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Codebook-based Electrooculography Data Analysis towards Cognitive Activity Recognition

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Abstract

With the advancement in mobile/wearable technology, people started to use increasingly a variety of sensing devices to track their daily activities as well as health and fitness conditions in order to improve the quality of life. This work addresses an idea of eye movement analysis, which due to the strong correlation with cognitive tasks can be successfully utilized in activity recognition. Eye movements are recorded using an electrooculographic (EOG) system built into the frames of glasses, which can be worn more unobtrusively and comfortably than other devices. Since the obtained information is low-level sensor data expressed as a sequence representing values in constant intervals (100Hz), the cognitive activity recognition problem is formulated as sequence classification. However, it is unknown what kind of features are useful for accurate cognitive activity recognition. To overcome this, a codebook approach is adopted where the sequences of recorded EOG data are described by the distribution of characteristic subsequences – codewords, obtained by clustering a large number of subsequences. Further, statistical analysis of the codeword distribution results in discovering features which are characteristic to a certain activity class. Experimental results demonstrate good accuracy of the codebook-based cognitive activity recognition reflecting the effective usage of the codewords.

Keywords: Ambient assisted living, Cognitive activity recognition, Electrooculography (EOG), Sequence classification, Codebook approach

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