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Abstract

A large number of multi-criteria methods have been developed to deal with different kinds of problems. Most of them use a linear aggregation, what is the cause of many shortcomings in solving decision problems. This paper presents how to identify nonlinear multi-criteria decision-making models with using the new fuzzy method: the Characteristic Objects Method (COMET). In this approach, models are constructed on the basis of characteristic objects and fuzzy rules. Thereby, the COMET method is free of rank reversal phenomenon, which is one of the most commonly indicated shortcoming of the multi-criteria decisionmaking methods. This study introduces the concepts of characteristic objects and way of their determination. Subsequently, the paper presents approach to construct the fuzzy rule base and the entire model. Finally, the theoretical nonlinear problem is presented to verify the developed approach and to demonstrate its effectiveness.

Refer

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- Pedrycz, W. , Ekel, P. , Parreiras, R. 2011. Fuzzy Multicriteria Decision Making: models, methods and applications. JohnWiley & Sons: Chichester.
- Goodwin, P. , Wright, G. 2009. Decision Analysis for Management Judgment. John Wiley & Sons: Chichester.

- Mosavi, A. 2014. Decision-Making in Complicated Geometrical Problems, International Journal of Computer Applications, Vol. 87, No. 19, pp. 22 – 25.
- Piegat, A. , Sa³abun W. 2012. Nonlinearity of human multicriteria in decision-making, Journal of Theoretical and Applied Computer Science, Vol. 6, No. 3, pp. 36 – 49.
- Kaufmann, A. , Gupta M. 1988. Fuzzy mathematical models in engineering and management science. Elsevier Science Publishers: Amsterdam, Netherlands.
- Piegat, A. 2001. Fuzzy Modeling and Control. Springer-Verlag: New York.
- Kumar, A. , Singh, P. , Kaur, A. 2010. RM Approach for Ranking of Generalized Trapezoidal Fuzzy Numbers, Fuzzy Information and Engineering, Vol. 2, No. 1, pp. 37 – 47.

- Wang, G. , Wang, H. 2001. Non-fuzzy versions of fuzzy reasoning in classical logics, Information Sciences, Vol. 138, No. 1 – 4, pp. 211 – 236.
- Afshari, A. , Mojahed, M. , Yusuff, R. 2010. Simple Additive Weighting approach to Personnel Selection problem. International Journal of Innovation, Management and Technology, Vol. 1, No. 5, pp. 511 – 515.
- Salih, Y. , See O. , Ibrahim, R. , Yussof, S. , Iqbal, A. 2014. A Novel Noncooperative Game Competing Model Using Generalized Simple Additive Weighting Method to Perform Network Selection in Heterogeneous Wireless Networks. International Journal of Communication Systems, first published online: 3 FEB 2014.
- Huang, YS. , Chang, WC. , Li, WH. , Lin, ZL. 2013. Aggregation of utility-based individual preferences for group decisionmaking. European Journal of Operational Research, Vol. 229, No. 2, pp. 462 – 469.
- French, S. 2009. Decision behavior, analysis and support. Cambridge, New York.
- Kontos, TD. , Komilis, DP. , Halvadakis, CP. 2005. Siting MSW landfills with a spatial multiple criteria analysis methodology. Waste Management, Vol. 25, No. 8, pp. 818 – 832.
- Simanaviciene, R. , Ustinovichius, L. 2010. Sensitivity analysis for multiple criteria decision making methods: TOPSIS and SAW. Procedia - Social and Behavioral Sciences, Vol. 2, No. 6, pp. 7743 – 7744.
- Blair, AR. , Mandelker, GN. , Saaty, TL. , Whitaker, R. 2010. Forecasting the resurgence of the u. s. economy in 2010: An expert judgment approach. Socio-Economic Planning Sciences, vOL. 44, No. 3, pp. 114 – 121.
- Dong, Y. , Zhang, G. , Hong, W. C. , Xu, Y. 2010. Consensus models for AHP group decision making under row geometric mean prioritization method. Decision Support Systems, Vol. 49, No. 3, pp. 281 – 289.
- Karami, E. 2006. Appropriateness of farmers adoption of irrigation methods: The application of the AHP model. Agricultural Systems Vol. 87, No. 1, pp. 101 – 119.
- Saaty, TL. 2004. Decision making the analytic hierarchy and network processes (AHP/ANP), Journal of Systems Science and Systems Engineering, Vol. 13, No. 1, pp. 1 – 35.
- Saaty, TL. 2007. Time dependent decision-making; dynamic priorities in the AHP/ANP: Generalizing from points to functions and from real to complex variables, Mathematical and Computer Modelling Vol. 46 No. 78, pp. 860 – 891.
- Saaty, TL. 2008. Decision making the analytic hierarchy and network processes (AHP/ANP), International Journal Services Sciences Vol. 1, No. 1, pp. 83 – 98.
- Saaty, TL. , Brandy, C. 2009. The encyclicon, volume 2: a dictionary of complex decisions using the analytic network process. RWS Publications, Pittsburgh.

