

An Investigation of Japanese Twitter Users

Who Disclosed Their Personal Profile Items in Their Tweets Honestly

Yasuhiko Watanabe, Hiromu Nishimura, Yuuya Chikuki, Kunihiro Nakajima, and Yoshihiro Okada

Ryukoku University

Seta, Otsu, Shiga, Japan

Email: watanabe@rins.ryukoku.ac.jp, t160405@mail.ryukoku.ac.jp, t160389@mail.ryukoku.ac.jp, nakajima.k216@gmail.com, okada@rins.ryukoku.ac.jp

Abstract—These days, many people use a Social Networking Service (SNS). Most SNS users are careful in protecting the privacy of personal information: name, age, gender, address, telephone number, birthday, etc. However, some SNS users disclose their personal information that can threaten their privacy and security even if they use non-real name accounts. In this study, we investigated tweets disclosing submitters' personal profile items which many of us think are not true. We collected 565 tweets where submitters used non-real name accounts and made promises to disclose their personal profile items, surveyed the details of their personal profile items disclosed by themselves, especially their ages, genders, heights, and foot sizes, and analyzed them statistically by applying the Shapiro-Wilk test of normality and the Welch's test. The results of these tests showed that most of the submitters disclosed their ages, genders, heights, and foot sizes honestly.

Keywords—personal information; Twitter; SNS; privacy risk; Shapiro-Wilk test of normality; Welch's test.

I. INTRODUCTION

These days, many people use a Social Networking Service (SNS) to communicate with each other and try to enlarge their circle of friends. SNS users are generally concerned about potential privacy risks. To be specific, they are afraid that unwanted audiences will obtain information about them or their families, such as where they live, work, and play. As a result, SNS users are generally careful in disclosing their personal information. They disclose their personal information only when they think the benefits of doing so are greater than the potential privacy risks. However, some SNS users, especially young users, disclose personal information on their profiles, for example, real full name, gender, hometown and full date of birth, which can potentially be used to identify details of their real life, such as their social security numbers. In order to discuss this phenomenon, many researchers investigated how much and which type of information is disclosed in SNSs, especially, on Facebook. Researchers might think that personal information disclosed on Facebook is reliable, or it is possible to check whether personal information disclosed on Facebook is true. This is because

- Facebook users are required to register and disclose their real names when they first start using Facebook.
- Facebook users would be criticized by their friends if they disclose their information dishonestly.

On the other hand, a small number of researchers investigated how much and which type of information is disclosed by non-real name account users, such as Twitter users. Researchers



Figure 1. A non-real name account user, *Rina*, disclosed her personal profile items in her tweets.

might think that personal information disclosed by non-real name account users is unreliable. This is because

- nobody criticizes non-real name account users when they disclose their personal information dishonestly.
- true personal information can threaten their privacy and security even if they use non-real name accounts.

As a result, many of us think that it is natural for non-real name account users not to disclose their personal information honestly. Figure 1 shows tweets submitted by non-real name account user, *Rina*. In these tweets, *Rina* disclosed her personal profile items: her age, gender, birthday, zodiac sign, height, and foot size. Many of us think that these personal profile items were not true. However, we cannot check whether *Rina*



Figure 2. A tweet promising to disclose the same number of submitters' personal profile items as likes to it.

disclosed her personal profile items honestly because it is difficult to do it. To solve this problem, we collected tweets where non-real name account users made promises to disclose their personal profile items, analyzed them statistically, and showed that it is likely that most of the non-real name account users, especially young users, disclosed their personal information honestly [1]. In this paper, we survey and analyze these tweets by taking into account foot size that has not been paid attention to before and discuss whether their submitters disclosed their ages, genders, heights, and foot sizes honestly.

The rest of this paper is organized as follows: In Section II, we survey the related works. In Section III, we show how to collect tweets disclosing submitters' personal profile items. In Section IV, we survey the details of submitters' personal profile items, analyze them statistically, and show that it is likely that most of the submitters disclosed their personal profile items honestly. Finally, in Section V, we present our conclusions.

