Knowledge Discovery and Data Mining-based Garment Size Selection for Mass Customization [*]

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Abstract

In this study, a new knowledge discovery and data mining-based technique has been proposed for garment size selection. It could be split into four sequential parts principally, involving data preparation, data preprocessing, fit models setting, and size selection. Two cases of mass customization, representing the top and bottom garments respectively, were utilized to expounding the implementation of the presented approach. After data preprocessing, key body dimensions were identified using the hierarchical clustering algorithm. Next, the enumeration algorithm was utilized by listing all the possible values while computing the distance between the target population and the fit models. Afterwards, an improved K-means clustering algorithm and support vector machine (SVM) method were utilized to size selection, respectively. Eventually, the SVM-based solution was considered as the optimal solution after being evaluated by the aggregate loss of fit, number of poor fit, accommodation rate of ideal fit, and number of sizes employed. The experimental results demonstrate that the present approach is a low-cost and high-effective improvement for size selection by exploiting the potentials of the existing sizing system, without creating new sizing systems. Moreover, the proposed approach can easily be applied to any type of garment in a flexible manner.

Keywords: Garment Size Selection; Mass Customization; Data Mining; Knowledge Discovery; Support Vector Machine

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1 Introduction

Due the fierce market competition worldwide and the uncertain consumer demands, the terminology of mass customization (MC) arose and has become a significant factor constituting the core competitiveness in vital economic sectors, such as the food industry, apparel industry, electronics, automobile, and homebuilding [1-3]. MC concentrates on offering individualized products and services at affordable prices by integrating craft production and mass production. With the concept of MC, individualization, efficiency, and costs are all critical aspects. Therefore, how to compromise the three aspects should be concerned comprehensively with regards to garment MC.

Garment fitness has been regarded as a fundamental and crucial issue for both consumers and enterprises [4]. In MC, the clothing industry requires a garment development approach that considers the fit demands of the individual consumer and fits the industrial manufacturing process. With the popularization of advanced manufacturing technologies, i.e., 3D whole-body scanning, virtual reality, and apparel CAD/CAM, garment enterprises can realize customization using full automation systems preliminarily. However, this method of MC has significant limitations, such as a relative lack of availability and flexibility that makes it unsuitable for small series production. Moreover, the costs are still high due to the necessity of expensive systems with advanced technologies [5]. It has been an uprising tendency for the clothing industry to reducing the production cost in MC by maintaining the approach (i.e., sizing system) in a standardized production process.

As seen in Fig. 1, in the context of MC, after signing the contract, most garment manufacturers initially procure the anthropometric data of the target population. And then, they sort the population and select the garment sizes using their knowledge based on the amended sizing systems and the returned merchandising reports. Afterwards, they draft the garment patterns utilizing the new sizing system and the grading rules. The final products are developed through a trial and error methodology. Sizing system, which was the presupposition of garment pattern making, plays a vital role in this process. With the sizing system's help, the manufacturers could only employ a limited number of patterns, while simultaneously fulfilling the fit requirements of the individual customer in the industry. Apart from catering well for the population sizing and fits demands, the right choice for garment sizes is said to have the advantage of estimating sales of diverse sizes and determine production quantities, resulting in precise material cost control and manufacturing planning [6, 7]. Size selection is a crucial point of garment MC, linking the garment fit and production costs. However, under the circumstances of MC, size selection is still a challenging issue to resolve. Several scholars have attempt advanced methodologies in
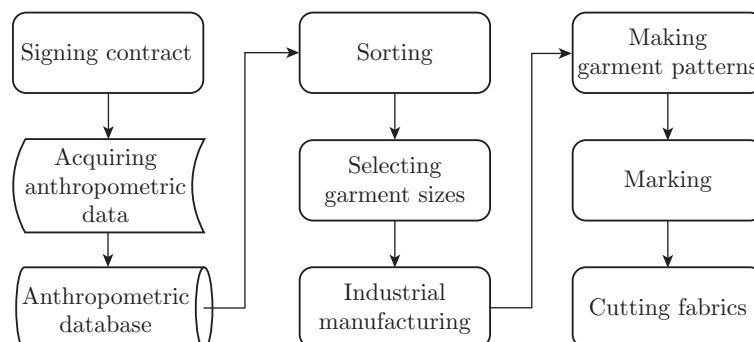

Fig. 1: Illustration of mass customization in the clothing industry