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Collecting Data of SNS User Behavior to Detect Symptoms of Excessive Usage: Technique for Retrieving SNS Data

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***Abstract*—Social networking sites (SNSs) have become widely used and their usage continues to increase. People use SNSs to connect with friends and family. Many businesses also use them as a marketing tool. Nevertheless, many studies have warned about the negative consequences of excessive SNS usage, including the potential of addictive behavior. Therefore, detecting the symptoms of excessive SNS usage is necessary. Data collection is an important first step for analyzing the SNS usage behavior. We designed a data collection application by employing questionnaire to gather user experiences and APIs to retrieve SNS data. We also designed questionnaire and experimentally evaluated it. The results showed that they have an appropriate usability as an instrument for gathering data. In this article, we introduce the techniques for obtaining data from SNSs. Each SNS provides different API for extracting data from their sites. At the beginning, we focus on Twitter and Facebook. These data collection techniques will be utilized in implementing the application. Unfortunately, these methods are limited. Thus, we will collect more data from Internet service providers (ISPs). The obtained data from our application will be applied to detect symptoms of excessive use of SNSs and develop prevention strategies.**

***Keywords*— Social Networking Sites, SNS, User Behavior, Social Network Addiction**

I. INTRODUCTION

Digital technology plays an important role in daily life. Mobile and Social Networking Sites (SNSs) are the next wave of the digital revolution. SNSs have become a popular type of communication where groups of people virtually meet and interact with others with similar interests.

In 2015, the use of SNSs dramatically rose 12% from 1.9 billion to 2.1 billion active users, an astonishing total that equals almost 30% of the world's population [1]. People use SNSs for many activities and purposes, including checking messages and comments and playing games. Many businesses also use them as tools to enhance a better relational experience with their employees and customers [2]. However, some people spend too much time on SNSs and use them in ways that are becoming excessive and/or addictive.

The excessive use of SNSs can cause emotional, relational, health-related, and performance problems, especially the risk of addiction. Similarly, there are the effects of SNSs on workspace productivity. For these reasons, we should understand how people interact with them. Collecting data is an important first step for analyzing the individual usage behaviors of SNSs.

In previous study, we designed a data collection application by employing self-report questionnaire to gather user experiences of SNSs and APIs to retrieve SNS data. We also designed questionnaire and experimentally evaluated it [3]. In this article, we introduce the techniques for retrieving data from SNSs by focusing on Twitter and Facebook. Unfortunately, retrieving SNS data using APIs has some limitations. Thus, alternative methods: for example, tracing network traffic or deploying a monitoring application might be employed in future research to get all of the aspects of SNS usage behavior.

We will analyze the obtained data from the application to clarify the relationships and characteristics of SNS usage. We will also use our analysis results for detecting the symptoms of excessive SNS use and developing strategies for preventing it in the next step of this research.

II. LITERATURE REVIEW

A. Social Networking Sites

Social networking sites are virtual communities where groups of people with similar interests can create individual public profiles and interact with others [4]. However, researchers define and describe them in different ways. Ellison [5] argued that "Terminology varied widely with the interchangeable use of 'social networking sites', 'online social networks' or even simply, 'social network' to refer to a diffuse – and sometimes improbable – range of sites and services." Ellison [6] defined social network

sites as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system." According to Burke [7], "social networking is all about engagement – creating relationships, communicating with your readers, building your following and connecting with your online audience." Wikipedia [8] defines social networking services or sites as platforms that allow people with common interests, activities, backgrounds, or real-life connections to create social relations. However, researchers may use the different words that refer to SNSs. Ellison and Boyd [5] suggested that "Terminology varied widely with the interchangeable use of 'social networking sites', 'online social networks' or even simply, 'social network' to refer to a diffuse – and sometimes improbable – range of sites and services." Ellison and Boyd [5] argued that the term Social Network Sites is the most accurate because it emphasizes the role of networks, unlike previous online interaction spaces.