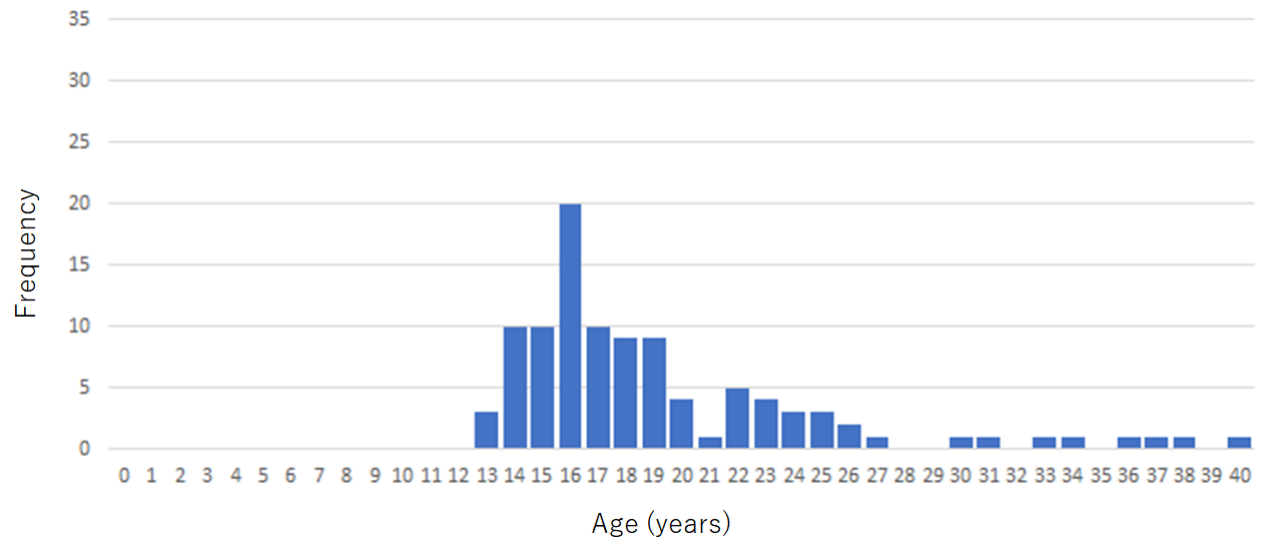
II. RELATED WORK

Personally identifiable information is defined as information which can be used to distinguish or trace an individual's identity such as social security number, biometric records, etc. alone, or when combined with other information that is linkable to a specific individual, such as date and place of birth, mother's maiden name, etc. [2] [3]. Unsafe disclosure of personal information on SNSs can lead to several concerns such as cyberbullies, addiction, risky behavior, and contact with dangerous communities [4]. Internet users are generally concerned about unwanted audiences obtaining personal information. Fox et al. reported that 86% of Internet users are concerned that unwanted audiences will obtain information about them or their families [5]. Also, Acquisti and Gross reported that students expressed high levels of concern for general privacy issues on Facebook, such as a stranger finding out where they live and the location and schedule of their classes, and a stranger learning their sexual orientation, name

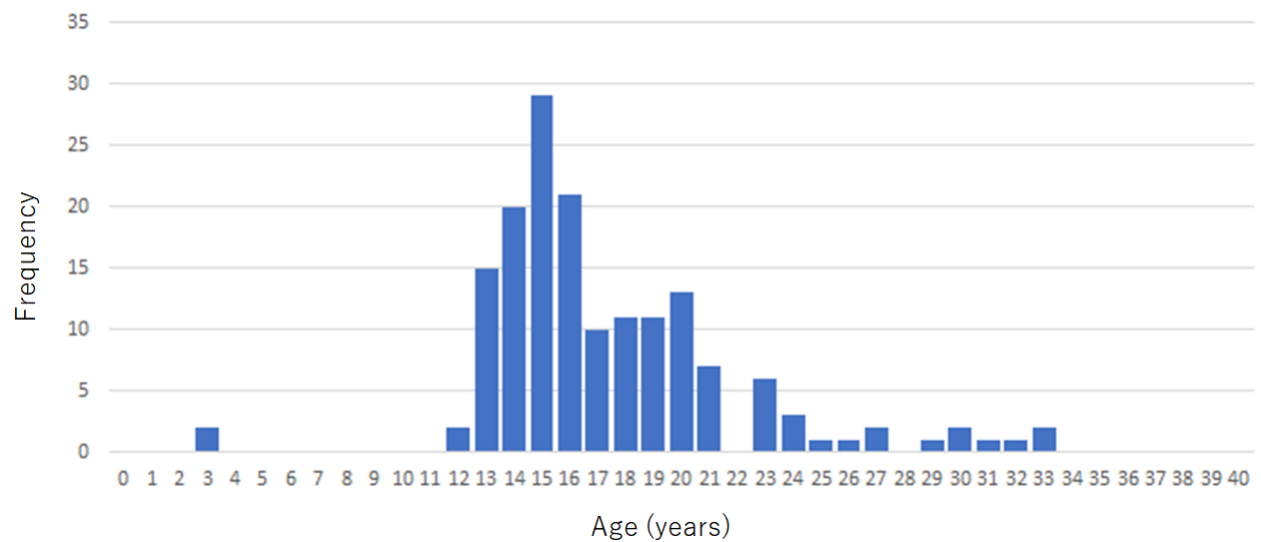
of their current partner, and their political affiliations [6]. However, Internet users, especially young users, tend to disclose personal information on their profiles, for example, real full name, gender, hometown and full date of birth, which can potentially be used to identify details of their real life, such as their social security numbers. As a result, many researchers discussed the reasons why young users willingly disclose personal information on their SNS profiles. Barnes argues that Internet users, especially teenagers, are not aware of the nature of the Internet and SNSs [7]. On the other hand, Hinduja and Patchin analyzed randomly sampled MySpace profile pages and reported that the majority of adolescents are responsibly using the web site [8]. Krasnova et al. reported that SNS users are primarily motivated to disclose personal information because SNSs are fun and convenient to develop their social networks [9]. Van der Heijden also reported that users' sense of enjoyment is a strong intention to use information systems [10]. For example, Liu et al. showed that the sense of enjoyment positively influences the intention of Chinese university students to use SNSs [11]. In contrast, Pavlou et al. reported that users' perception on privacy risk negatively influences their intention to use online services [12]. Viseu et al. reported that many online users believe the benefits of disclosing personal information in order to use an Internet site are greater than the potential privacy risks [13]. Joinson et al. reported that trust and perceived privacy had a strong effect on individuals' willingness to disclose personal information to a website [14]. Also, Tufekci found that concern about unwanted audiences had an impact on whether or not students revealed their real names and religious affiliation on MySpace and Facebook [15]. The authors also think that most students are seriously concerned about their privacy and security. However, they often underestimate the risk of their online messages and submit them. For example, Watanabe et al. reported that many students submit tweets concerning school events and these tweets may give a chance to other people, including unwanted audiences, to distinguish which schools students go to [16]. Hirai reported that many users experienced trouble in SNSs because they did not mind that strangers observed their communication with their friends [17]. On the other hand, Acquisti and Gross explain this phenomenon as a disconnection between the users' desire to protect their privacy and their actual behavior [6]. Dwyer concluded in her research that privacy is often not expected or undefined in SNSs [18]. Also, Livingstone points out that teenagers' concept of privacy does not match the privacy settings of most SNSs [19]. Hui et al. reported that online companies can induce users to disclose their personal information by offering benefits [20].

