An Evaluation of Correlation between Difference of WLAN Quality and Results of Lifelog Analysis Application

Akika Yamashita (akika@ogl.is.ocha.ac.jp) Masato Oguchi (oguchi@computer.org)

Ochanomizu University

In recent years, the demand for multimedia communications over wireless LAN (WLAN) is on the rise, and various kinds of research works related to WLAN have been performed. Although many researchers have investigated WLAN to improve the communication quality, how the difference of communication quality affects the behavior of the data analysis applications using transferred data has not been discussed in detail. Thus, in this paper, we have focused on how the difference of communication quality will affect the correct answer rate of the lifelog analysis application and shown the correlation between the packet loss rate during data transfer and the correct answer rate of the application.

The purpose of this research work is to show the correlation between the quality of WLAN communication and the correct answer rate of the lifelog analysis application. As an example of the lifelog analysis application, we have developed and used 'Verbalization application[1]', which is a system that converts sensor data such as video image data and acceleration data collected with sensor terminals into verbalization of human's actions, for example, "open the door", "sit on the chair" and so on. In this verbalization application, verbalized phrases will be outputted while human's action continues. Input data is processed with either two different probability models, Bayesian Classifier or Hidden Markov Model (HMM). Note that inputted stream data is processed per each frame in Bayesian Classifier. On the other hand, inputted stream data is processed per a group of frames in HMM (Figure. 1).

In the data quality evaluation experiment, lifelog data is collected in the sensor space(Figure. 2). It is collected by cameras need to be sent to PC immediately through a WLAN. When the data is being sent, a packet loss is supposed to occur in the following two reasons:

1. The bandwidth is shared with other communications because many terminals use the same access point (AP)
2. There is radio wave interference in the background

The packet will be lost uniformly and randomly in case 1, and will occur in bursts in case 2. In this paper, we have executed the experiments to evaluate the case 1.

The result of experiments is shown in the Figure. 3 and Figure. 4. We have connected 0-5 background terminals, Android terminal Nexus S (NS) to add a load on AP. As a result, the throughput of video data transmission terminal is five times as high as that of NS when the number of NS is one and gradually drops as the number of NS increases. In addition the packet loss happens and MAC frame retransmission rate rises as the number of NS increases.

As shown in the Figure. 4, when the number of NS is five and packet loss rate is about 70%, the correct answer rate of verbalization application drops to about 60% in Bayesian Classifier and drops to 0 % in HMM. It appeared that the difference between Bayesian Classifier and HMM is bigger than 60% at same packet loss rate. The correct answer rate is calculated by following formula:

$$C = \frac{V_q - V_{extra} - V_{error}}{V_{100} + V_{extra} + V_{error}} \times 100(\%)$$

When extra verbalization (**V**extra) or verbalization error (**V**error) occurs, the correct answer rate (**C**) decreases from perfect answer (**V**100) based on **V**q (verbalization when the input data is q %). The case of HMM drop earlier than that of Bayesian Classifier because HMM executes the data processing per group of frames, and thus the relevance to previous and/or following frames should be lost by packet losses.

We have shown the correlation between the packet loss rate of WLAN communication quality and correct answer rate of lifelog analysis application. As a future work, we will evaluate case 2 described above and compare the result of case 1 with that of case 2 to clarify how these two cases will affect the behavior of application.

References

[1]E. Ochiai, et al.,"Efforts to verbalize human activity in given space based on the predict model," JSAI2010, 2G1-OS3-2, June. 2010.

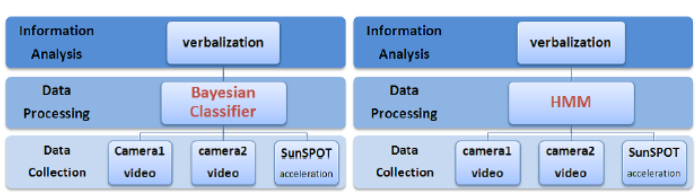

Fig. 1: Data quality evaluation framework

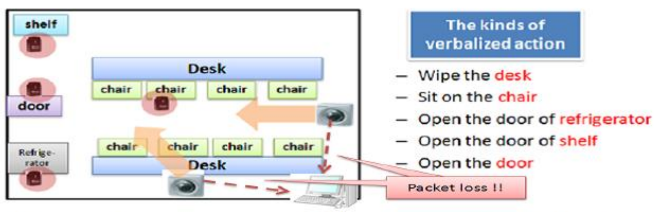

Fig. 2: Sensor space and the target of verbalization

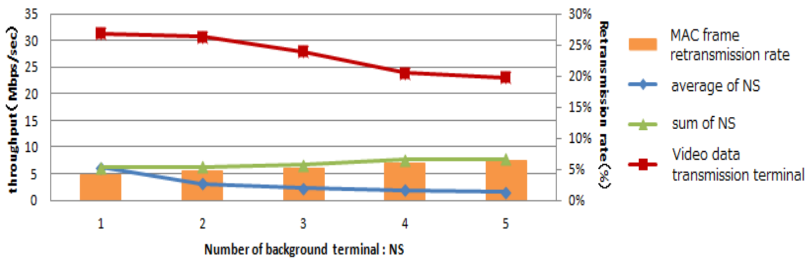

Fig3. Video data transmission terminal

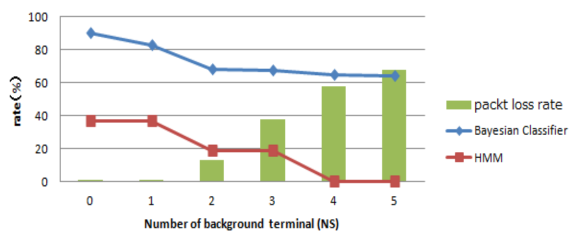

Fig. 4 Packet loss rate and correct answer rate of verbalization application