

A New Method Separating Relevant Features from Irrelevant Ones Using Fuzzy and OWA Operator Techniques

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Abstract : Selection of relevant parameters from a high dimensional process operation setting space is a problem frequently encountered in industrial process modelling. This paper presents a method for selecting the most relevant fabric physical parameters for each sensory quality feature. The proposed relevancy criterion has been developed using two approaches. The first utilizes a fuzzy sensitivity criterion by exploiting from experimental data the relationship between physical parameters and all the sensory quality features for each evaluator. Next an OWA aggregation procedure is applied to aggregate the ranking lists provided by different evaluators. In the second approach, another panel of experts provides their ranking lists of physical features according to their professional knowledge. Also by applying OWA and a fuzzy aggregation model, the data sensitivity-based ranking list and the knowledge-based ranking list are combined using our proposed percolation technique, to determine the final ranking list. The key issue of the proposed percolation technique is to filter automatically and objectively the relevant features by creating a gap between scores of relevant and irrelevant parameters. It permits to automatically generate threshold that can effectively reduce human subjectivity and arbitrariness when manually choosing thresholds. For a specific sensory descriptor, the threshold is defined systematically by iteratively aggregating (n times) the ranking lists generated by OWA and fuzzy models, according to a specific algorithm. Having applied the percolation technique on a real example, of a well known finished textile product especially the stonewashed denims, usually considered as the most important quality criteria in jeans' evaluation, we separate the relevant physical features from irrelevant ones for each sensory descriptor. The originality and performance of the proposed relevant feature selection method can be shown by the variability in the number of physical features in the set of selected relevant parameters. Instead of selecting identical numbers of features with a predefined threshold, the proposed method can be adapted to the specific natures of the complex relations between sensory descriptors and physical features, in order to propose lists of relevant features of different sizes for different descriptors. In order to obtain more reliable results for selection of relevant physical features, the percolation technique has been applied for combining the fuzzy global relevancy and OWA global relevancy criteria in order to clearly distinguish scores of the relevant physical features from those of irrelevant ones.

Keywords : data sensitivity, feature selection, fuzzy logic, OWA operators, percolation technique

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