

## Accepted Manuscript

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PII: S0360-8352(17)30565-X  
DOI: <https://doi.org/10.1016/j.cie.2017.11.032>  
Reference: CAIE 5003

To appear in: *Computers & Industrial Engineering*

Received Date: 7 December 2016  
Revised Date: 7 August 2017  
Accepted Date: 29 November 2017

Please cite this article as: Wu, T., Liu, X., Qin, J., A linguistic solution for double large-scale group decision-making in E-commerce, *Computers & Industrial Engineering* (2017), doi: <https://doi.org/10.1016/j.cie.2017.11.032>

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# A linguistic solution for double large-scale group decision-making in E-commerce

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**Abstract:** This paper develops a solution for solving large-scale attributes and decision-makers in double large-scale group decision-making problems. Linguistic principal component analysis is used to reduce the dimensions of the attributes and fuzzy equivalence clustering with linguistic information is used to aggregate the preferences of the decision-makers, respectively. Considering that people tend to give their direct preference information with linguistic variables, a codebook that used to model such language information with interval type-2 fuzzy sets is constructed. Numerical principal component analysis is extended into linguistic principal component analysis to reduce the dimensions of large-scale attributes under uncertainty situations. In addition, a linguistic aggregation operator is extended to aggregate decision information. The large-scale attributes and decision makers are classified by linguistic principal component analysis and fuzzy equivalence clustering with linguistic information respectively. Finally, the data that used to construct codebook and sample matrix of linguistic principal component analysis is obtained through questionnaire survey. The decision model is applied to the customer decision for E-commerce service to verify its feasibility and effectiveness.

**Keywords:** Decision analysis; large-scale group decision-making; principal component analysis; linguistic variables; interval type-2 fuzzy sets

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