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基于广义模糊软集理论的云计算资源需求组合预测研究

徐达宇[1,2], 杨善林[2], 罗贺[2]

1. 浙江农林大学浙江省林业智能监测与信息技术研究重点实验室, 浙江 杭州 311300;
2. 合肥工业大学过程优化与智能决策教育部重点实验室, 安徽 合肥 230009

Research on Generalized Fuzzy Soft Sets Theory based Combined Model for Demanded Cloud Computing Resource Prediction

XU Da-yu[1,2], YANG Shan-lin[2], LUO He[2]

1. Zhejiang A&F University, Zhejiang Provincial Key Laboratory of Forestry Intelligent Monitoring and Information Technology Research, Hangzhou 311300, China;
2. HeFei University of Technology, Key Laboratory of Process Optimization and Intelligent Decision-making, Ministry of Education, HeFei 230009, China

摘要
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摘要 论述了云计算资源需求预测的作用,提出了新的基于夹角余弦的广义模糊软集相似性度量方法,将相似性度量结果与预测精度相结合来获得各单项预测模型的权重,并针对云计算环境中资源需求所表现出的短期动态性和长期周期性特征,选用自适应神经模糊推理系统ANFIS和季节性ARIMA模型SARIMA作为单项预测模型,以此构建基于广义模糊软集理论的组合预测模型GFSS-ANFIS/SARIMA。最后将该模型用于云计算环境下的资源需求预测应用中去。实验结果表明,与其它预测模型相比,该模型能有效提高预测精度,具有良好的预测性能。本文所提方法能为云计算资源的高效调度和分配提供决策支持。

关键词： 云计算 广义模糊软集 相似性度量 组合预测 自适应神经模糊推理系统

Abstract： In order to realize high scalability, flexibility and cost-effectiveness, cloud computing platforms need to be able to quickly plan and provision resources. To this end, it calls for mechanisms to predict demanded resource effectively. Therefore, resource prediction is a crucial issue for efficient resource utilization in dynamic cloud computing environment. In this paper, the basic concept of generalized fuzzy soft sets is introduced, and a novel angle cosine is proposed based similarity measurement of generalized fuzzy soft sets. Then the similarity measurement result and the prediction accuracy from Adaptive Neuro-Fuzzy Inference System and Seasonal ARIMA model are adopted to obtain the weights of combined prediction model. On this basis,the generalized fuzzy soft sets theory based on the combination of forecasting model GFSS-ANFIS/SARIMA is constrncted. Finally, this model is explorted to predict the demanded resource in cloud computing. The experimental results show that the proposed model can significantly improve the prediction accuracy with high prediction performance. Efficient decision support for resource scheduling and allocation in cloud computing can be provided by the proposed method.

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作者简介: 徐达宇(1985-),男(汉族),浙江杭州人,浙江农林大学信息工程学院讲师,研究方向:预测理论与方法、云计算.

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[1] Bianchini R, Rajamony R. Power and energy management for server systems[J]. Computer, 2004, 37(11):68-74.

[2] Guenter B, Jain N, Williams C. Managing cost, performance, and reliability tradeoffs for energy-aware server provisioning[C].Proceedings of the 30th IEEE International Conference on Computer Communications,Shanghai,China,April 10-15,2011.

[3] Baliga J, Ayre R W A, Hinton K,et al.Green cloud computing: Balancing energy in processing, storage, and transport[J]. Proc. IEEE, 2011, 99(1):149 -167.

[4] Garg S K, Yeo C S, Anandasivam A,et al. Environment-conscious scheduling of HPC applications on distributed cloud-oriented data centers[J]. Journal of Parallel and Pistributed Computing, 2011, 71(6): 732-749.

[5] Mark C C T,Niyato D,Che-khong T. Evolutionary optimal virtual machine placement and demand forecaster for cloud computing[C].Proceedings of the 25th International Conference on Advanced Information Networking and Applications, Biopolis,Singapore,March 22-25,2011.

[6] Caron E, Desprez F, Muresan A. Forecasting for grid and cloud computing on-demand resources based on pattern matching[C]. Proceedings of the 2nd IEEE International Conference on Cloud Computing Technology and Science,Indianapolis,November 30-December 3,2010.

[7] Islam S, Keung J, Lee K, et al. Empirical prediction models for adaptive resource provisioning in the cloud[J]. Future Generation Computer Systems, 2011,28(1): 155-162.