The first social network site, launched in 1997, was SixDegrees.com, which allowed people to connect with others and send messages [6]. The next wave of SNSs included Friendster, which was launched in 2002. While other SNSs were designed to facilitate meetings between strangers with similar interests, Friendster helped friends of friends meet [6]. In 2004, Facebook was established on a college network and expanded worldwide [4]. Currently, it is the most successful SNS, followed by Twitter and Google+ [1], [4].

Due to shifts in technology, some features have improved SNS user experiences: integration of SNSs with other tools and sites by Application Programming Interfaces (APIs, a form of third-party integration) and using SNS credentials for site authentication (single sign-on: SSO). SNSs provided several features to update profiles easily, such as status updates for Facebook and tweets for twitter. SNSs also began to support media sharing, including posting photographs and videos and access by mobile phones and tablets [5].

B. Negative Consequences of Excessive SNSs Usage

Many studies have suggested that excessive SNS usage leads to various negative consequences. According to Kuss and Griffiths [4], excessive SNS usage causes relationship problems and impacts academic and work performances. For instance, people who spend excessive time on SNSs appeared less involved in their real life communities and Facebook users had lower grades than students who did not use it because they were easily distracted and exercised poor time management. J. Al-Menayes et al. [9] concluded that Kuwaiti university students who spend too much time on SNSs had lower grades. In Thailand, many teenagers suffer from the negative effects of excessive SNS usage, such as a lack of sleep, reduced academic performance, inappropriate manners, negative emotional expressions, impairment of family and social functions, and mental health problems [10]. Excessive SNS usage delays bedtimes and reduces sleep quality [11].

C. SNS Addiction

Researchers have identified that the excessive use of technologies might become addictive behavior [4]. The following are the six core components of addiction from a biopsychosocial perspective: (1) mood modification: engagement that modifies/changes emotional states, (2) salience: prominent use, (3) tolerance: increased amounts of time spent, (4) withdrawal symptoms: experiencing unpleasantness when use is restricted, (5) conflict: relationship problems with family and friends because of usage, and (6) relapse: failure to avoid use [10], [11]. The excessive use of SNSs has also been described as a behavioral addiction [9], [12].

Young [15], [16] identified five different types of internet addiction: computer addiction, information overload, net compulsions, cyber-sexual addiction, and cyber-relation addition. SNSs fall into a cyber-relationship addiction [4]. SNS addiction can also be a specific internet addiction or a sub-category [17]. Kuss and Griffiths [4] claimed that the symptoms of SNS addiction resemble the symptoms of other addictions.

According to the review of Griffiths et al. [14], the increase in amount of SNS usage drew many researchers to be interested in SNS addiction. Griffiths et al. [14] classified such studies into four types: "(1) self-perception studies of social networking addiction, (2) studies of social networking addiction utilizing a social networking addiction scale, (3) studies examining the relationship between social networking and other online addictions and (4) studies examining social networking addiction and interpersonal relationships."

D. Existing Data Collection Methods

Since SNSs have become so popular, many researchers have sought to understand user behavior in them by collecting the data of SNS usage behavior. Many types of data and collection methods exist. Abdesslem, et al. [18] summarized the methods for collecting data from SNSs and users as following:

1) *Self-report Data*: A common methodology to gather self-report data is to directly ask users about their experiences through questionnaires. Most researchers have employed this method in their studies for various purposes. J. Al-Menayes et al. [9] examined the dimensions of social media addiction and their correlates by collecting data through a self-administered questionnaires from 1,327 college students in Kuwait. Burke et al. [19] collected data from 1,193 participants using survey-based method to analyze the relationship between social well-being and SNS activity. Geisel et al. [20] used an online survey to explore the characteristics of SNS gamers. Sagioglou and Greitemeyer [21] investigated the relation between Facebook activity and users' emotional state by collecting data through an online survey. Self-report measurement can gather difficult to obtain or expensive data as well as

saving time. It can also be implemented on large samples as web questionnaire systems [11]. However, research in human behavior areas argued that self-report measures are inaccurate when compared to actual behavior [15], [18].

