Chapter 7.13
Fabric Database and Fuzzy Logic Models for Evaluating Fabric Performance

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ABSTRACT

A Web-based fabric database is introduced in terms of its physical structure, software system architecture, basic and intelligent search engines, and various display methods for search results. A fuzzy linear clustering method is used to predict fabric drape coefficient from fabric mechanical and structural properties. Experimental data indicate that fuzzy linear clustering is quite effective for this purpose. A hybrid method combining fuzzy linear clustering with K-nearest neighbor is also applied for the prediction of the fabric drape coefficient with improved prediction accuracy. The study also reveals that the fuzzy linear clustering method can also be used for predicting fabric tailorability with good prediction accuracy. Mathematical principles of fuzzy comprehensive evaluation are summarized and a typical application for assessing fabric comfort is exhibited. Through the fuzzy calculation, a single numerical value is produced to express female preferences for six fabric types for use in blouses, slacks, and underpants with respect to fabric property changes in an incremental-wear trial. Finally, a neuro-fuzzy computing technique for evaluating nonwoven fabric softness is presented. The combinational use of the fuzzy logic models (CANFIS) and the neural network method makes a significant step toward launching a fabric database application for neural network computing as a routine laboratory evaluation.

INTRODUCTION

Fabric end-use performance is determined by fabric mechanical and physical properties. Many aspects of performance, such as softness, tactility, and comfort, are assessed by physiological responses and subjective judgment only because of their physical complexity and users' preference. Instrumental approaches for directly measuring these fabric quality features are still limited to date. However, with the availability of high-performance computers and advanced computing techniques, opportunities to solve these problems become more realistic.

Internet technology is making a notable impact on the traditional textile industry. This revolutionary information technology is helping textile manufacturers to enhance their competitiveness in production management and marketing. As Internet users communicate with each other across networked computers, diverse business applications, ranging from the design of textile products to clothing retailing, are popping up through the Internet. For instance, to meet fashion designers' increasing desire for online fashion tracking, a Web site called Worth Global Style Network (WGSN, http://www.wgsn.com) was established in London. This Web site is providing the fashion and style industries with trend-watching news and services, including resources for yarn, fabrics, and garment accessories, and graphics of updated design styles and fashion trends. The information, which covers more than 250,000 pages, comes from a team of 150 designers, trend analysts, journalists, and photographers all over the world. Another Web site, TextileWeb (http://www.textileweb.com), was developed as a community for professionals of the textile industry. It provides product information (buyers' guide and marketplace) and professional services (job search and training).

Online shopping is the ultimate desire for both manufacturers and consumers and is driving Internet technology toward e-commerce. More and more clothing retailers favor a strong Internet presence to promote online shopping. A recent example of this can be seen with the retailer Neiman Marcus launching a $24 million Web site investment with new multimedia applications (Kemp & Lewis, 2000). The company hopes that the new investment will extend its merchandising strategy and promise to make the online shopping experience more realistic. Today, apparel retailing holds the second place for online sales, next to long-term e-business leader online travel. It is reported that the online sales of apparel, footwear, and accessories have risen to $18.3 billion in 2006, and are expected to reach $22.1 billion in 2007 (Dilworth, 2007). All these figures indicate that the textile and clothing industries will further stimulate the IT industry to develop new technologies for accelerating e-commerce capabilities.

Although the IT achievements are significant, online fabric sourcing and shopping still has many obstacles to overcome. Technology, customer service, and distribution management are all challenging apparel manufacturers and retailers. From a technical point of view, apparel design and manufacturing is still more a kind of art than science. For example, fabric quality is mainly assessed by experts' subjective impression by hand. This traditional skill is still commonly used by fabric finishers, bespoke tailors, and even mass-production garment makers. Thus, few apparel designers care about the importance of fabric physical properties and about how to determine these properties and incorporate them into their designs. Garment making is on a trial-and-error basis. Garment quality relies largely on technicians' experience and operators' skill. However, with the severe shortage of experienced textile engineers and hand evaluation experts, the traditional approach is now not practical. Moreover, as automation increases in garment manufacturing, the determination of fabric properties becomes more and more necessary for the control of interaction between making-up machines and fabric