Emotwitter – A Tool for Emotional Analysis of Twitter Stream

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Abstract

Social media is rapidly developing now, and its influence is significant for many people. It is used for many purposes, such as communicating with friends and strangers, obtaining information and news, advertising new products and so on. In the University of Aizu we developed a tool called Emotwitter, which can analyze user tweets.

Emotwitter can download tweets of particular users, analyze word frequency, build tweet word cloud and identify emotions contained in tweets. Since the system still needs improvements, this study is dedicated to resolving existing problems and to adding new functions. Improvements include the support of the latest Twitter API 1.1 and OAuth authentication using access token of user account. New functionality includes a keyword-based tweet search function. These improvements enable Emotwitter to provide better analysis options than before.

1 Introduction

On the Internet, different forms of communication are developing. We use various Internet communication tools to get into contact with people. Among them, social media has a significant place. Social media is a scalable media that provides usergenerated contents and helps user to connect with each other.

Twitter is one of the most famous micro blogs in the world. According to official Twitter, Inc. information, it has more than 30 million active users per month all over the world. The number of users who visit a website through a link posted on a tweet is more than billion per month [1]. Twitter is also becoming an important tool for marketing, and especially popular among young people. This trend is expected to continue in the future, so we need tools to analyze tweets. Information volume of Twitter is huge, and its content is diverse: individual emotional messages, news, advertisements of new products and so on. Therefore, there is a demand for software instruments that are able to categorize and analyze tweets, helping to use Twitter resources more effectively. Emotwitter is a tool for emotional analysis of Twitter messages, created at the University of Aizu [2]. It supports several types of text analysis, but in its recent version also suffered from a number of problems. First, it did not support the latest Twitter API 1.1. It caused occasional faults when retrieving user tweets. Next, Emotwitter did not use OAuth authentication with access token of user account. Without OAuth support it is impossible to redistribute the software to an unspecified group of users (because they will use the same limited access token). So I mainly improved these points in my work.

2 Emotwitter in Detail

Emotwitter is a tool written in C \sharp with the support of several third-party libraries to analyze user emotions. The Fig.1 shows the control panel of Emotwitter. When a user inputs a Twitter account name into the text box "Username" and clicks the "Twitter" button, the system displays the retrieved tweets of the given user. In the example it is visualizing the tweet stream of @darthvader¹. Emotwitter can get no more than 3200 tweets using Twitter API (it is a limitation of Twitter API). If a user inputs certain keywords into the text box "Filter by keyword", the system will extract tweets from the list of downloaded tweets that contain the given keyword. Emotwitter can also build the following types of visualization:

- Emotional distribution by calculating emotional score using word-emotion association lexicon.
- Rader chart of emotional score (see the Fig.2).
- Word cloud of frequent words in tweets (see the Fig.2).

¹Darth Vader is a fictional character in Star Wars.

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🖳 Control Panel(user search)				
User name darthvader 200 tweet(s) from 'darthvader' from	7 Twitter Disk Spikes Reinput PIN Code 2012/01/07 to 2016/01/08	Select All	ord 🛛	
(2015/05/05) Arrived too late to wit (2015/05/05) @ESPNAssignDesk A (2015/05/05) @ESPNAssignDesk A (2015/05/09) Palpatine / Vader 201 (2015/06/20) With a special appear. (2015/06/27) RT @cr.wookie: RT @c (2015/06/27) RT @cr.wookie: RT @c (2015/06/27) RT @cr.wookie: RT @c (2015/10/20) RT @DrewLewis: My g (2015/10/20) RT @DrewLewis: My g (2015/10/20) RT @DrewLewis: My g (2015/11/20) @SteveStreza &Itpeer (2015/11/20) @SteveStreza &Itpeer (2015/12/11) Soon. #TheForceAwak (2015/12/17) @mikebush @TechJou (2015/12/17) @mikebush @TechJou (2015/12/17) Couldn't find any reb (2015/12/17) Couldn't find any reb (2015/12/23) @extor your feelings. (2015/12/23) @extor your feelings. (2015/12/23) @extor whost* in (2015/12/28) © amillegrace *pee (2015/12/28) @eamillegrace *pee (2015/12/31) @extor Aldred Impres (2015/12/31) @extor Aldred Aray (2015/12/31) @CApZA I'm the Dark (2015/12/31) @CApZA I'm the Dark	thess my evil Empire trounce #RedSc s you wish, yes. Mayo w/ the 501st today by blowing u 16 ance by your favorite Sith Lord - http preme Court just altered the deal, pra darthwader Rh rhr raauuh: The Supren ressive, MOST impressive. start, #TheForceAwakens #StartWars god reverse hyperspace blows my mir on both counts. 's at you while slowly breathing from cens 's at you while slowly breathing from thow good can a movie really be wit urnalist &ItStares at you ominously fr rels to destroy today. Spoiled #TheFor pressive. #TheForceAwakens you *know* it to be true. https://too we been to paradise, but you've new- tieve I'm saying this but don't let th /loR&n https://t.co/tR&hBMcn ars back at you in silence* ssive, most impressive. Ping @DeathS after me instead of his grandmother. I clord of the Sith. Do you think I care I don't alter it any further. https://t. opark Side develops a 'Force Craniu e preaching to the dark, foreboding ch il #kyloren explores the forests of sta	xx, but enjoyed my @NESN inte up a small rebel enclave. I love os://tco/ro9bq90rf5 ay they don't alter it further. #L he Court rrhn aauurhh rhr nuuh, https://tco/m7LZGsTuDp nd. It's incredible. https://tco/E across the room&et wunderkind. Brought to justice. hout your favorite Sith Lord in om across the room, slowly bre rceAwakens for a bunch of nen i/Fdk9alYTyC er been to me. ose pierogi go over to the dark ittps://tco/6kjGQcMwjg about spoiling your movie-goi co/Tm9a6SYhPT m Enlargement' ability, I'll be oir. Try putting a period at the rkiller base with his imaginary	view none-the-less http://t.co/LCuil a good party. #RevengeOfTheFifth oveWins rrhn wahr raa'r aahrn ur raaugrr. #Lov 3dtlotk 4OR #starwars #ExplainAFilmPlotBadly https://t.co/ it? #TheForceAwakens sathing> ds instead. Evil itch scratched. side, golden brown is best. IPD - Imperial Propaganda Departmen ng experience? #Answercarefully sure to let you know. start of that tweet next time. friend. #calvinandhobbes #starwars #)FX2EJ eWins yWSOqNO8Dz t t