2) *SNS Measurement:* The most common way to directly retrieve data from SNSs is to use the application programming interfaces (APIs) provided by SNSs. For instance, Facebook provides Graph API as the primary way to get data in and out of its platform [16], and Twitter provides REST API to read and write its data [22]. Alfantoukh and Durresi [23] demonstrated different techniques on collecting stock data from Twitter by API. Consolo and Pertillo [24] developed the framework for collecting information from online social networks using public APIs. They sampled Twitter user profiles of one million Italian and downloaded 2,000 pictures from Flickr as a test-set for experimenting with source camera identification algorithms. However, some of the data available on SNSs cannot be collected through APIs.

Some studies employ automated script that automatically scans and crawls content from websites using HTTP requests/responses [25]. Similarly, other researchers collect data through a social network aggregator [25], [26], which organizes and maintains the data of multiple social network accounts under a single username. User activities from one site are automatically synchronized to all other sites. Benevenuto and Rodrigues [25] collected data from a social network aggregator website to investigate the impact of friends on the behavior of user of social networks, to understand content distribution patterns across multiple online social networks and to build a social network workload generator. Shahrak and Mohammadi [27] collected data of Middle East users from Facebook, Instagram, Twitter, and LinkedIn from a social network aggregator website to examine the effects of online social networks on interactions in e-commerce and tendency to use this channel.

Other researchers collect data by tracing network traffic from internet service providers (ISPs). All internet activities are recorded as log data by ISPs [18]. Schneider et al. [28] traced network traffic with tens of thousands of users from different ISPs to study usage of online social networks.

3) *Application Deployment:* Deploying a monitoring application is another way of obtaining SNS user behavior. Monitoring applications record and log the operations and activities of users while they are using computers or smartphones. The monitored data can be stored on local computer and cloud services. Junco [15] used computer-logging method for collecting data from 49 survey participants to compare actual and self-reported measures of Facebook use. Abdesslem et al. [18] praised this method because it provides flexibility and privacy for data access. Unfortunately, it has some limitations. Researchers need to install applications on user devices to manually get data from them. Even though some cloud-based applications exist, most are commercial and limit the number of monitoring devices.

III. THE DESIGN OF DATA COLLECTION APPLICATION

A. Conceptual Design

Collecting data from different sources further improves data analysis. In our design, we collect data for analysis from self-report questionnaires, SNS data, and ISP logs. In addition, alternative methods might be employed in future research. Fig. 1 shows our conceptual design for collecting data.

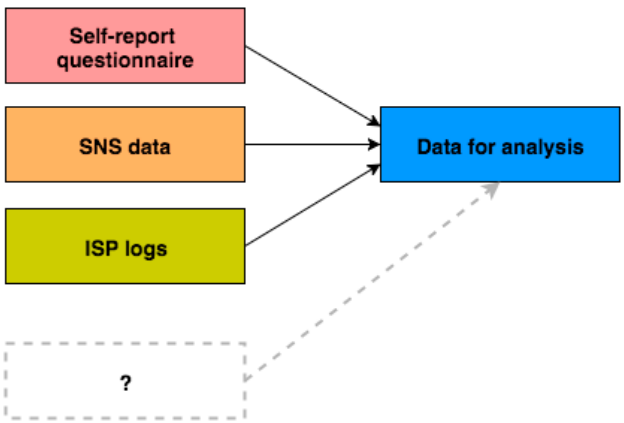

Fig. 1 Conceptual design for collecting data for analysis

Self-report questionnaires are generally used for gathering user experiences. Even self-report data might be inaccurate when compared to actual behavior, this method remains very useful for gathering data that is not available by other methods. Also, SNS data are retrieved using APIs provided by each SNS, even though some data available on SNSs might not be collected by APIs. Since self-report data might be inaccurate and SNS APIs are insufficient to capture all activities, alternative methods: for example, tracing network traffic between users and SNSs might be employed to improve data analysis. At the beginning, we will trace the network traffic data from the computer center of the Shibaura Institute of Technology (SIT) in Japan.

