ABSTRACT

THESIS PAPER: Real-Time Human Activity Recognition Based on Radar

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Most smart systems such as smart home and smart health respond to human's locations and activities. However, traditional solutions either require wearable sensors or lead to leaking privacy. This work proposes a deep learning based ambient radar solution that is a real-time, privacy-preservative, and lightness resistant system. In this solution, we use a low-power, Frequency-Modulated Continuous Wave (FMCW) radar array to capture the reflected signals and then construct 3D image frames from the wireless radar signals. Then deep learning is applied to model and recognize various human activities from the wireless radar signals. This solution includes: 1) a data preprocessing mechanism to remove static background reflection, 2)a signal processing mechanism to transform received complex radar signals to a matrix containing spatial information, 3) a deep learning scheme to filter broken frames which are caused by the rough surface of human body, and 4) a deep recurrent neural network system to recognize human activities based on radar imaging results. This solution has been extensively evaluated in a research area for real-time human activity imaging that is recognizable for various activities. The results show that the solution is able to generate wireless imaging frame-by-frame compared to camera recorded video, and it can achieve over 86.7% accuracy in recognizing six different types of human activities based on the wireless radar imaging.