ABSTRACT

PARAMETER OPTIMIZATION OF SUPPORT VECTOR MACHINE METHOD WITH PARTICLE SWARM OPTIMIZATION ALGORITHM FOR PHYSICAL ACTIVITY CLASSIFICATION

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The development of wearable technology such as smartwatches has provided convenience in real-time health and fitness monitoring. The use of these devices for physical activity data collection is important in health research, especially in the classification of activity types using machine learning methods. However, the Support Vector Machine (SVM) method in previous studies showed less than optimal accuracy due to improper hyperparameters selection. This study aims to optimize SVM hyperparameters using the Particle Swarm Optimization (PSO) algorithm, focusing on the hyperparameters C and gamma (γ). The data used includes six types of physical activity, such as Lying, Sitting, Self Pace Walk, Running 3 METs, Running 5 METs, and Running 7 METs. The results show that PSO can significantly improve the accuracy of SVM. On Apple Watch data, the accuracy increased from 57.65% to 82.79% with optimal hyperparameters C = 353.84 and γ = 0.7046, using PSO parameter configuration c1 = 0.12, c2 = 1.2, w = 0.5 with 10 particles and 50 iterations. Meanwhile, on Fitbit data, the accuracy increased from 67.50% to 87.50% with optimal hyperparameters C = 454.59 and γ = 0.0855, using a similar configuration with a different inertia value, i.e. w = 0.7. The optimized model also showed a more stable and even classification performance across activity classes. These findings prove that the combination of SVM and PSO is effective in improving the accuracy of wearable data-based physical activity classification.

Keywords: Classification, Optimization, Physical Activity, PSO, SVM