B. Application Design

Our data collection application, which is a web-based application designed for aggregating data for analysis from questionnaires and SNSs, has two parts: questionnaire and quizzes. Fig. 2 shows an overview of this application that can also be called client-server architecture.

1) Questionnaire: Self-report questionnaires are used for gathering the user experiences of SNSs. We designed them for gathering personal information, SNS usage information, and SNS addictive behavior. We also experimentally validated their content and usability. The results showed that they provide appropriate usability as an instrument for gathering data [3].

2) Quizzes: Quizzes are small games that ask questions, for example “What words do you use most often on Facebook?” Users do the quizzes and get results, which are retrieved from SNSs. Quizzes engage and motivate

users for retrieving data from SNSs and query data through APIs provided by SNSs. Each SNS provides different APIs. At the beginning, we retrieved SNS data from Twitter and Facebook.

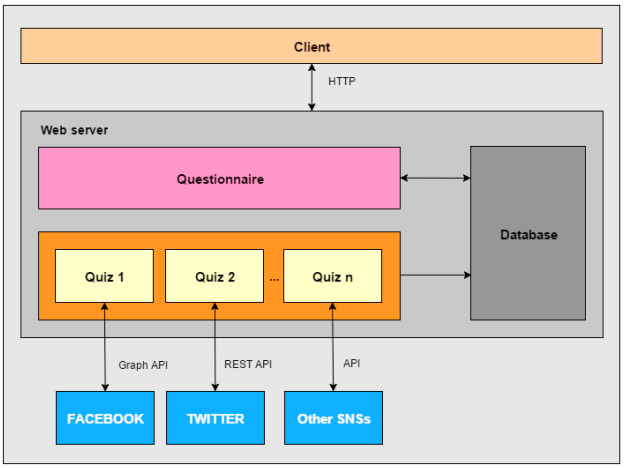

Fig. 2 Overview of data collection application

IV. TECHNIQUE FOR RETRIEVING SNS DATA

Many types of data and collection methods exist. As mentioned, there is an Application Programming Interface (API) provided by each SNS for accessing their data. The common procedures are installing their corresponding libraries, obtaining the authorization and extracting data. There are various SNSs, which provide access to their data. However, each SNS provides different APIs. In this article, we focus on Twitter and Facebook.

A. Twitter

Twitter is a microblogging service that allows users to publish 140-character messages called "tweets" [24]. A tweet can contain links and multimedia contents, such as a photo or a video. Users can "reply" to a tweet or to another user and "retweet" a tweet published by other users. Users also can "like" or "favorite" any tweet. Moreover, users may decide to "follow" other users to see tweets published by followed users. Similarly, users may be followed by other users.

1) Twitter APIs: Twitter provides two APIs [22] for accessing its data: REST API and Streaming API. The Streaming API is designed for long-running requests, capturing everything from a continuous stream of data in real time. REST API is designed to take a number of requests to perform a number of tasks and taking smaller samples of streams. In our case, we chose the REST API since real-time APIs are not necessary.

The REST API identifies Twitter applications and users using OAuth authentication and uses an HTTP-based communication interface. This API provides two operations: read and write for accessing Twitter data and responses data in JSON formation [22].

2) Development of Twitter Quiz: Twitter quiz is a small game that ask a question and process the result from retrieved Twitter data. The procedures for developing Twitter quiz are:

(1) Create Twitter account
(2) Create an application
(3) Request for authentication
(4) Get Twitter data
(5) Store data

The developers should have a Twitter account in order to use Twitter libraries. Once the developers sign in, they are able to create an application. Developers fill in application details and obtain OAuth settings that consists of consumer key and consumer secret.