III. A COLLECTION OF TWEETS DISCLOSING SUBMITTERS' PERSONAL PROFILE ITEMS

It is difficult to collect tweets disclosing submitters' personal profile items, such as tweets in Figure 1, directly. To solve this problem, we focused on tweets where submitters promised their followers to disclose the same number of their own personal profile items as likes to their tweets. Figure 2 shows a tweet submitted by *Rina* on September 3, 2019. In this tweet, *Rina* promised her followers to disclose the same number of her personal profile items as likes to her tweet. Actually, *Rina* submitted 35 replies disclosing her personal profile items to her tweet shown in Figure 2 from September 3 to 9, 2019. The six tweets shown in Figure 1 were the first six



(a) The number of submitters who disclosed that they were men by age.



(b) The number of submitters who disclosed that they were women by age.

Figure 3. The number of submitters who disclosed their genders clearly by age.

replies submitted by *Rina* to her tweets shown in Figure 2. As of November 20, 2019, we confirmed that 37 likes were given to her tweet shown in Figure 2. Furthermore, we found many tweets promising to disclose the same number of their own personal profile items as likes to their tweets. As a result, it is easy to collect tweets disclosing submitters' personal profile items when we collect tweets promising to disclose submitters' personal profile items. The reasons why many Twitter users submitted tweets promising to disclose submitters' personal profile items might be

- they thought they looked fun,
- they wanted to draw attention, and
- they wanted to know how much attention was paid to

their tweets.

In order to collect tweets promising to disclose submitters' personal profile items, we focused on images attached to these tweets. This is because many submitters attached the same image to their tweets and many personal profile items were listed in the image. As shown in Figure 2, *Rina* attached an image to her tweet and showed the list of personal profile items that she promised her followers to disclose in the image. Many twitter users attached the same image to their tweets promising to disclose their personal profile items. As a result, we used these shared images as key to collect tweets promising to disclose submitters' personal profile items. To be specific, we collected these tweets by using Twigaten [21]. Twigaten helps us to collect tweets to which the same image is attached. By

using Twigaten, we collected 565 Japanese tweets promising to disclose submitters' personal profile items on November 20, 2019. The obtained tweets were submitted from October 3, 2018 to November 20, 2019.

IV. AN ANALYSIS OF TWEETS DISCLOSING SUBMITTERS' PERSONAL PROFILE ITEMS

It is difficult to determine whether an individual submitter disclosed his/her personal profile items honestly. For example, it is difficult to determine whether *Rina*, who submitted tweets in Figure 1 and Figure 2, was a woman. In this study, we discuss whether submitters disclosed their personal profile items honestly when they made promises to disclose them. In order to discuss this problem, we analyze submitters' genders, ages, heights, and foot sizes statistically.