- Saaty, TL. , Shang, JS. 2011. An innovative orders-of-magnitude approach to AHP-based multi-criteria decision making: Prioritizing divergent intangible humane acts, *European Journal of Operational Research*, Vol. 214 No. 3, pp. 703 – 715.
- Saaty, TL. , Tran, LT. 2007. On the invalidity of fuzzifying numerical judgments in the analytic hierarchy process, *Mathematical and Computer Modelling*, Vol. 46, No. 78, pp. 962 – 975.
- Kwanyoung, I. , Hyunbo, C. 2013. A systematic approach for developing a new business model using morphological analysis and integrated fuzzy approach, *Expert Systems with Applications*, Vol. 40 No. 11, pp. 4463–4477.
- Kuo, RJ. , Wu, YH. , Hsu, TS. 2012. Integration of fuzzy set theory and TOPSIS into HFMEA to improve outpatient service for elderly patients in Taiwan, *Journal of the Chinese Medical Association*, Vol. 75, No. 7, pp. 341 – 348.
- La Scalia, G. , Aiello, G. , Rastellini, C. , Micale, R. , Cicalese, L. 2011. Multi-criteria decision making support system for pancreatic islet transplantation, *Expert Systems with Applications*, Vol. 38 No. 4, pp. 3091–3097
- Taleizadeh, AA. , Akhavan Niaki, ST. , Aryanezhad, MB. 2009. A hybrid method of Pareto, TOPSIS and genetic algorithm to optimize multi-product multiconstraint inventory control systems with random fuzzy replenishments, *Mathematical and Computer Modeling*, Vol. 49 No. 5-6, pp. 1044–1057.
- Kim, Y. , Chung, ES. , Jun, SM. , Kim, SU. 2013. Prioritizing the best sites for treated wastewater instream use in an urban watershed using fuzzy TOPSIS, *Resources Conservation and Recycling*, Vol. 73, pp. 23 – 32.
- Sun, YF. , Liang, ZS. , Shan, CJ. , Viernstein, H. , Unger, F. 2011. Comprehensive evaluation of natural antioxidants and antioxidant potentials in *Ziziphus jujuba* Mill. var. *spinosa* (Bunge) Huex H. F. Chou fruits based on geographical origin by TOPSIS method, *Food Chemistry*, Vol. 124, No. 4, pp. 1612 – 1619.
- Sa³abun, W. 2013. The mean error estimation of TOPSIS method using a fuzzy reference models, *Journal of Theoretical and Applied Computer Science*, Vol. 7, No. 3, pp. 40-50.
- Norese, MF. , Carbone, V. 2013. An Application of ELECTRE Tri to Support Innovation, *Journal of Multi-Criteria Decision Analysis*, first published online: 20 DEC 2014.
- Hatami-Marbini, A. , Tavana, M. 2011. An extension of the ELECTRE I method for group decision-making under a fuzzy environment, *Omega*, Vol. 39, No. 4, pp. 373 – 386.
- Brito, A. J. , de Almeida, A. T. , Mota, C. M. 2010. A multicriteria model for risk sorting of natural gas pipelines based on ELECTRE TRI integrating utility theory, *European Journal of Operational Research*, Vol. 200, No. 3, pp. 812 - 821.
- Montazer, G. A. , Saremi, H. Q. , Ramezani, M. 2009. Design a new mixed expert decision aiding system using fuzzy ELECTRE III method for vendor selection, *Expert Systems with Applications*, Vol. 36, No. 8, 10837 – 10847.
- Figueira, J. , Greco, S. , Ehrgott, M. 2004. *Multiple Criteria Decision Analysis: State of the Art Surveys*. Springer, New York.
- Eppe, S. , De Smet, Y. 2014. Approximating Promethee IIs net flow scores by piecewise linear value functions, *European Journal of Operational Research*, Vol. 233, No. 3, pp. 651 - 659.
- Amaral, TM. , Costa APC. 2014. Improving decision-making and management of hospital resources: An application of the PROMETHEE II method in an Emergency

Department, Operations Research for Health Care, Vol. 3, No. 1, pp. 1 - 6.

- Makan, A. , Mountadar, M. 2013. Sustainable management of municipal solid waste in Morocco: Application of PROMETHEE method for choosing the optimal management scheme, African Journal of Environmental and Waste Management, Vol. 1, No. 1, pp. 1 - 13.

- Ziolkowska, JR. Evaluating sustainability of biofuels feedstocks: A multi-objective framework for supporting decision making, Biomass and Bioenergy, Vol. 55, pp. 425 - 440.

- Ross, T.J. 2010. Fuzzy logic with engineering applications. John Wiley & Sons: Chichester.

- Sa³abun, W. 2012. The use of fuzzy logic to evaluate the nonlinearity of human multi-criteria used in decision making, Przegląd Elektrotechniczny (Electrical Review), Vol. 88, No. 10b, pp. 235 – 238.

- Bartlett, JE. , Kotrlik, JW. , Higgins, CC. 2001. Chadwick C. Higgins Organizational Research: Determining Appropriate Sample Size in Survey Research, Information Technology, Learning, and Performance Journal, Vol. 19, No. 1, pp. 43 – 50.

Index Terms

Computer Science

Applied Mathematics

Keywords

Multi-criteria Making-decision Method Rank Reversal Decision Making
Characteristic Objects

COMET Method