In order to request for authentication, the application must obtain access tokens on behalf of a Twitter user and authorize all HTTP requests. Basically, most developers use Twitter libraries to work with the detail of OAuth authentication. In our case, we use Twitter library for PHP platform. The authentication process is illustrated in Fig. 3

Before starting the Twitter quiz, users have to accept the terms of agreement and be verified by Twitter. Users' browsers are redirected to the Twitter page and back to our application after authentication is completed. We collected the following Twitter activity data by REST API:

- Tweets
- Retweets
- Replies
- Favorites or likes

We can get the action time of each activity except favorites/likes. Moreover, we collected Twitter user profiles for the following background of Twitter usage:

- Number of following
- Number of friends or followers
- Number of tweets (posts)
- Number of favorite or like action
- Date of joining Twitter

Then, we map above data as Twitter data model and store in our database. Our Twitter data models are:

- *Twitter User Profile*: Collection of Twitter user objects.
- *Tweet*: Collection of tweets, retweets and replies objects. Each *Tweet* object associates with *Twitter User Profile* object.
- *Favorite Tweet*: Collection of favorite or like objects. Each Favorite Tweet object associates with *Twitter User Profile* object

3) Limitations of retrieving Twitter data

Even Twitter provides API to access its data, API is insufficient to capture all Twitter activities, especially reading activities. The following are the limitation of the REST API:

- We cannot get the action times of favorites/likes. We can access only the created time of parent tweet that users do favorite/like.
- Twitter does not allow request operation with a combination of date period and specific user condition.

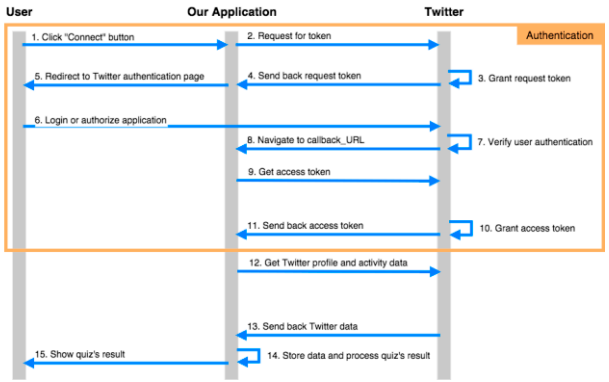

Fig. 3 Communication with Twitter by REST API

- Twitter limits the maximum number of request operation to 15 requests per window. If an application reaches this limit, it has to wait for the next time window.
- Return data are limited to 200 records per request and up to 3,200 records.

B. Facebook

Facebook is an online social networking site that allows registered users to create profiles, add other users as "friends", and publish messages called "post". A post can contain a text, a photo or a video. Users can "comment" and "reply" to a post. Users can also "like" any post or "share" a post published by other users. Moreover, users may "create" or "join" interest groups and "create" or "follow" interest pages.

Facebook launched platform for third-party developer to create applications and services that access Facebook data [16]. The Facebook platform is made up of several high-level components such as application programming interfaces (APIs), software development kits (SDKs), social plugins, mobile platform, etc.

1) Facebook APIs: Facebook provides APIs [16] for accessing its data for various purposes. Graph API is the primary way to access data on Facebook based on HTTP. This API has multiple versions. In our implementation, we used Graph API version 2.5, which is the latest version published in 2015.

Graph API is HTTP based. Most requests require an access token, which is "an opaque string that identifies a user, app or page" [16], generally obtained in the OAuth authentication process.

2) Development of Facebook Quiz: Facebook quiz is a small game as Twitter quiz. The procedures for developing Facebook quiz are:

(1) Create Facebook account
(2) Create an application
(3) Request for authentication
(4) Get Facebook data
(5) Store data

The developer should have a Facebook account and register as Facebook developer. Once the developer sign in, they are able to create an application. Developers set up and fill in application detail then obtain a unique app ID and app secret.