A. Submitters' genders

As mentioned in Section III, we obtained the 565 tweets promising to disclose user's personal profile items. We surveyed these 565 tweets and their replies and, according to submitters' genders disclosed in the replies, classified them into

- 282 tweets (women)
- 156 tweets (men)
- 27 tweets (unclear)
- 100 tweets (no replies)

B. Submitters' ages

We also surveyed the 565 tweets and their replies and, according to whether submitters' ages were disclosed in their replies clearly, classified them into

- 276 tweets (clearly)
- 60 tweets (unclearly)
- 229 tweets (no replies)

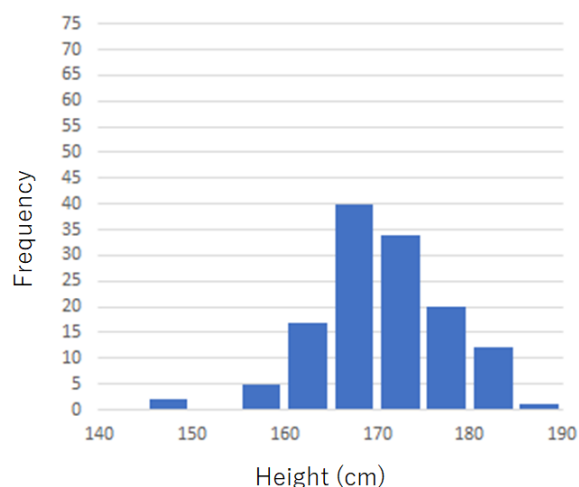
When submitter's age was disclosed such as "early 20s" and "over thirty", we determined that submitter's age was disclosed unclearly. Among the 276 tweets where submitters' ages were disclosed clearly, we found 102 and 161 tweets where submitters' genders were also disclosed clearly, men and women, respectively. Figure 3 shows the number of submitters, who disclosed their genders clearly, men and women, by age. As shown in Figure 3, the most popular age of men and women were 16 and 15 years old, respectively.

C. Submitters' heights

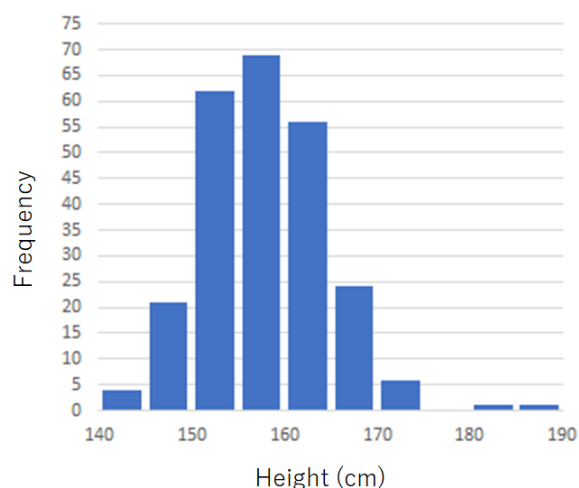
We also surveyed the 565 tweets and their replies and, according to whether submitters' heights were disclosed in their replies clearly, classified them into

- 401 tweets (clearly),
- 8 tweets (unclearly), and
- 156 tweets (no replies).

Among the 401 tweets where submitters' heights were disclosed clearly, we found 131 and 244 tweets where submitters' genders were disclosed clearly, men and women, respectively. Figure 4 shows the histogram of heights of submitters who disclosed their genders, men or women, clearly.



(a) the histogram of submitters' heights (disclosed genders: men).



(b) the histogram of submitters' heights (disclosed genders: women).

Figure 4. The histogram of heights of submitters who disclosed their genders, men or women, clearly. (bin width = 5cm)

It is difficult to determine whether an individual submitter disclosed his/her personal profile items honestly. In this study, we statistically examine whether submitters disclosed their personal profile items honestly when they made promises to disclose their personal profile items and disclosed them in the same way as *Rina* did.

It is well known that our heights follow a normal (Gaussian) distribution [22]. As a result, if most of submitters disclose their ages, genders, and heights honestly, their heights would follow a normal distribution. Also, the average of their heights would be equal to the national average height in Japan. To solve this problem, in this paper, we conduct the statistical analysis on

- 37 submitters who disclosed their genders (men), ages (15-17 years old), and heights clearly, and
- 60 submitters who disclosed their genders (women), ages (14-16 years old), and heights clearly.