Figure 1: Control panel of Emotwitter. It visualizes tweets from "darthvader"



Figure 2:Rader chart and word cloud of "darthvader"

3 Emotwitter Improvements

3.1 Correspond Twitter API 1.1

Emotwitter used Tweetsharp — one of C \sharp libraries that support communication with Twitter. However, Tweetsharp support was finished in 2014, and its final version is not compatible with the latest twitter API 1.1. As a result, Emotwitter operations often failed with no clear reasons.

So I decided to substitute it with the modern Twitter library Tweetinvi [3]. Tweetinvi is a C \sharp library designed to simplify the development of applications for Twitter in C \sharp . When we migrated to this new Twitter library, Emotwitter started working normally. The Fig.3 is a part of the source code used to download tweets. Migration to Tweetinvi also required numerous modifications in this module. Normally, "user timeline" API can download only max 200 tweets per call, so it is necessary to perform numerous requests. Emotwitter implements using "Max_id" and repeats Fig.3 instruction.

3.2 OAuth Authentication

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OAuth is an open protocol that provides algorithms for secure authorization. So it leads saving user password and it can say secure authentication. [4]

OAuth authentication does not use user password, instead it relies on the access token sent by the application. So it leads saving user password and it can say secure authentication.

Each Twitter API-enabled application needs a Twitter account to rely on consumer key, consumer secret sequence, access token and access token secret sequence of a Twitter account. Consumer key and consumer secret sequence must belong to the developer, but the access token and the access token secret sequence should belong to the application user (since Twitter limits the number of requests per user).

```
var oldestTweet = tweets.Min(x => x.Id) - 1;
var userTimelineParameter = new UserTimelineParameters();
userTimelineParameter.MaxId = oldestTweet;
userTimelineParameter.MaximumNumberOfTweetsToRetrieve = 200;
receivedTweets = Timeline.GetUserTimeline(userName, userTimelineParameter).ToArray();
tweets.AddRange(receivedTweets);
```

Figure 3: Retrieving tweets

🖳 pin 📃 💻 💻	EmotionalTwitにアカウントの利用を 許可しますか?
Get Access Token	達捞アプリを問題 キャンセル No-websile.yet No description yet
Input PIN Code	 タイムラインのツイートを見る。 フォローしている人を見る
	EmotionaITwitにアカウントへのアクセスを許可しました。
	次に、EmotionalTwitに戻ってこのPINコードを入力し、認証を完了してください。
ОК	6216593

Figure 4: When user starts Emotwitter, first this window opens

Figure 5: The upper part is the authentication page. The lower part is a PIN code.



Figure 6: OAuth Authentication

So I made Emotwitter rely on OAuth authentication with user access token and access token secret sequence. The Fig.4 shows a screen used to authenticate with OAuth. The application contains hardcoded consumer key and consumer secret sequence, and when the user starts the application, it sends them to the Twitter server.