To request for authentication, the application must obtain access tokens on behalf of a Facebook user and authorize all HTTP requests. Developers need to specify types of permission for accessing data such as user posts, birthday, email, etc. Facebook provides SDK to work with the details of

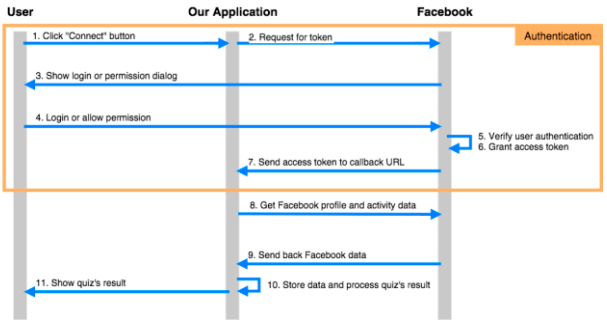

Fig. 4 Communication with Facebook by Graph API

OAuth authentication. In our case, we used PHP SDK, which is a rich set of server-side functionality. The authentication process is shown in Fig. 4.

Before starting the Facebook quiz, users have to accept the terms of agreement and be verified by Facebook. When authentication is completed, we collect Facebook activity data by Graph API, which we can only get in the following the user feed (user profile page):

- Posts
- Comments
- Likes

We can get the action time of each activity except likes. Additionally, we collected Facebook user profiles for the personal information. The following data are available by Graph API with specific data permissions:

- Number of friends
- Gender
- Birthday
- Location/hometown

Then, we map above data as Facebook data model and store in our database. Our Facebook data models are:

- *Facebook User Profile*: Collection of Facebook user objects.
- *Facebook Post:* Collection of post objects.
- *Facebook Comment*: Collection of comment objects.
- *Facebook Like*: Collection of like objects.

Each *Facebook Post*, *Facebook Comment* and *Facebook Like* object associates with Facebook User Profile object.

3) Limitations of retrieving Facebook data:

Some data available on Facebook cannot be collected through Graph API especially reading activities. The following are the limitations of Facebook Graph API:

- Activity data are available only on the user feeds on the profile page since API versions after 2.0 do not support Facebook Query Language (FQL).
- We cannot get the action time of likes.
- The latest APIs do not support the new reaction: love, haha, wow, sad, and angry.
- Facebook continue to update the versions of their APIs. Developers should migrate their application with new updates, or otherwise some commands will work incorrectly or maybe not at all.

V. DISCUSSION

Our research aims to study user behavior and clarify the characteristic of SNS usage to detect symptoms of excessive SNS usage. Data collection is an important first step to understand how people interact with SNSs. Fig. 5 illustrates our procedures for studying SNS user behavior.

In our previous study [3], we designed a data collection application for aggregating data from questionnaires and SNSs, which is the first procedure in Fig. 5. We also designed self-report questionnaires and experimentally evaluated them. Our results showed that they have an appropriate usability as a tool for gathering data.

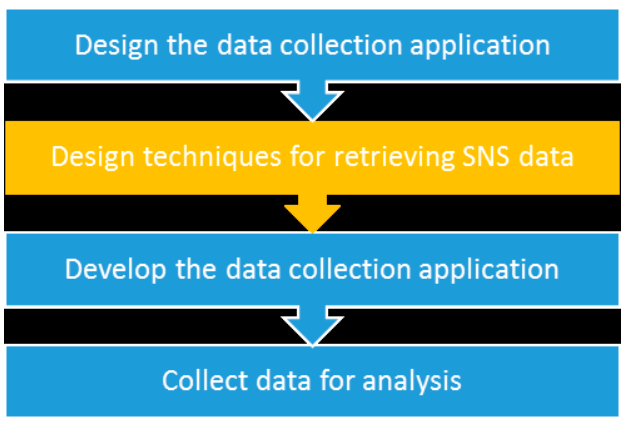

Fig. 5 Procedures for studying SNS user behavior

In this article, we designed the techniques for retrieving data from Twitter and Facebook using their APIs, which is the second procedure in Fig. 5. We classified the obtained data into two groups: activity data and user data. Activity data can represent type of interaction and frequency of usage between users and SNSs. User data from Twitter and Facebook represent different information. While, Twitter user data provide the usage background, Facebook user data give the personal information.