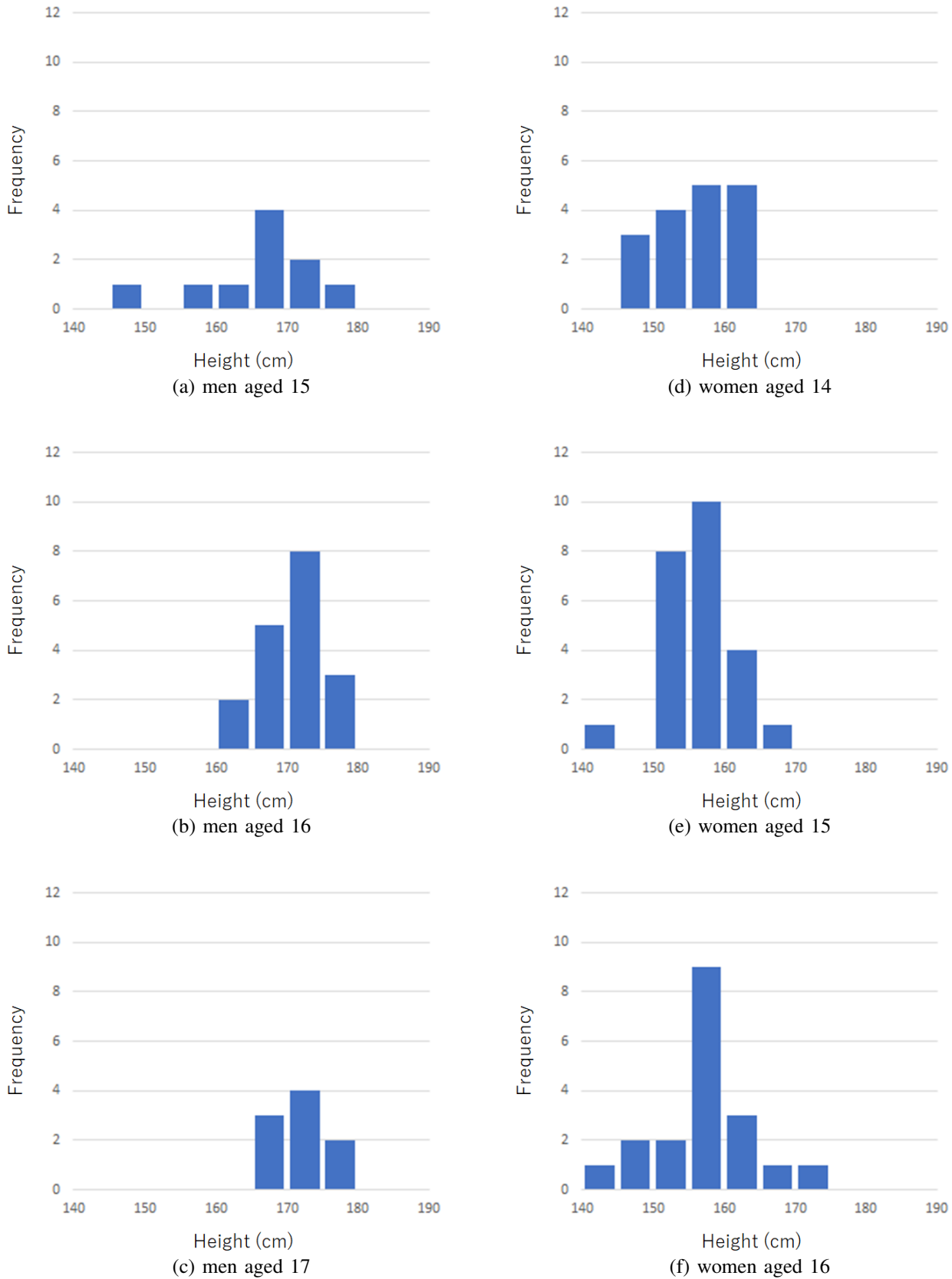


Figure 5. The histograms of heights of submitters who disclosed that they were men aged 15-17 and women aged 14-16 (bin width = 5cm).

TABLE I. THE RESULTS OF THE SHAPIRO-WILK TEST OF NORMALITY ON HEIGHTS

gender	age	sample size	W value	p-value
men	15	10	0.885	0.147
men	16	18	0.929	0.190
men	17	9	0.977	0.946
women	14	17	0.933	0.244
women	15	24	0.971	0.697
women	16	19	0.961	0.587

TABLE II. THE AVERAGE AND STANDARD DEVIATION OF SUBMITTERS' HEIGHTS

gender	age	sample size	average	standard deviation
men	15	10	165.5	7.58
men	16	18	169.2	4.08
men	17	9	171.3	3.84
women	14	17	155.0	6.11
women	15	24	155.7	4.99
women	16	19	156.9	6.54

TABLE III. THE NATIONAL AVERAGE AND STANDARD DEVIATION OF HEIGHTS IN JAPAN

gender	age	sample size	average	standard deviation
men	15	1411	168.37	5.75
men	16	1428	169.59	5.70
men	17	1427	170.46	5.82
women	14	1386	156.36	5.24
women	15	1413	156.76	5.36
women	16	1419	157.16	5.17

As shown in Figure 3, men aged 15-17 and women aged 14-16 were the most popular segments in the submitters' ages.