[8] Duy T V T, Sato Y, Inoguchi, Y. Performance evaluation of a green scheduling algorithm for energy savings in cloud computing[C].Proceeding of International Symposium on Parallel Distributed Processing Workshops and Phd Forum IPDPSW,Atlanta,GA,April 19-23,2010.

[9] Dickinson J P. Some comments on the combination of forecasts[J]. Operational Research Quarterly, 1975,26(1):205-210.

[10] Bates J M, Granger C W J. The combination of forecasts[J]. Operations Research Quarterly, 1969, 20(4): 415-468.

[11] 陈华友,盛昭瀚.一类基于IOWGA算子的组合预测新方法[J].管理工程学报,2005,19(4):36-39.

[12] 李美娟,陈国宏,林志炳.基于漂移度的组合预测方法研究[J].中国管理科学,2011,19(3):111-117. 浏览

[13] Xiao Zhi, Gong Ke, Zou Yan. A combined forecasting approach based on fuzzy soft sets[J]. Journal of computational and Applied Mathematics, 2009,228(1): 326-333.

[14] Molodtsov D. Soft set theory-first results[J]. Computers & Mathematics with Application, 1999,37(4):19-31.

[15] Maji P K, Roy A R, Biswas R. An application of soft sets in a decision making problem[J]. Computers & Mathematics with Application, 2002,44(8):1077-083.

[16] 孙智勇,刘星.模糊软集合理论在税收组合预测中的应用[J].系统工程理论与实践,2011,31(5): 936-943.

[17] Majumdar P, Samanta S K. Generalized fuzzy soft sets[J]. Computers & Mathematics with Application, 2010, 59 (4): 1425-1432.

[18] Xiao Zhi, Yang Xianglei,Niu Qing,et al. A new evaluation method based on D-S generalized fuzzy soft sets and its application in medical diagnosis problem[J]. Applied Mathematical Modelling,2012, 36(10): 4592-4604.

[19] Maji P K, Biswas R, Poy A R.Intuitionistic fuzzy solf sets[J]. Journal of Fuzzy Mathematics,2001, 9(3): 677-692.

[20] Bustince H, Barrenechea E, Pagola M. Image thresholding using restricted equivalence functions and maximizing the measures of similarity[J]. Fuzzy Sets and Systems, 2007, 158(5): 496-516.

[21] Benson T, Akella A, Maltz D A. Network traffic characteristics of data centers in the wild[C].Proceedings of the 10th ACM SIGCOMM conference on Internet measurement,Melbourne,Australia,November 1-3,201 1-3,2010.

[22] Tan Jian, Dube P, Meng Xiaoqiao, et al. Exploiting resource usage patterns for better utilization prediction[C].Proceedings of the 31st International Conference on Distributed Computing Systems Workshops (ICDCSW'11), Minneapolis,Minnesota,USA,June 20-24,2011.

[23] Bezdek J, Pal S. Fuzzy models for pattern recognition[M].New Jersey,USA: IEEE Press, 1992.

[24] Tseng F M, Tzeng G H. A fuzzy seasonal ARIMA model for forecasting[J]. Fuzzy Sets and Systems, 2002, 126(3): 367-376.

[25] Traces in the Internet traffic archive[DB/OL]. http://ita.ee.lbl.gov/html/traces.html.

[26] Mehta A, Menaria M,Dangi S,et al. Envergy conservation in cloud infrastructures[C]. Prceedings of 5th Annual IEEE International Systems Conference, Montreal,Canada,April, 4-11,2011.

[27] Prevost J J, Nagothu K M,Kelley B,et al. Prediction of cloud data center networks loads using stochastic and neural models[C].Proceeding of 6th International Conference on System of Systems Engineering, Albuquerque,USA,dune 27-30,2011.

[1] 赵昕东, 钱国骐.**基于Kullback-Leibler信息量的最优ARMA模型组选择与组合预测研究**[J]. 中国管理科学, 2011,19(5): 21-28

[2] 曾波, 刘思峰, 方志耕, 谢乃明.**灰色组合预测模型及其应用**[J]. 中国管理科学, 2009,17(5): 150-155

[3] 陈华友, 刘春林, 盛昭瀚.**IOWHA算子及其在组合预测中的应用**[J]. 中国管理科学, 2004,(5): 35-40

[4] 董景荣, 杨秀苔.**汇率的非线性组合预测方法研究**[J]. 中国管理科学, 2001,(5): 1-7

[5] 杨桂元, 唐小我.**折扣系数法在建立预测模型中的应用**[J]. 中国管理科学, 1998,(3): 27-33