Journal Pre-proofs

Large-Scale and Adaptive Service Composition Based on Deep Reinforcement Learning

Jiang-Wen Liu, Li-Qiang Hu, Zhao-Quan Cai, Li-Ning Xing, Xu Tan

PII: S1047-3203(19)30308-6
DOI: https://doi.org/10.1016/j.jvcir.2019.102687
Reference: YJVCI 102687

To appear in: *J. Vis. Commun. Image R.*

Received Date: 16 August 2019
Revised Date: 14 October 2019
Accepted Date: 14 October 2019

Please cite this article as: J-W. Liu, L-Q. Hu, Z-Q. Cai, L-N. Xing, X. Tan, Large-Scale and Adaptive Service Composition Based on Deep Reinforcement Learning, *J. Vis. Commun. Image R.* (2019), doi: https://doi.org/10.1016/j.jvcir.2019.102687

Large-Scale and Adaptive Service Composition Based on Deep Reinforcement Learning

Jiang-Wen LIU[1], Li-Qiang HU[2], Zhao-Quan Cai[4*], Li-Ning XING[3], Xu TAN[3*]

1 College of Mechanical and Electrical Engineering, Jiangsu Vocational Institute of Architectural Technology, Xuzhou 221116, P.R. China

2 School of Electrical and Electronic Engineering, Shijiazhuang Tiedao University, Shijiazhuang 050043, PR China

3 School of Software Engineering, Shenzhen Institute of Information Technology, Shenzhen 518172, P.R. China

4 Department of Information Science and Technology, Huizhou University, Huizhou 516007, PR China

*Corresponding author: Zhao-Quan Cai, Xu Tan.

Abstract: Service composition is a research hotspot with practical value. With the development of Web service, many Web services with the same functional attributes emerge. However, service composition optimization is still a big challenge since the complex and unstable composition environment. To solve this problem, we propose an adaptive service composition based on deep reinforcement learning, where recurrent neural network (RNN) is utilized for predicting the objective function, improving its expression and generalization ability, and effectively solving the shortcomings of traditional reinforcement learning in the face of large-scale or continuous state space problems. We leverage heuristic behavior selection strategy to divide the state set into hidden state and fully visible state. Effective simulation of hidden state space and fully visible state of the evaluation function can further improve the accuracy and efficiency of the combined results. We conduct comprehensive experiment and experimental results have shown the effectiveness of our method.

Keywords: Service composition; deep reinforcement learning; QoS; behavior strategy.

1. Introduction

With the development of Internet, traditional service cannot meet the demand of users. Inter-domain, multi-collaborative, integrated network collaboration has been becoming a research hotspot [24-29]. The combination of IT and service is significant for modern intelligent systems. One the one hand, IT can support the application of transportation, banking, and e-commerce. Users access these service websites through the network, so that these traditional services can be extended to the Internet network platform. On the other hand, on the basis of focusing on their core business, enterprises also need the services provided by other business partners to complete some non-core business. As a result, the demand for integration technology is becoming more and more intense. How to solve the system integration problems caused by platform differences, protocol differences and language differences of many application systems has become a difficult problem and challenge.

Service-Oriented Architecture (SOA) aims to combine different units of applications to complete specific tasks. Web services are the most promising technical means to