Comparison of genetic and general algorithms of MLPs in posture prediction based on 3D scanned landmarks

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Abstract

Since the introduction of the 3D anthropometric techniques, engineers and ergonomists have sought to exploit the potential of this exciting technology. The added components of human body shape provided by 3D measurements offer a more detailed description of human variation compared with traditional manual 1D or 2D data. With the 3D anthropometry, it is possible to work on the landmark coordinates in 3D space directly. This paper is focused on comparison of two different algorithms of artificial neural networks in predicting of human body posture. The input is a set of demographic data and the coordinates of the landmarks characterizing a given posture. The output is another set of landmarks characterizing the transformed postures. The artificial neural networks are based on the principles of back-propagation feed forward network. With the simulating of trained networks, the users can predict the landmark coordinates in 3D space from sitting posture to standing posture, vice versa. In workspace design and automobile interior design, this technique will help the designer and ergonomists to solve anthropometric problems more effectively compared with using traditional methods. Our conclusion has been that the genetic algorithm is computationally more efficient in predicting of human body postures than general algorithm, but it needs much more computer time and cost which leads to very slow training. General algorithm is better for experienced network designer since it saves a lot of time in manually optimization and still can have the good result as using genetic algorithm.

Introduction

With the development of the IT-knowledge, many opportunities have emerged to integrate ergonomics modules into CAD environments. Computer-aided ergonomic design (CAED) supports: (1) visualization of the exact workspace of human limbs, (2) defining and planning trajectories in the workspace, (3) designing ergonomic workplaces subject to specified cost functions, (4) facilitating the design of layouts and packaging, (5) verifying measured data and validate human models, (6) predicting realistic postures, and (7) optimizing designs based on specified cost functions (Karwowski et al., 1990). Therefore, CAED is essential for industrial design engineering (Wier, 1989, Geuss, 1998). In the past couple of decades, Digital human modeling (DHM) has been becoming more and more versatile and convenient

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