Improved Human Activity Recognition Using Majority Combining of Reduced-Complexity Sensor Branch Classifiers

Authors: Webber J, **Mehbodniya A, Arafa A, Alwakeel A.**

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Abstract: Human activity recognition (HAR) employs machine learning for the automated recognition of motion and has widespread applications across healthcare, daily-life and security spaces. High performances have especially been demonstrated using video cameras and intensive signal processing such as the convolutional neural network (CNN). However, lower complexity algorithms operating on low-rate inertial data is a promising approach for portable use-cases such as pairing with smart wearables. This work considers the performance benefits from combining HAR classification estimates from multiple sensors each with lower-complexity processing compared with a higher-complexity single-sensor classifier. We show that while the highest single-sensor classification accuracy of 91% can be achieved for seven activities with optimized number of hidden units and sample rate, the classification accuracy is reduced to 56% with a reduced-complexity 50-neuron classifier. However, by majority combining the predictions of three and four low-complexity classifiers, the average classification accuracy increased to 82.5% and 94.4%, respectively, demonstrating the efficacy of this approach.