Language Processing research field is discussed in next section.

#### E. Linguistics identifiers:

Certain extremist mindsets or attitudes, might be detectable in the way the subject expresses him or herself on social web. These expressions of attitude or mindset are referred as linguistic identifiers. Such identifiers can be used as input to computer algorithms so that they may be able to recognize signs of radical violence. A basic approach in which the Facebook posts are extracted and after returning the word's common base form ,are matched against a word list of violent actions. For this propose we can use a well-known representative lexical database, in which semantic relations between synonym sets are clearly expressed.

### III. SENTIMENT ANALYSIS OF SOCIAL MEDIA DATA:

Sentiment analysis, which is also called opinion mining, involves in building a system to collect and examine opinions about a specific subject in Facebook posts, comments, reviews or tweets for examples. The effects for creation of opinion mining and sentiment analysis have gained popularity within last three decades. Opinion mining in text analysis can be done by different ways by machine learning as supervised and unsupervised learning. On the other hand, polarity, degree of polarity, features [3], subjectivity [4], relationships identification [5], affect types [6], mood classification [7] and ordinal scales like giving ratings reviews and products are used in some other. In a similar way, one can make use of machine learning to “teach” computer algorithms to identify radical texts. This technique has, for example, been used in comparing the levels of violence, anger, hate, and racism expressed in various web forums[8].

There are several challenges in opinion mining. The first is an opinion word that is considered to be negative in one situation may be considered positive in another situation. A second challenge is that people don't always express opinions in the same manner. Most traditional text processing relies on the fact that small differences between two pieces of text don't change the meaning. However, in the more informal medium like Facebook or blogs, people are willing to combine different opinions in the same sentence which is difficult for a computer to parse. Sometimes even users have difficulty understanding what someone thought based on a short piece of text. In light of these characteristics, the use of traditional methods of sentiments analysis will yield poor results. A number of recent approaches on sentiment analysis take this into account, such as sentiment classification that classifies opinion texts or sentences as positive, negative or neutral [9-10].

Texts in online social networks have their specificity [14]. It is common in these sites for users to use less structured language to communicate with their friends.[15] present some features of this “social language”. In the microblogging literature two classification have attained significant attention: subjectivity and sentiment polarity. Subjectivity classification is useful for discovery of sarcasm in text [11], or for assessing the amount of opinion content a user expresses in comment. Much research has concerned the discovery of sentiment polarity in text [12], with some recent research correlating sentiment classification with real-world[13]behaviour. For efficient recognition of extremism and radicalism in text, sentiment analysis algorithm must be combined with other algorithms that specifically treat violent behaviours detection problematic.

Since extremist lone wolves are acting on their own, information about them cannot be collected using traditional law enforcement methods. One way to attempt to discover them is to search for various “sentiment extremism signs” in online foot print, such as digital traces left in social networks platforms. With the right tools and techniques, such traces can be collected ,analysed and used as digital evidences.

### IV. SOCIAL BIG DATA MINING FRAMEWORK:

Our proposed framework ,graphically presented in “Fig. 1”, comprises of following four main phases:

#### A. Extraction of online social media data :

Gathering of streaming social media data from representative sample of Facebook public pages, through the creation of a Facebook API application, that navigate the Social Graph, query text post object from the target node, and parse the data for processing.

Three Facebook page’s category are the most relevant for the radical and violent content detection: Cause and Community category, Artist or Public Figure category, and Entertainment .

The current process involve the following four phases :

1) *Registration of the Facebook application* with the Facebook development for getting the Access Tokens and other credentials for the authentication.

2) *Authentication of the application* : The application need to be authenticated to getting access to the Facebook Social Graph, which is done by using OAuth (OAuth is an open standard for authorization).

3) *Sending the streaming requests to the Facebook API graph* for interacting with the Social Graph nodes and getting the JSON format public page data.

4) *Parsing the result* : The JSON format obtained result, need to be parsed for the filtering and the extraction of raw text data from the crawled data.

#### B. Sentiment analysis and extremist content detection:

1) *Sentiment Analysis*: Sentiment analysis or opinion mining consists of the following main six tasks[15]:

- Entity extraction and classification: Extract and categorize all entity expressions in the text data, into entity Classes.
- Aspect extraction and categorization: Extract and classify all aspect expressions of the entities into clusters.
- Opinion holder extraction and categorization: Extract opinion holders from text and categorize them.
- Time extraction and standardization: Extract the times of the opinions in a standard time format.
- Aspect sentiment classification: Determine whether an opinion is positive, negative or neutral, on a specific targeted aspect, or attribute, a numeric sentiment rating to the aspect of interest.
- Opinion quintuple generation : Produce all opinion attributes expressed in the text data based on the results of the above tasks.

