Motion sensor data anonymization by time-frequency filtering

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The emergence of Internet of Things (IoT) devices have paved the way for personal monitoring. These devices record electronic measurements from a variety of sensors (accelerometer, gyroscope and magnetometer) and send the person data to an application server to be analyzed. This analysis implies advanced signal processing and machine learning algorithms to provide a variety of services such as number of steps, burned calories, traveled distance and sleep monitoring.

However, the data captured by these sensors can also contains private information about users without their awareness where highly sensitive information can be inferred such as the user's health status or even the user identity. Yet, the complex workflow of collected data multiplies the security and privacy risks, including the data collection and transmission, as well as the processing and the storage.

In this presentation, we propose a privacy-preserving framework for activity recognition. The method consists of a two-step process. First, acceleration signals are encoded in the time-frequency domain by three different linear transforms. Second, we propose a method to anonymize the acceleration signals by filtering in the time-frequency domain. Finally, we evaluate our approach for the three different linear transforms with a neural network classifier by comparing the performances for activity versus identity recognition. We extensively study the validity of our framework with a reference dataset: results show an accurate activity recognition (85%) while limiting the re-identifation rate (32%). This represents a large utility improvement (19%) against a slight privacy decrease (10%) compared to state-of-the-art baseline.