A Proposal of a Scoring Method of Impatience with a Text-based Emergency Call to Fire Department

Yudai Higuchi, Takayoshi Kitamura, Tomoko Izumi and Yoshio Nakatani

***Abstract*—Japan is a country prone to earthquakes. However, there are other types of disasters such as typhoons, floods, volcanoes, and landslides. These disasters cause significant damage in affected areas. During large disaster events, the fire departments of affected areas are expected help these areas. When a disaster occurs, a huge amount of reports are sent to the fire department by telephone so there is a problem that the telephone lines get saturated. Reporting by text using Social Networking Services (SNS) such as Twitter and LINE has attracted attention. In general, fire brigades who respond to the call may judge the urgency of the situation from the tone of the person reporting, but text report cannot do this.**

Therefore, in this research, we propose a method for judging the impatience of a caller from their behavior during the creation of a text message.

***Keywords*—Disaster, Emergency call, Smartphone, impatience**

I. Introduction

According to a 2015 report published by the Central Disaster Prevention Council, which is one of the agencies on important policies of the Cabinet of Japan, there is a high possibility for the occurrence of Nankai megathrust earthquake and an earthquake that directly hits the Tokyo area, and it has also been pointed out that the earthquake will cause enormous damage to a vast area from Kanto region (eastern area) to Kyushu region (western area)[1].

In the Great East Japan Earthquake occurred on March 11th, 2011. Regardless of whether or not the equipment for the public communication network was physically damaged due to the earthquake and tsunami, enormous damage occurred in a wide area causing a surge in emergency calls. It was reported that the fire department could not deal with these situations [2].In recent years, Social Networking Services (SNS) has been utilized when such large-scale disasters occur. SNS is a service provided to build social connections and communities on the Internet. LINE [3] and Twitter [4] are widely used in Japan. Internet lines are said to be relatively strong against disasters [2]. Even in the Great East Japan Earthquake, there were many cases of emergency request using SNS on the Internet, and its usefulness has been pointed out [2].

However, voiceless emergency calls using SNS cannot convey users' emotions such like tension and impatience. In interviews with the fire department conducted by the authors of this paper, it was found that the fire department sometimes judges the urgency of the situation from the voice tone of the reporting person. Therefore, in addition to the text information, a system that can extract the tension level from the text and the situation at the time of input is required.

In this research, we propose a system for judging the degree of impatience of a caller from the process of creating a message in SNS and the caller's behavior.Furthermore, we examined whether or not it is useful as information for estimating the impatience of the reporting person taking the shaking of the hands and body, mistakes and their occurrence, soliloquy, and typing speed as a reference.

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II. Related work

A. Method to Estimate Emotions from an Input Text

Matsubayashi et al.[5] proposed a method to classify emotions into five categories; delight, anger, sorrow, pleasure and apathy using tweets posted on Twitter[4] to estimate emotions from sentences posted on SNS.

In the evaluations to estimate the emotions from sentences posted on Twitter using an emotional expression dictionary, the authors created a set of training data by assigning to assign five feelings joy, anger, sorrow, pleasure, and emotion to the tweet labels. This was possible by generating feature vectors using Word2Vec [6] and classifying random forest suitable for large amounts of data.

Although there is a method to estimate the emotion of the input person from the contents of the text, only the text information is analyzed, but this method do not consider whether or not the person intentionally inputted a text sentence.

B. Research on Acquiring Information from Input Text

There have been many efforts to extract information on editing process from sentences such as the found in e-mails. Kadono et al. [7] focused on the behavior of the sender in the writing process extract information that seems to be equivalent to non-verbal clues from differences situation of sentence creation, as well as inferring the situation. The extracted information that was focused in this work is listed

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below.

・Total message creation time: The time from opening the message creation window until pressing the message send button.

・Total number of characters: Number of characters included in the sent message

・Total number of keystrokes: Number of keystrokes during message creation.