These tasks is seemingly very simple but it is in fact very difficult in many cases and involve a combined use of statistical Natural Language Processing algorithms and a well-conceived representative training set to have meaningful results .Sentiment analysis involve many other Natural Language Processing issues, including word sense disambiguation, sarcasm detection, metaphor interpretation, and aspect extraction.

2) *Extremist content detection*: For the extremist content detection purpose,we suggest a second layer of processing ,that involve the implementation of three behavioral linguistic identifiers :

a) *Leakage* : The leakage is the communication of an intent to harm a target person or organization, can indicate an interest with the target and may alert on the research, planning, and ,or execution of a violent act.

b) *Fixation* : The fixated person expresses deep interest on the group or person considered responsible for the subject's grievance by spending a large amounts of time studying the believed enemy.

c) *Identification* : Identification is an alarming behavior characteristic nearly associate with weapons .The subject identify himself with previous famous attackers or assassins, or as a fanatic and a defender of a cause. Narcissism and fantasies are also a characteristic of this group of dangerous behaviors.

### C. Building the Hbase:

Storing the analytic data in the HBase after processing sentiment analysis and extremist linguistic marker detection algorithms on the Facebook streaming text data. All communications with the row database are done through Representational State Transfer (REST) calls.

### D. Building of a monitoring interface for the law enforcement analyst:

Building a monitoring law enforcement interface that query the HBase through Java framework for detecting the suspicious content, and conduct further digital forensic investigation if needed.

1) *Building a front end on java script which is connected to the Java framework which in turn connected to HBase for fetching and analyzing the analytic data.*

2) *Graphical representation for the law enforcement forensic data analyst:*The analytic data is presented graphically to the intelligence analyst who can conduct further cyberinvestigation to estimate the risk level of the information. If the cyber investigation reveal a high predefined risk level than the digital data are sent to the law enforcement digital forensic team to open an investigation case,otherwise the data is saved in a context awareness database that can be used to process behavioral analysis and detect and trace warning behaviors, wich can be studied and categorized regarding there degree of influence (likes,comments...).

### V. CONCLUSION:

This paper propose a semi-automated big data based framework that can be used to detect a lone wolf terrorist before an attack occur, and prevent innocent people from being harmed. Implementation of such framework can lead to build a big data application for extremist and violent content detection, which can help for the effort of government agencies to protect their citizens. Big data technologies represent a real chance for Natural Language Processing researches, for the implementation and testing of the NLP algorithms, thanks to the flexibility and efficiency of the database and the distributed processing techniques that improve considerably the performance of the implemented systems. We predict that this technology will be widely used at the next generations of internet surveillance and monitoring tools.

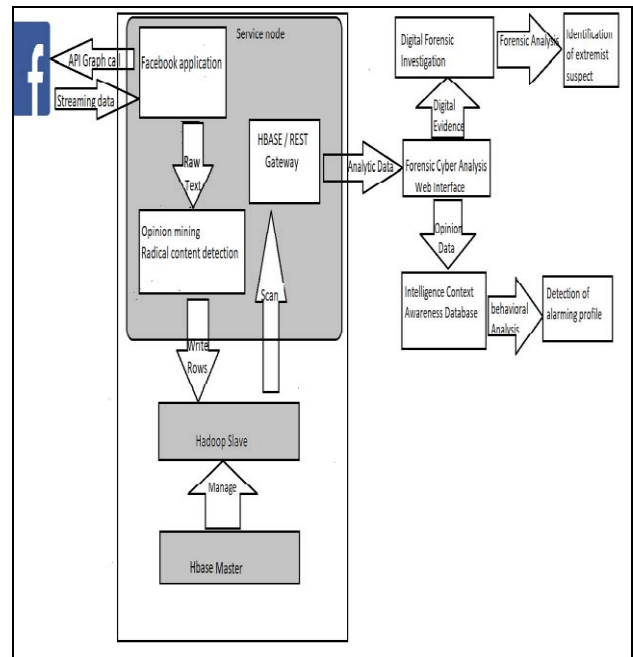


Fig. 1. Social Big Data Mining Framework for extremist content detection

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