In the next procedure, the self-report questionnaire from previous study and these data collection techniques will be utilized in developing the data collection application [29].

Nevertheless, retrieving SNS data using APIs has some limitations. SNS APIs are insufficient to capture all SNS activities, especially reading activities. Thus, alternative methods will be employed in the future to improve data analysis.

Finally, we will use our application to collect data for analysis in our further research.

Additionally, privacy concerns should be considered in our development. Users should be notified about the obtained data. Thus, we should provide privacy policy information and terms of use and requested users to accept the terms of agreement before the data collection process.

VI. CONCLUSIONS

Collecting data is an important first step for analyzing SNS user behavior. Many types of data and collection methods exist. We designed a data collection application by employing questionnaire to gather user experiences and APIs to retrieve SNS data. In this article, we introduced the techniques for retrieving data from Twitter and Facebook by their APIs.

Even though APIs have benefits to directly collect data from SNSs, they also have limitations. Some data available on SNSs cannot be collected through APIs. They are insufficient to capture all SNS activities, especially reading activity. Thus, alternative methods will be employed in future research to improve data analysis.

These data collection techniques will be utilized in implementing the data collection application. The obtained data from our application will be applied to detect symptoms of excessive use of SNSs and develop prevention strategies in the next step of this research.

REFERENCES

[1] "Digital, Social and Mobile in 2015 on We Are Social," 2015. [Online]. Available: http://wearesocial.com/uk/special-reports/digital-social-mobile-worldwide-2015.

[2] F. Awolusi, "The Impacts of Social Networking Sites on Workplace Productivity," *The Journal of Technology, Management and Applied Engineering*, vol. 28, no. 1, pp. 2–6, 2012.

[3] P. Intapong, T. Achalakul, and M. Ohkura, "Collecting data of SNS user behavior to detect symptoms of excessive usage design of data collection application," in *International Symposium on Affective Science and Engineering (ISASE)*, Tokyo, Japan, 2016.

[4] D. J. Kuss and M. D. Griffiths, "Online Social Networking and Addiction—A Review of the Psychological Literature," *Int J Environ Res Public Health*, vol. 8, no. 9, pp. 3528–3552, Sep. 2011.

[5] N. B. Ellison and D. M. Boyd, "Sociality through social network sites," in *The Oxford Handbook of Internet Studies*, 2013, pp. 151–172.

[6] D. Boyd and N. Ellison, "Social Network Sites: Definition, History, and Scholarship," *Journal of Computer-Mediated Communication*, vol. 13, pp. 210–230, 2007.

[7] F. B. F. of F. A. A. of O. M. for B. Authors, "Social Media vs. Social Networking Huffington Post," *The Huffington Post*, 02-Oct-2013–02-Oct-400.[Online]. Available:http://www.huffingtonpost.com/fauzia-burke/social-media-vs-social-ne_b_4017305.html. [Accessed: 04-Oct-2015].

[8] "Social networking service," *Wikipedia, the free encyclopedia*. 02-Oct-2015.

[9] J. J. Al-Menayes, "Dimensions of Social Media Addiction among University Students in Kuwait," *Psychology and Behavioral Sciences*, vol. 4, no. 1, p. 23, 2015.

[10] M. Phanasathit, M. Manwong, N. Hanprathet, J. Khumsri, and R. Yingyeun, "Validation of the Thai version of Bergen Facebook addiction scale (Thai-BFAS).," *J Med Assoc Thai*, vol. 98 Suppl 2, pp. S108–117, Mar. 2015.

[11] C. S. Andreassen, T. Torsheim, G. S. Brunborg, and S. Pallesen, "Development of a Facebook Addiction Scale," *Psychol Rep*, vol. 110, no. 2, pp. 501–517, Apr. 2012.

