User Identification on Smartphones from Accelerations based on LSTM and Deep Convolutional LSTM

Yoshihaya TAKAHAHSI[†a)], ***Non member***, **Masato OGUCHI**[††],***Member***, **Takeshi KAMIAYMA**[†††], ***Non member***, ***and*** **Saneyasu YAMAGUCHI**[†], ***Member***

1. Introduction

Recent advances in artificial intelligence and sensing technology enabled many types of inference from sensed data. In the work of [1], a method for user identification based on an accelerometer using LSTM(Long Short Term Memory) was proposed. In this paper, we propose to improve this method by using Deep Convolutional LSTM instead of LSTM.

2. Related Work

A method for identifying a user from pre-given target users was proposed [1]. This consisted of three phases. First, this measured the acceleration of each user during walking in advance. Second, this trained with these data and creates a model using LSTM. Third, it identified the user from the acceleration data for identification by using a model.
Ordóñez et al. proposed a generic deep framework for human activity recognition (HAR) based on convolutional and LSTM recurrent units [2]. They showed the advantage of a deep architecture based on the combination of convolutional and LSTM recurrent layers for HAR.

3. Proposed Method

We propose to improve the existing method [1] by utilizing deep convolutional LSTM instead of LSTM.

4. Performance Evaluation

We measured accelerations of eight users while walking with a smartphone (Nexus5x). Each identification was performed by inputting 2,048 sets of three-dimensional acceleration. The accelerometer gave 50 sets per second. 2,048 sets of data correspond to around 40 seconds. Each user's data contains five sets of 2,048 accelerations. The performance was evaluated with 40-fold cross-validation. The softmax function was used as the activation function of both methods. The cross-entropy was used as the error function in both methods. Adagrad and Adam were used as optimization functions in LSTM and Deep Convolutional LSTM methods, respectively. The number of the intermediate layers of LSTM was one. The numbers of Deep Convolutional LSTM were 3 (CNN) and 2 (LSTM). The numbers dimensions of the intermediate layer were 128 in both methods.
Fig. 1 shows the accuracies. The results indicate that the proposed method improved the existing method.

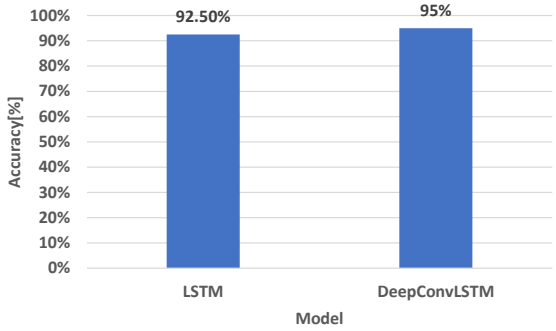

Fig 1 Eight-class identification

5. Conclusion

In this paper, we proposed to apply Deep Convolutional LSTM on user identification and showed its advance.

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References

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[†]The author is with Kogakuin university
[††]The author is with Ochanomizu University
[†††]The author is with Nagasaki University
[a)] E-mail: cm21031@ns.kogakuin.ac.jp