Next, Twitter publishes the request token and request secret sequence needed for the subsequent operations. The application redirects the user to the Twitter server and opens the Twitter authentication webpage. (see the Fig.5 upper) There are several types of OAuth authentication available. Emotwitter relies on the pinbased authorization suitable for desktop applications. It uses a 7 digits pin code number to authenticate. When the user clicks "Authorize app", a pin code is displayed. (see the Fig.5) Then the user inputs this number into the text box (Fig.4, "Input PIN code"), and obtains an access token and access token secret sequence. This way, OAuth authentication completes, and Emotwitter main module starts.

The Fig.6 is a part of the source code to authenticate OAuth. Button2 Click() is a function that opens the authentication page on the Internet using consumer key and consumer secret sequence. Button1 Click() is a function that accepts an input pin code and authenticates with OAuth.

3.3 Keyword-based tweet search function

Emotwitter can analyze individual user's emotion by collecting his or her tweets. But it could not analyze the impact of a certain keyword in the whole Twittersphere. For example, Emotwitter can analyze whether a specific user likes Star Wars. But it could not analyze the general impact of Star Wars on Twitter users.

So I made a module can search and display all the tweets of Twitter that include the keywords typed in the text box. Next, it performs their emotional analysis, calculates polarity (whether they are positive or negative) and builds a word cloud. (see the Fig.8)

The Fig.7 visualizes tweets including "darthvader". The tweet date and user name are displayed at the left side of the window, and the user tweet is displayed after the user name. This module utilizes Twitter search API.

The Fig.9 is a part of the source code used to process keywords. The "SearchParameter" used to set "Keyword search" options. The parameter of "SearchType" sets the preferred types of retrieved tweets: popular, recent and mixed (mix popular and recent).

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🖳 Control Panel(word search) Search Word Filter by keyword ∇ ″darthvader″ -RT 🗁 Twitter 🗁 Disk Spikes Select All 862 tweet(s) from "darthvader" -RT from 2016/02/05 to 2016/02/09 (2016/02/05) pmc_youtuber (2016/02/05) Jimmie_Ramseyer (2016/02/05) star_wars_toy (2016/02/05) star_wars_toy (2016/02/05) pabloxamatattoo (2016/02/05) Dynomutttcoles (2016/02/05) _yohh_8 (2016/02/05) gotechtown We loved this @ www.commercials where is de mini #paintyable indire volverage include both an indirect and interview commercial of the store and interview indirection in a store and a store and interview indirection in a store and a store and interview indirection in a store and a store and interview indirection in a store and a store (2016/02/05) Cerecessins (2016/02/05) ConChrisoulis (2016/02/05) TravelAwan (2016/02/05) ConChrisoulis (2016/02/05) TravelAwan (2016/02/05) star_wars_toy (2016/02/05) allpaq (2016/02/05) MMonicaNovo (2016/02/05) StarWarsPolling (2016/02/05) teewarehouse2 (2016/02/05) teewarehouse2 (2016/02/05) CoolStuff2Get (2016/02/05) taboMenares (2016/02/05) star_wars_toy (2016/02/05) star_warsneeds (2016/02/05) WIREDGIJOE (2016/02/05) nicholashartan2 Star Wars #war #StarWars #Rebels #Batman #DarthVader #awesome #lightsaber https://t.co/YxdeoBy50N

Figure 7: Control panel "Keyword search" of Emotwitter. It displays tweets including "darthvader".



Figure 8: Radar chart and word cloud of tweets including "darthvader" except retweets.

4 **Result and Discussion**

Emotwitter now supports Twitter API 1.1, and thus works stable and reliably with Twitter services. Thanks to OAuth authentication with using user access token we can freely redistribute Emotwitter as open source and let anyone use the software. We are planning to develop Emotwitter further into a complete system available online. "Keyword-based search" function enables the users to analyze emotions on tweets, retrieved by a keyword search.

5 Acknowledgement

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Reference

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```
var searchParameter = new TweetSearchParameters(userName)
{
    Lang = Language.English,
    SearchType = SearchResultType.Mixed,
    MaximumNumberOfResults = 100,
};
var tweets2 = Search.SearchTweets(searchParameter).ToArray();
var user = User.GetUserFromScreenName(userName);
tweets.AddRange(tweets2);
int requestNum = 10;
for (int y = 0; y <= requestNum; y++)</pre>
{
    var oldestTweet = tweets.Min(x => x.Id) - 1;
    searchParameter.MaxId = oldestTweet;
    tweets2 = Search.SearchTweets(searchParameter).ToArray();
    user = User.GetUserFromScreenName(userName);
    tweets.AddRange(tweets2);
```

Figure 9: Keyword-based tweet search.