[12] I. Brown, "A Theoretical Model of the Behavioural Addictions - Applied to Offending," in *Addicted to Crime?*, Chichester: Wiley, 1997, pp. 13–65.
[13] Mark Griffiths, "Behavioural addiction: an issue for everybody?," *Employee Counselling Today*, vol. 8, no. 3, pp. 19–25, Jun. 1996.
[14] M. D. Griffiths, D. J. Kuss, and Z. Demetrovics, "Chapter 6 - Social Networking Addiction: An Overview of Preliminary Findings A2- Rosenberg, Kenneth Paul," in *Behavioral Addictions*, L. C. Feder, Ed. San Diego: Academic Press, 2014, pp. 119–141.
[15] R. Junco, "Comparing actual and self-reported measures of Facebook use,"*Computers in Human Behavior*, vol. 29, no. 3, pp. 626–631, May 2013.
[16] "Facebook Developers," 2015. [Online]. Available:https://developers.facebook.com.
[17] A. P. C. Cheak, G. G. G. Goh, and T. S. Chin, "Online social networking addiction: exploring its relationship with social networking dependency and mood modification among undergraduates in Malaysia," in *International Conference on Management, Economics and Finance (ICMEF 2012) Proceeding*, Sarawak, Malaysia, 2012, pp. 247–262.
[18] F. B. Abdesslem, I. Parris, and T. Henderson, "Reliable Online Social Network Data Collection," in *Computational Social Networks*, A. Abraham, Ed. Springer London, 2012, pp. 183–210.
[19] M. Burke, C. Marlow, and T. Lento, "Social Network Activity and Social Well-being," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2010, pp. 1909–1912.
[20] O. Geisel, P. Panneck, A. Stickel, M. Schneider, and C. A. Müller, "Characteristics of Social Network Gamers: Results of an Online Survey," *Front Psychiatry*, vol. 6, p. 69, 2015.
[21] C. Sagioglou and T. Greitemeyer, "Facebook's emotional consequences: Why Facebook causes a decrease in mood and why people still use it," *Computers in Human Behavior*, vol. 35, pp. 359–363, Jun. 2014.
[22] "Twitter Developers," 2015. [Online]. Available:https://dev.twitter.com/.
[23] L. Alfantoukh and A. Durresi, "Techniques for Collecting data in Social Networks," in *2014 17th International Conference on Network-Based Information Systems*, 2014, pp. 336–341.
[24] S. Consolo and U. F. Petrillo, "A Framework for the Efficient Collection of Big Data from Online Social Networks," in *2014 International Conference on Intelligent Networking and Collaborative Systems (INCoS)*, 2014, pp. 34–41.
[25] F. Benevenuto, T. Rodrigues, M. Cha, and V. Almeida, "Characterizing User Behavior in Online Social Networks," in *Proceedings of the 9th ACM SIGCOMM Conference on Internet Measurement Conference*, New York, NY, USA, 2009, pp. 49–62.
[26] C. Virmani, A. Pillai, and D. Juneja, "Study and analysis of Social network Aggregator," in *2014 International Conference on Optimization, Reliabilty, and Information Technology (ICROIT)*, 2014, pp. 145–148.
[27] M. Z. Shahrak and S. Mohammadi, "Middle East User Navigation in Online Social Networks and Interactions in E-Commerce, an Analogy,"*Advances in Computer Science : an International Journal*, vol. 3, no. 2, pp. 32–36, Mar. 2014.
[28] F. Schneider, A. Feldmann, B. Krishnamurthy, and W. Willinger, "Understanding Online Social Network Usage from a Network Perspective," in *Proceedings of the 9th ACM SIGCOMM Conference on Internet Measurement Conference*, New York, NY, USA, 2009, pp. 35–48.
[29] P. Intapong, T. Achalakul, and M. Ohkura, "Collecting data of SNS user behavior to detect symptoms of excessive usage: Development of data collection application," presented at the 7th International Conference on Applied Human Factors and Ergonomics (AHFE 2016) Conference 2016, Florida, USA., 2016.