・Total number of keystrokes of the deletion key: Total number of keystrokes of the Delete key and Backspace key during the message creation.

This work obtained the message creation time, typing speed, and correction rate based on this information. The authors pointed out that we could infer the psychology and situation of the sender.

Although research to extract information on editing process of e-mail at the time of text entry exists in this way, there is no research for extracting the situation of a caller during an emergency.

C. Method to Estimate the Emotions from Motions

Tamura et al. [8] proposed a system that distinguishes the four emotions of neutral, sadness, joy and anger from walking using a single acceleration sensor and a part of biological motion data (movement of a joint piece in the body). In the evaluation, the subjects wore a single acceleration sensor that recorded the time and the force data from the acceleration information of three axes obtained from walking motions while exercising neutral, sadness, joy, anger and emotions. Data including spatiality and dynamics were used as feature quantities and the feature quantities were used as discriminator input to differentiate four emotions.

D. Study on Measurement of Time Anxiety

Tamura et al. [9] employed the items listed on Table I for a measure of time anxiety.

However, this study attempt to quantitatively extract anxiety and fear using time, as this study covers in this paper.

III. Experiment

A. Outline of the Experiment

In this research, we propose a method to estimate the degree of impatience from behaviors such as the shaking of hands and body at the time of inputting text to an emergency report using, mistakes, number of corrections, soliloquy, and typing speed.

For this reason, in this research, we conducted experiments using smartphones and determinate what kind of information obtained from smartphones is effective for estimating the impatience of the person reporting using two experiments.

In this research, we assume on scenario where a person reporting uses a text-based reporting system using a smartphone in an emergency situation. Therefore, in the experiment in this research, an application created using Swift 3.0 [10] was installed on Apple iPhone 6 [11]. In addition, for display emergency notifications, texts and moving images projected on the screen were used.

B. Measured Data

In this research, only data obtained by an iPhone 6 is used.

TABLE I
Time-related Anxiety as a Measure of Time Anxiety

Scales
・ It will be confusing if things do not proceed as they always do
・ I feel very impatient if my job does not go well
・ When tackling something, there is not enough time to panic
・ I am worried that I will be in an unpredictable situation
・ I get confused when my work is interrupted
・ Feeling upset if there is a sudden schedule change
・ I cannot handle other things if I do not finish the thing that I currently do magnetization
・ I cannot get to work unless I schedule it
・ I am a person who is being blown away by time than others
・ When unexpected things happen, I do not know what to do

TABLE Ⅱ
Measured Data

Data	Content
Shakes of user	Acceleration information acquired from the acceleration sensor
Total message creation time	Time from when the message creation window is opened until the send button is pressed
Total number of characters	Total number of readable characters contained in the message sent in the end
Total number of keystrokes of deletion key	Total number of keystrokes of the Delete key and Backspace key during the message creation
Number of wrong characters	Number of unreadable characters in the sent message
Achievement rate	Percentage indicating how much the specified message content can be entered
User's own soliloquy	The content of the voice sound such as a "Wow" or "Oh" that the user murmured during message creation, the size of the voice and the number of utterances

Information obtained by other devices is not considered. Their data covered in this research and the outline are listed above on Table Ⅱ.

In this research, the values of the above items were used to calculate the values of the character input speed, the wrong character transmission rate, the correction rate, the soliloquy rate, and the achievement rate expressed by the equations (1) to (4). The reason for calculating these values is to eliminate variations due to the number of sentences to be created. For example, when preparing a report message containing many contents, the total creation time, the total number of characters, the number of keystrokes of deletion key and the number of soliloquys will naturally increase, and simply by comparing these values, it was not possible to determine which information is useful for determining the degree of impatience. Therefore, in this research, we use character input speed, wrong letter transmission rate, correction rate, soliloquy utterance rate and achievement rate.

