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Personalizing Human Physical Life Routines Recognition over Cloud-based Sensor Data via AI and Machine Learning

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Abstract : Pervasive computing is a growing research field that aims to acknowledge human physical life routines (HPLR) based on body-worn sensors such as MEMS sensors-based technologies. The use of these technologies for human activity recognition is progressively increasing. On the other hand, personalizing human life routines using numerous machine-learning techniques has always been an intriguing topic. In contrast, various methods have demonstrated the ability to recognize basic movement patterns. However, it still needs to be improved to anticipate the dynamics of human living patterns. This study introduces state-of-the-art techniques for recognizing static and dy-namic patterns and forecasting those challenging activities from multi-fused sensors. Further-more, numerous MEMS signals are extracted from one self-annotated IM-WSHA dataset and two benchmarked datasets. First, we acquired raw data is filtered with z-normalization and denoiser methods. Then, we adopted statistical, local binary pattern, auto-regressive model, and intrinsic time scale decomposition major features for feature extraction from different domains. Next, the acquired features are optimized using maximum relevance and minimum redundancy (mRMR). Finally, the artificial neural network is applied to analyze the whole system's performance. As a result, we attained a 90.27% recognition rate for the self-annotated dataset, while the HARTH and KU-HAR achieved 83% on nine living activities and 90.94% on 18 static and dynamic routines. Thus, the proposed HPLR system outperformed other state-of-the-art systems when evaluated with other methods in the literature.

Keywords : artificial intelligence, machine learning, gait analysis, local binary pattern (LBP), statistical features, micro-electro-mechanical systems (MEMS), maximum relevance and minimum re-dundancy (MRMR)
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