ESTRATTA BASSANI

PROVA 3

T3.1 Il/la candidato/a descriva l'architettura di una rete convolutiva

T3.2 Il/la candidato/a descriva le componenti principali che compongono un'interfaccia aptica tipicamente utilizzata per il feedback di forza in un'applicazione di telemedicina

F3 – Il/la candidato/a definisca che cosa si intende con RSPP e quali sono i compiti cui esso è tenuto a svolgere.

INF3 – Il/la candidato/a descriva che cosa è una VPN e l'utilità della stessa

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An optimized hybrid deep learning model using ensemble learning approach for human walking activities recognition

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Abstract

Recent advancements in edge computing devices motivate us to develop a sustainable and reliable technique for multiple gait activities recognition using wearable sensors. This research work presents the multitask human walking activities recognition using human gait patterns. Human locomotion is defined as the change in the joint angles of hip, knee and ankle. To achieve the aforementioned objective, the data are collected for 50 subjects in a controlled laboratory environment using inertial measurement unit (IMU) sensors for 7 different activities. The IMU sensor is placed on the chest, left thigh, and right thigh. Total 100 samples are collected for all 7 activities. The sampling rate considered was 50 Hz. Following 7 walking activities are performed for all the 50 subjects: (i) natural walk, (ii) standing, (iii) climbing stairs, (iv) cycling, (v) jogging, (vi)running, (vii) knees bending(Crouching). The major contribution of this research paper is the design of four hybrid deep learning models to provide the generic activity recognition framework and tune the performance. The following combination of the deep learning model is designed for the classification of gait activities, namely, convolution neural network–long short-term memory (CNN–LSTM), CNN–gated recurrent unit (CNN–GRU), LSTM–CNN and LSTM–GRU. To support edge computing, the ensemble learning is utilized to optimized the model size. The proposed ensemble learning-based hybrid deep learning framework has provided a promising classification accuracy of 99.34% over other models. The other models namely CNN, LSTM, GRU, CNN–LSTM, LSTM–CNN, CNN–GRU, GRU–CNN have achieved 97.26%, 90.67%, 77.38%, 97.83%, 94.35%, 97.64%, 96.98% accuracy, respectively, on our HAG data set. The proposed technique is also validated on MHEALTH data set for comparative analysis. The hybrid deep learning model in combination with ensemble learning has outperformed other techniques. The optimized code can be used on small computation devices for walking activity recognition.

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Extended author information available on the last page of the article