A Heart-Rate-Controlled Animated Exercise Trainer Using Neural-Network-Based Adaptive Control

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Regular exercise helps maintaining physical fitness and preventing diseases. Many people choose to exercise at home by following training videos. Without feedback from the videos, the exercisers may not be able to control the intensity of their workouts in order to reach and maintain the heart rate within the suitable effective ranges, and especially not to overdo the exercises, which leads to heart attacks. This project presents an intelligent exercise training system that displays a virtual trainer in 3D animation to lead the exercises and monitors the exerciser's heart rate in order to automatically adjust the exercises and their intensities of the virtual trainer. The system consists of three components. The first component is a real-time, adaptive, heart rate predictor, using a neural network model. The second component is a model of heart rate slope as a function of the movement and intensity level, where multiple linear self-organizing maps, adaptively adjusted in real time, are applied. The final component is an adaptive controller algorithm that determines a necessary adjustment in the exercise routine. The system has been tested for its performance, such as the heart rate prediction errors and exercisers' satisfaction.

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