Real-time Arm Skeleton Tracking and Gesture Inference Tolerant to Missing Wearable Sensors

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**ABSTRACT**

This paper presents ArmTroi, a wearable system for understanding and analyzing the detailed arm motions of people primarily by using the motion sensors from wrist-worn wearable devices. ArmTroi can achieve real-time 3D arm skeleton tracking and reliable gesture inference tolerant to missing wearable sensors for enabling numerous useful application designs. We have coped with two major challenges through ArmTroi. First, the skeleton of each arm is determined from the locations of the elbow and wrist, whereas a wearable device only senses a single point from the wrist. We find that the potential solution space is huge. This underconstrained nature fundamentally challenges the achievement of accurate and real-time arm skeleton tracking. Second, wearable sensors may not reliably provide sensory data. For example, devices are not worn by the user, yet the learning tools for gesture inference, such as deep learning, typically have static network structures, which require nontrivial network adaptation to match the input’s varying availability and ensure reliable gesture inference. We propose effective techniques to address above challenges, and all computations can be conducted on the user’s smartphone. ArmTroi is thus a fully lightweight and portable system. We develop a prototype and extensive evaluation shows the efficacy of the ArmTroi design.

This paper will be presented in the 17th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys 2019), 17-21 June 2019, Seoul, South Korea.

Supervisor: Dr. Zhenjiang Li

Research interests: Developing intelligent mobile and wearable sensing technologies from IoT systems, machine learning and cyber security.

All are welcome!

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