First, we discuss whether submitters' heights followed a normal distribution. Figure 5 shows the histograms of their heights. In order to discuss whether submitters' heights followed a normal distribution, we conducted the Shapiro-Wilk test of normality. The null hypothesis in this study was that submitters' heights followed a normal distribution. Table I shows the results of the Shapiro-Wilk test of normality on heights. As shown in Table I, the p-value in each case was greater than 0.05. As a result, the null hypothesis in each case was not rejected. In other words, submitters' heights, in each case of men aged 15-17 and women aged 14-16, followed a normal distribution.

Next, we discuss whether the average of submitters' heights was equal to the national average height in Japan. Table II shows the average of submitters' heights. Table III shows the national average height in Japan [23]. In order to discuss whether the average of their heights was equal to the national average height in Japan, we conducted the Welch's test. The null hypothesis in this study was that the average of submitters' heights was equal to the national average height in Japan. Table IV shows the results of the Welch's test. As shown in Table IV, the p-value in each case was greater than 0.05. As a result, the null hypothesis in each case was not rejected. In other words, in each case of men aged 15-17 and women aged 14-

TABLE IV. THE RESULTS OF WELCH'S TEST ON HEIGHTS

gender	age	Degrees of freedom	test statistic T	p-value
men	15	9.07	1.195	0.262
men	16	17.84	0.380	0.708
men	17	8.23	-0.675	0.518
women	14	16.29	0.914	0.374
women	15	23.91	1.060	0.300
women	16	18.30	0.179	0.860

16, the average of submitters' heights was equal to the national average height in Japan.

The results of the Shapiro-Wilk test of normality and the Welch's test rarely happened when many submitters disclosed their ages, genders, and heights dishonestly. As a result, it is assumed that most of the submitters disclosed their ages, genders, and heights honestly. Furthermore, age, gender, and height were important personal information. It is likely that they disclosed not only their ages, genders, and heights but also other personal profile items honestly.

D. Submitters' foot sizes

We also surveyed the 565 tweets and their replies and, according to whether submitters' foot sizes were disclosed in their replies clearly, classified them into

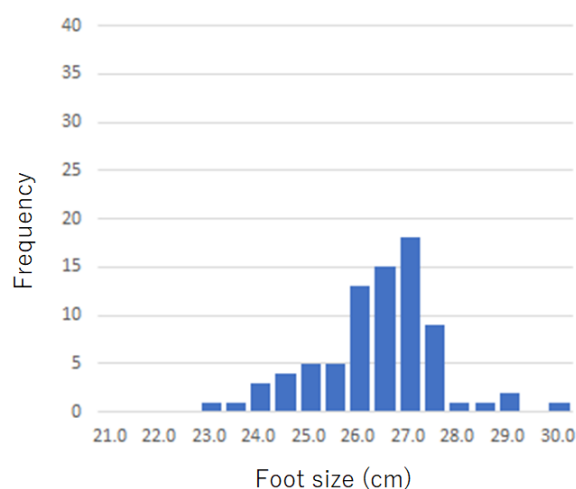
- 257 tweets (clearly),
- 20 tweets (unclearly), and
- 288 tweets (no replies).

Among the 257 tweets where submitters' foot sizes were disclosed clearly, we found 79 and 159 tweets where submitters' genders were disclosed clearly, men and women, respectively. Figure 6 shows the histogram of foot sizes of submitters who disclosed their genders, men or women, clearly. In this section, we statistically examine whether submitters disclosed their foot sizes honestly.

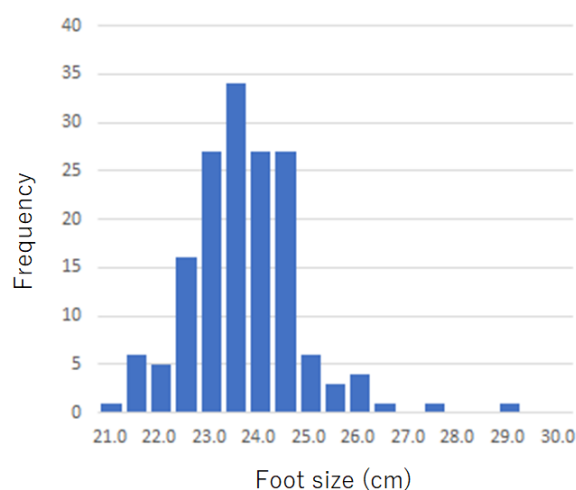
One thing to note is that the term *foot size* can be interpreted in two ways: foot length and shoe size. Katase et al. reported that most Japanese people do not know their own foot lengths, only know their shoe sizes, because they rarely have the opportunity to measure their foot lengths [24]. As a result, when Japanese submitters disclosed their foot sizes in their tweets, their values are mainly those of their shoe sizes. However, our shoe sizes are close to our foot lengths, and our foot lengths are generally considered to follow a normal distribution, like our heights. As a result, if most of submitters disclose their ages, genders, and foot sizes honestly, their foot sizes would follow a normal distribution. Also, the average of their foot sizes would be equal to the average of foot sizes surveyed in Japan. To solve this problem, in this paper, we conduct the statistical analysis on