$$CharacterInput\,Speed = \frac{Total\ Number\ of\ Characters}{Total\ message\ Creation\ Time} \quad (1)$$

$$Wrong\ Character\ Transmission\ Rate = \frac{Number\ of\ Wrong\ Characters}{Total\ Number\ of\ Characters} \quad (2)$$

$$Correction\ Rate = \frac{Number\ of\ Keystrokes\ of\ deletion\ Wrong\ key}{Total\ Number\ of\ Characters} \quad (3)$$

$$Solioquy\ Rate = \frac{Solioquy\ Talk\ Count}{Total\ Number\ of\ Characters} \quad (4)$$

Furthermore, in this paper, we examine which editing process was useful for judging the degree of impatience by using the difference between the normal process and the emergency process information and the degree of impatience of the user. Normal process means that the subject inputs letters as usual, and emergency is to input characters even in an impatient state. Obtain useful editing process information, by analyzing the difference in the character input speed, the wrong character transmission rate, the correction rate, the achievement rate and the degree of impatience heard by the examinee after inputting in normal time and emergency time.

For data on text, we used a screen capture software [12] manufactured by Apowersoft Ltd. For the content and behavior of solitary idiom we use camera C930e [13] manufactured by Logicool to acquire data. In the preliminary study, acceleration information representing the shakes of the user during input of the message and soliloquy rate could not be confirmed for each user, so it was not considered in this experiment.

C. Outline of Experiment 1

Figures 1 and 2 show examples of screens of the system used in Experiment 1. The input dialog on the screen is general smartphone text dialog. So it is not dependent on the interface of the SNS system.

The users were assigned with the task to describe the contents of sentences shown on a projector in the text input area of the screen. We first asked the user to input text without a time limit, and then performed the same task with a time limit based on the completion time of a user with a time longer than two hours on the first task. Also, to catch the attention of the user, in the Experiment 1, the screen background shifted from FIG. 1 to FIG. 2 when time limit approached. (Yellow outer frame region). Regarding the degree of impatience, we asked users to respond percentage on how much they felt impatience after each task.

The users were 15 university students majoring in informatics (13 male, 2 females). Fig. 3 shows the scenery of Experiment 1.

D. Results of Experiment 1

The average of impatience obtained between a normal situation and an emergency was 35.67 [%]. The average of character input speed was 0.03 [characters / second]. The average of wrong character transmission rate was -0.001 [number of wrong characters / total number of characters]. The average of the correction rate was 0.01[total number of keystrokes of deletion key / total number of characters], and the average of the achievement rate was 97.03 [%]. In addition, a multiple regression analysis was performed using the difference in the degree of impatience as an explanatory variable for the variables; character input speed, wrong character transmission rate, and correction rate difference. As a result, as shown in Fig. 4, we found that there was a possibility of relationship in the difference degree of impatience with character input speed and the correction rate. From these results, we can conclude that if the degree of impatience increase, the correction rate and the character input speed decrease.

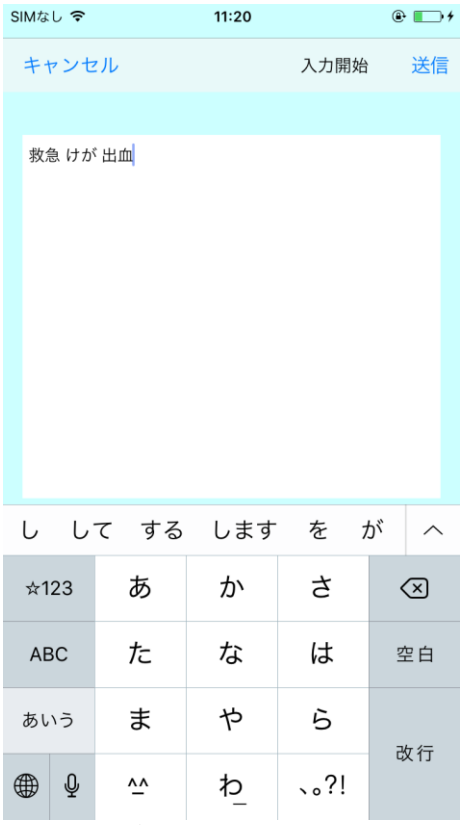

Fig. 1. Screenshot of the system used in Experiment 1 (normal)

