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## Hybrid Privacy-Preserving Clinical Decision Support System in Fog-Cloud Computing<sup>☆</sup>

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### 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.

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