

Multi-attention Deep Recurrent Neural Network for Nursing Action Evaluation Using Wearable Sensor

Today, there is an increasing demand of qualified and skillful nurses in our society due to the problems as aging population and so on. However, the shortage of nursing educators and high student-educator ratio at nursing school result that nursing student cannot receive enough individualized supervision and feedback when they are training nursing skills. Thus, a nursing action evaluation system that can assess the performance of students when practicing specific nursing actions becomes an urgent need. Such an evaluation system should be designed with less hand-crafted procedures for its extensibility. Additionally, realizing high accuracy of nursing action recognition, especially fine-grained action recognition remains a problem. This reflects in the recognition of the correct and incorrect methods when students perform a nursing action.

To satisfy above requirements, we propose a multi-attention deep recurrent neural network (MA-DRNN) for nursing action recognition, by applying the attention mechanism to RNN-based architecture. To validate the effectiveness of the proposed method, we select two critical nursing actions as standing-up and turning-around of a nursing skill called patient transfer as target actions. In order to train and test the model, data samples of correct and incorrect methods for performing these target actions are collected by attaching 6 inertial measurement unit sensors on patient's body (see Fig.1). The experimental results demonstrate that the proposed model outperforms the state-of-the-art wearable sensor based methods and achieves approximately 96% recognition accuracy.

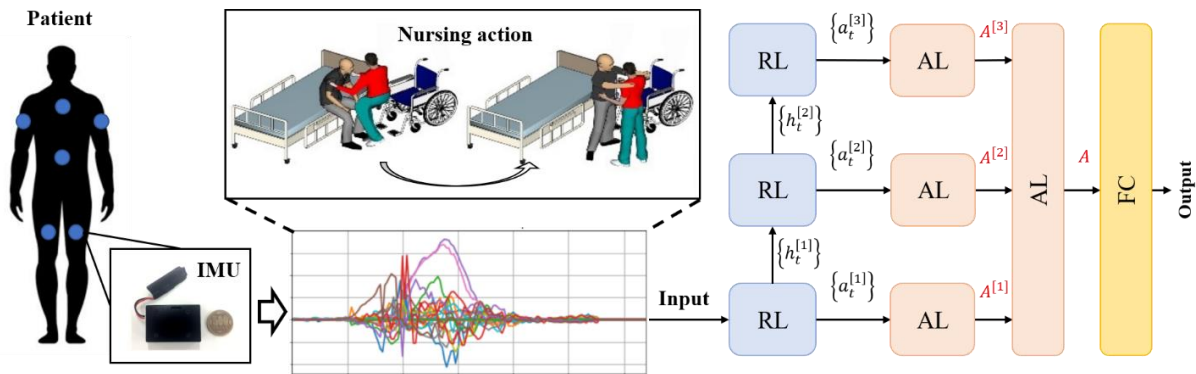


Figure 1. Nursing action evaluation: There are 6 IMU sensors attached on different parts of patient's body. As for recognition model MA-DRNN, RL refers to recurrent layer, AL refers to attention layer and FC refers to fully connection layer.

Keywords: nursing skill evaluation, fine-grained action recognition, recurrent neural network, attention mechanism

References:

- [1] Zhong, Z., Lin, C., Ogata, T., & Ota, J. (2020, March). Multi-attention deep recurrent neural network for nursing action evaluation using wearable sensor. In Proceedings of the 25th International Conference on Intelligent User Interfaces (pp. 546-550).