

Abstract

To date, convolutional neural networks have played a dominant role in sensor based human activity recognition (HAR) scenario. In 2021, researchers from four institutions almost simultaneously released their newest work to arXiv.org, where each of them independently presents new network architectures mainly consisting of linear layers. This arouses a heated debate whether current research hotspot in deep learning architectures is returning to MLPs. Inspired by recent success achieved by MLPs, in this paper, we first propose a lightweight network architecture called all-MLP for HAR, which is entirely built on MLP layers with a gating unit. By dividing multi-channel sensor time series into nonoverlapping patches, all linear layers directly process sensor patches to automatically extract local features, which is able to effectively reduce computational cost. Comparing with convolutional architectures, it takes fewer FLOPs and parameters but achieves comparable classification score on WISDM, OPPORTUNITY, PAMAP2 and USC-HAD HAR benchmarks. The additional benefit is that all involved computations are matrix multiplication, which can be readily optimized with popular deep learning libraries. This advantage can promote practical HAR deployment in wearable devices. Finally, we evaluate actual operation of all-MLP model on a Raspberry Pi platform. We conclude that the new architecture is not a simple reuse of traditional MLPs in HAR scenario, but is a significant advance over them.

Keywords:

Human Activity Recognition, Deep Learning, all-MLP, Sensor, Convolution Neural Networks, Wearable Device