Fig. 2. Screenshot of the system used in Experiment 1 (emergency)

E. Outline of Experiment 2

Figs. 5 and 6 show screen examples of the system used in the Experiment 2. From the system that was used last time, it

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Fig. 3. Scenery of Experiment 1

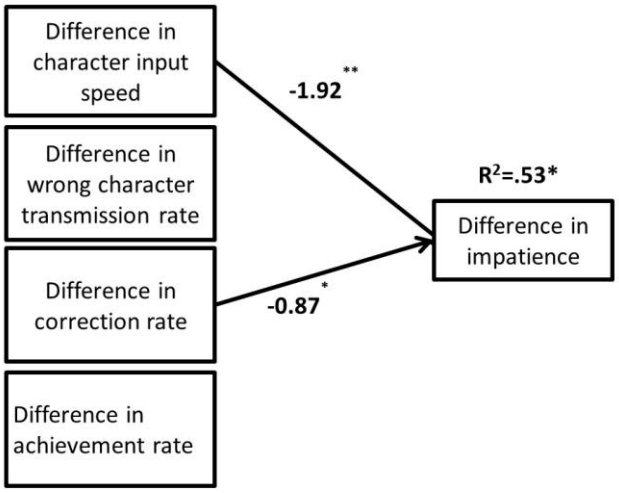

Fig. 4. Result of Multiple regression analysis in Experiment 1

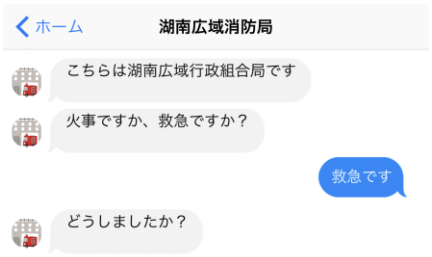

Fig. 5. Screenshot of the system used in Experiment 2 (reporting)

became closer to the input screen of text with a general smartphone. FIG. 7 shows the scenery of Experiment 2.

Fig. 6. Screenshot of the system used in Experiment 2 (warning)

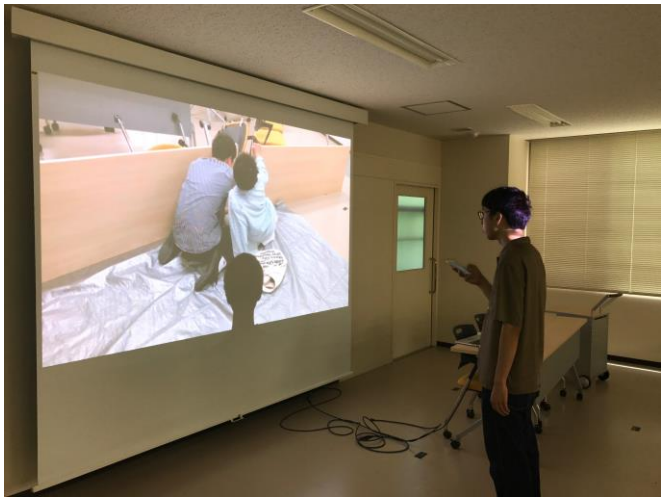

Fig. 7. Scenery of Experiment 2

In Experiment 2, in order to create it a closer experience to where reports are actually made in emergency calls, users freely describe the content of the report while watching the video within a specified time limit. The contents of the video reproduced a situation where a person got stuck in the furniture and could not move. To increase user's impatience, an alert is displayed twice to indicate that the remaining battery level is decreasing during the experiment. Furthermore, in order to restrict the degree of freedom of text dialog contents, interactive format was adopted so that the artificial agent is interpreting the situation. The questions ask by the artificial agent is as follows.

