Accepted Manuscript

Hybrid privacy-preserving clinical decision support system in fog-cloud computing

Ximeng Liu, Robert H. Deng, Yang Yang, Hieu N. Tran, Shangping Zhong

PII: S0167-739X(17)30387-4
DOI: http://dx.doi.org/10.1016/j.future.2017.03.018
Reference: FUTURE 3386

To appear in: *Future Generation Computer Systems*

Received date: 25 May 2016
Revised date: 11 February 2017
Accepted date: 11 March 2017

Please cite this article as: X. Liu, R.H. Deng, Y. Yang, H.N. Tran, S. Zhong, Hybrid privacy-preserving clinical decision support system in fog-cloud computing, *Future Generation Computer Systems* (2017), http://dx.doi.org/10.1016/j.future.2017.03.018

Hybrid Privacy-Preserving Clinical Decision Support System in Fog-Cloud Computing☆

Ximeng Liu[a,b], Robert H. Deng[b], Yang Yang[a,b,*], Hieu N. Tran[b], Shangping Zhong[a]

[a] *College of Mathematics and Computer Science, Fuzhou University, Fuzhou, China, 350117.*
[b] *Singapore Management University, 80 Stamford Road, Singapore, 178902.*

Abstract

In this paper, we propose a framework for hybrid privacy-preserving clinical decision support system in fog-cloud computing, called HPCS. In HPCS, a fog server uses a lightweight data mining method to securely monitor patients' health condition in real-time. The newly detected abnormal symptoms can be further sent to the cloud server for high-accuracy prediction in a privacy-preserving way. Specifically, for the fog servers, we design a new secure outsourced inner-product protocol for achieving secure lightweight single-layer neural network. Also, a privacy-preserving piecewise polynomial calculation protocol allows cloud server to securely perform any activation functions in multiple-layer neural network. Moreover, to solve the computation overflow problem, a new protocol called privacy-preserving fraction approximation protocol is designed. We then prove that the HPCS achieves the goal of patient health status monitoring without privacy leakage to unauthorized parties by balancing real-time and high-accurate prediction using simulations.

Keywords: Clinical Decision Support System, Privacy-Preserving, Neural Networks, Fog Computing, Cloud Computing.

☆This research is supported by the National Natural Science Foundation of China under grant No.61402112.

*Corresponding author
Email address: yang.yang.research@gmail.com (Yang Yang)