Classification of Human Motions Using Dynamic On-body Creeping Wave Mechanisms

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In recent years, there are emerging interests in utilizing on-body wireless channels to detect and identify human daily activities for remote health monitoring and athletic training purposes [*Guraliuc, et. al., IEEE Trans. Inf. Technol. Biomed., vol. 15, no. 3, pp. 474–480, May 2011*]. Compared with other traditional motion tracking approaches, such as motion-capture technique, wearable accelerometer, and gyroscope sensors, the on-body channel based method removes the use of additional on-body sensor modules to save both power usage and cost. The classification accuracies were found to be above 80%, which are comparable to those of traditional approaches.

In this presentation, we utilized dynamic on-body creeping wave mechanisms to classify human activities during daily lives. Two types of activities are under monitoring: compound activities involving upper limb movements, such as arm swinging and boxing; and small-scale activities over localized region of the body, such as head and neck movement. Correspondingly, two types of creeping waves are measured for classification purposes: around-torso creeping wave for compound activities and around-neck creeping wave for head and neck motions.

As a first step, we measure both creeping wave mechanisms at 2.45 GHz for a non-moving human subject. The measurement results are compared to those of full-wave simulations and theoretical predictions. Next, the dynamic creeping wave propagation are measured as the subject performs different types of compound and small-scale activities. Multiple male and female subjects of different ages and body sizes are recruited for experimental trials. Finally, a deep convolutional neural network algorithm is introduced for the classification purposes. It is found that the classification accuracy can be above 90% for both compound and small-scale activity classifications.