- 32 submitters who disclosed their genders (men), ages (15-17 years old), and foot sizes clearly, and
- 57 submitters who disclosed their genders (women), ages (14-16 years old), and foot sizes clearly.

As shown in Figure 3, men aged 15-17 and women aged 14-16 were the most popular segments in the submitters' ages.



(a) the histogram of submitters' foot sizes (disclosed genders: men).



(b) the histogram of submitters' foot sizes (disclosed genders: women).

Figure 6. The histogram of foot sizes of submitters who disclosed their genders, men or women, clearly. (bin width = 1cm)

First, we discuss whether submitters' foot sizes followed a normal distribution. Figure 7 shows the histograms of their foot sizes. In order to discuss whether submitters' foot sizes followed a normal distribution, we conducted the Shapiro-Wilk test of normality. The null hypothesis in this study was that submitters' foot sizes followed a normal distribution. Table V shows the results of the Shapiro-Wilk test of normality on foot sizes. As shown in Table V, the p-values in the cases of men aged 15 and women aged 14 were less than 0.05, on the other hand, those in cases of men aged 16-17 and women aged 15-16 were greater than 0.05. As a result, the null hypothesis in four out of the six examined cases was not rejected. In other words, submitters' foot sizes followed a normal distribution in more than half of the examined cases.

Next, we discuss whether the average of submitters' foot sizes was equal to the average of foot sizes surveyed in Japan. Table VI shows the average of submitters' foot sizes. Table VII shows the average of shoe sizes in Japan, surveyed by Japan

TABLE V. THE RESULTS OF THE SHAPIRO-WILK TEST OF NORMALITY ON FOOT SIZES

gender	age	sample size	W value	p-value
men	15	8	0.779	0.023
men	16	16	0.917	0.153
men	17	8	0.826	0.063
women	14	16	0.857	0.017
women	15	23	0.930	0.108
women	16	18	0.908	0.080

TABLE VI. THE AVERAGE AND STANDARD DEVIATION OF SUBMITTERS' FOOT SIZES

gender	age	sample size	average	standard deviation
men	15	8	25.9	1.45
men	16	16	26.4	0.74
men	17	8	26.1	1.35
women	14	16	23.7	1.06
women	15	23	23.4	0.92
women	16	18	23.9	1.08

TABLE VII. THE AVERAGE AND STANDARD DEVIATION OF SHOE SIZES IN JAPAN (SURVEYED BY JLIA IN OCTOBER 2013)

gender	age	sample size	average	standard deviation
men	15	76	26.6	1.10
men	16	127	26.6	0.96
men	17	151	26.6	1.02
women	14	109	23.8	0.61
women	15	76	23.7	0.76
women	16	88	23.8	0.67

TABLE VIII. THE RESULTS OF WELCH'S TEST ON FOOT SIZES

gender	age	Degrees of freedom	test statistic T	p-value
men	15	7.87	1.326	0.222
men	16	21.92	0.982	0.337
men	17	7.43	1.032	0.334
women	14	16.49	0.369	0.717
women	15	31.63	1.424	0.164
women	16	19.76	-0.378	0.709

Leather and Leather Goods Industries Association (JLIA) in October 2013 [25]. As mentioned, when Japanese submitters disclosed their foot sizes in their tweets, their values are mainly those of their shoe sizes. As a result, we examine whether the average of submitters' foot sizes was equal to the average of shoe sizes in Japan surveyed by JLIA [25]. In order to discuss whether the average of their foot sizes was equal to the average of shoe sizes in Japan, we conducted the Welch's test. The null hypothesis in this study was that the average of submitters' foot sizes was equal to the average of shoe sizes in Japan. Table VIII shows the results of the Welch's test. As shown in Table VIII, the p-value in each case was greater than 0.05. As a result, the null hypothesis in each case was not rejected. In other words, in each case of men aged 15-17 and women aged 14-16, the average of submitters' foot sizes was equal to the

