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A NOVEL APPROACH IN FORMULATING A SIZE CHART FOR FEMALE PANTS

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Chandra Padmini Vithanage

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Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of
Philosophy in Textile and Clothing Technology

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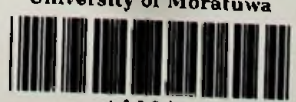
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ABSTRACT

Each country understands that they need their own size charts representing their population because researchers have found that human body shapes, proportions and measurements change significantly due to the geographical and demographical differences. Even though, many countries have developed their own size charts, ready-to-wear apparel industry still faces the problem of poor fit of apparels. Reasons for this fit problems may be due to several factors such as limitations of existing size chart development approaches, lack of up-to-date anthropometric data of the relevant population, vast body shape differences among the population, and restrictions in mass production systems. In this research, one of the above problems; issues in existing size chart development approaches, was studied comprehensively in order to identify drawbacks of the size chart development approaches. Statistical approach which uses descriptive statistics, k-means clustering combined with factor analysis and classification and regression decision tree method were widely used popular size chart development approaches. With the current lower body anthropometric data of Sri Lankan females of age 20-40 years, limitations of the above approaches were investigated. Through this explorative analysis, limitations of current approaches and potential improvements for a better approach were discerned. Thereby a novel approach for development of size charts was formulated. The proposed approach is capable of handling linearly inseparable data with high dimensionality without variable reduction. Further, number of clusters can be objectively determined and the transformation function could be optimized by tuning the parameters of it.

Kernel based learning is one of the latest data mining approaches in pattern recognition. A kernel based clustering technique called “global kernel k-means clustering technique”, was adopted to cluster lower body anthropometric data in the proposed method. Selection of proper kernel function and tuning of kernel parameters are crucial in successful data clustering. For determining the number of clusters objectively, kernel based Dunn’s index, which is one of the cluster validation technique, was successfully instrumented in the said novel approach. Thereby the lower body anthropometric dataset of females was successfully clustered through the proposed novel approach taking all variables into account. It was also proved that the developed size chart could successfully eliminate the fitting problems of Sri Lankan female pants. The size chart was validated through a well accepted index called Aggregate Loss of Fit index on theoretical ground and the live model fitting of fabricated pants according to the size chart through a standard feedback questionnaire. The complete approach in developing size charts could be of interest to other clustering applications in many fields also.

Keywords

Anthropometry, Clustering, Kernel based clustering, Cluster Validation, Development of size charts

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List of Abbreviations

- ALF : Aggregate Loss of Fit factor
- CART : Classification And Regression Tree
- GSM : Grams per Square Meter
- KDI : Kernel-based Dunn's Index
- MRI : Magnetic Resonance Imaging
- RTW : Ready-To-Wear
- WHR : Waist-to-Hip-Ratio

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