- Is it a fire or an emergency?
- What's wrong?
- How many people need help?
- Please tell me more about the symptoms
- What are the ages of those who want help?
- Where are you?

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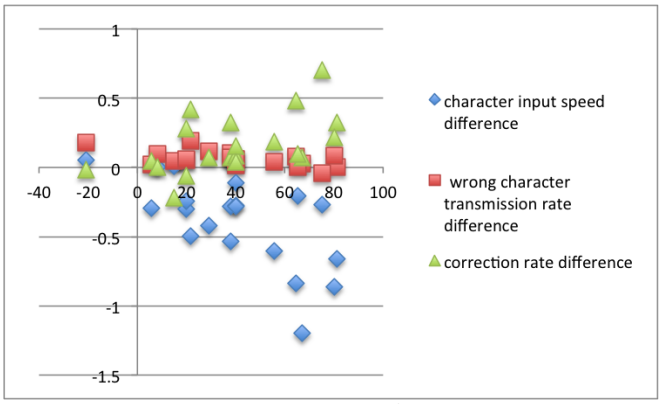

Fig. 8. Correlation Chart showing the level of impatience between a normal situation and an emergency

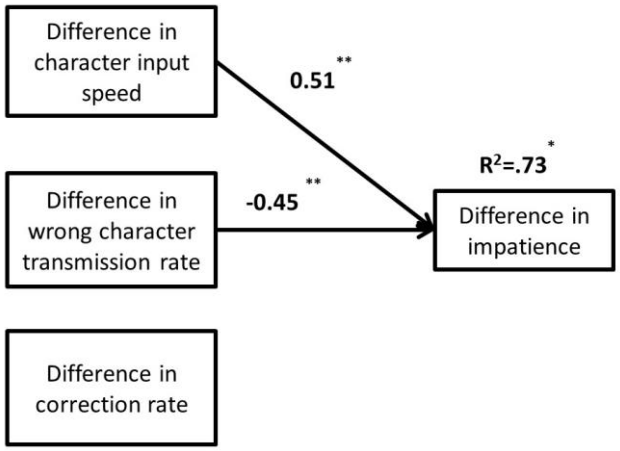

Fig. 9. Result of Multiple regression analysis in Experiment 1

・On what floor are you?

Following normal task definition, each message entered by the user does not have a time limit. Also, we asked how much their impatience after each task and assigned a percentage based on their answers.

The subjects were 20 university students majoring in informatics (17 males and 3 females).

F. Results of Experiment 2

The average in the difference of impatience between a normal process and an emergency was 26.78 [%]. The average of character input speed was -0.33 [characters / second]. The average of wrong character transmission rate was 0.040 [number of wrong characters / total number of characters]. The average of the correction rate was 0.15[total number of keystrokes of deletion key / total number of characters]. Fig. 8 shows the correlation users' impatience between a normal situation and an emergency.

We performed a multiple regression analysis using the difference in the degree of impatience as an explanatory variable as well as the target variable, the character input speed, the wrong character transmission rate, and the correction rate, as shown in Fig. 9.

We found that there was relationship in the difference degree of impatience with the character input speed and the wrong character transmission rate.

From these results, it can be concluded that if the degree of impatience rises, the wrong character transmission rate and the character input speed will decrease. The reason why there is no correction rate is that it is considered that the flexible typing which is the current task is less likely to input the Back space key than in the specified sentence.

IV. Conclusion

In this paper, we describe experiments to obtain useful data to evaluate the degree of impatience to create a method to judge the degree of impatience from a text typing process.

In this experiment, we found that there is a measurable difference between emergency and normal situation in the degree of impatience and there is a relationship in the character input speed and the wrong character transmission rate. In the future we plan to increase the number of users to improve our analysis.

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