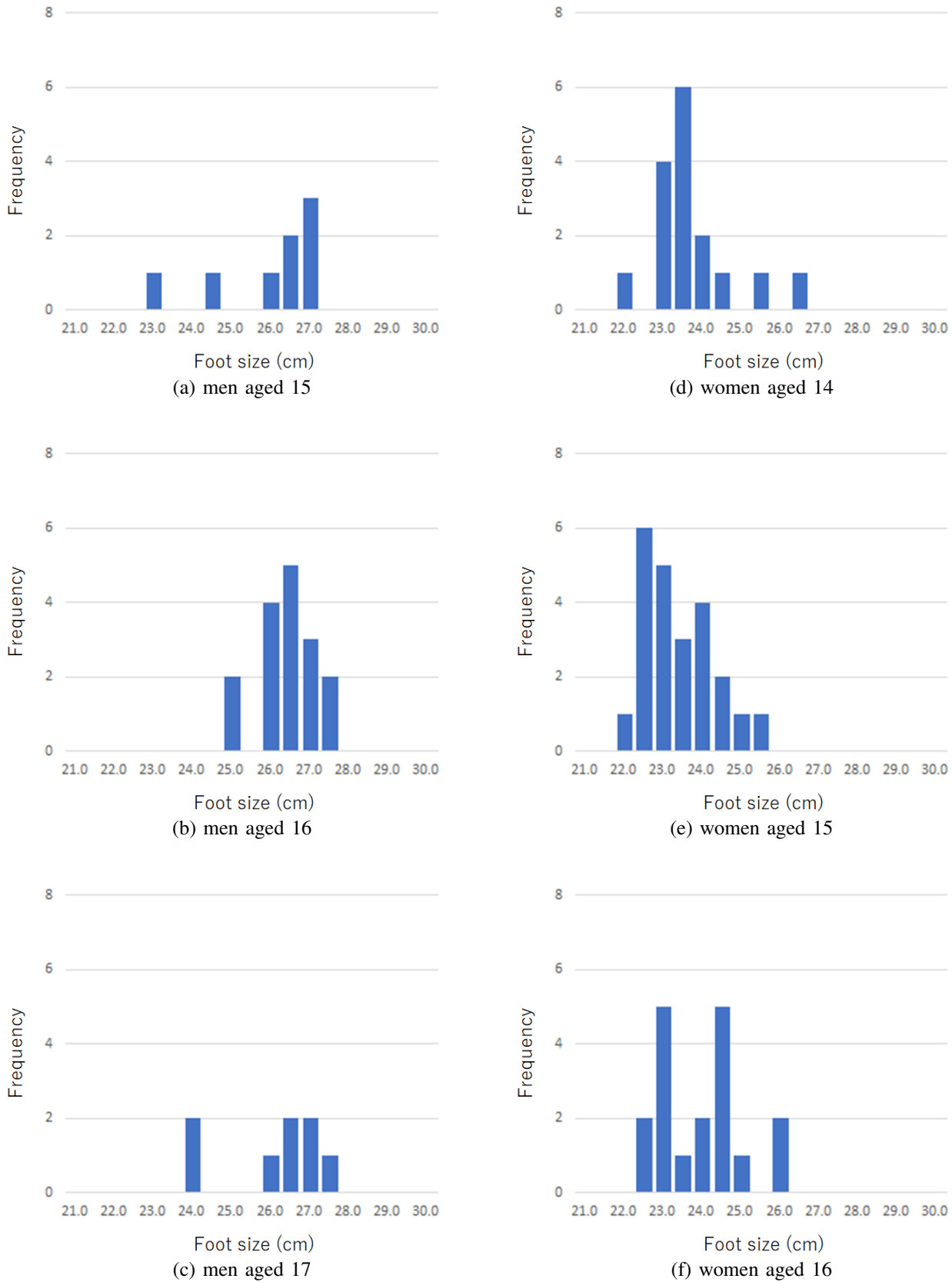


Figure 7. The histograms of foot sizes of submitters who disclosed that they were men aged 15-17 and women aged 14-16 (bin width = 1cm).

average of shoe sizes in Japan surveyed by JLIA.

The results of the Shapiro-Wilk test of normality and the Welch's test rarely happened when many submitters disclosed their ages, genders, and foot sizes dishonestly. As a result, it is assumed that most of the submitters disclosed their ages, genders, and foot sizes honestly.

V. CONCLUSION

In this paper, we investigated tweets disclosing submitters' personal profile items and analyzed submitters' ages, genders, heights, and foot sizes statistically. The results of the statistical analysis showed that it is likely that most of the submitters disclosed their personal profile items honestly. These personal profile items can threaten their privacy and security even if they use non-real name accounts. We are investigating whether submitters were concerned about their privacy and security risks caused by submitting tweets disclosing their personal profile items honestly [26]. Furthermore, we intend to conduct the same statistical analysis on tweets in languages other than Japanese.

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