Blockchain Assisted Collaborative Service Recommendation Scheme With Data Sharing

ABSTRACT

With the rapid development of cloud computing, a large number of web services have been emerging quickly, which brings a heavy burden for users to choose the services they preferred. In order to suggest web services for users, recommendation algorithms are needed and many of them have been investigated recently. However, most of the existing recommendation schemes are based on centralized historical data, which may lead to single point of failure. Generally, the data contains a lot of sensitive information that cloud may expose the privacy of users, which makes most cloud platforms reluctant to share their own data. In order to solve the above issues, the secure data sharing among cloud platforms is necessary for better recommendation, which can maximize the profits. In this paper, we propose a blockchain-assisted collaborative service recommendation scheme (*BC*-*SRDS*). Specifically, we adopt the ciphertext-policy attribute-based encryption (CP-ABE) algorithm to encrypt the data, which ensures the data confidentiality and realizes secure data sharing. Then, we utilize the blockchain to share data, such that the DoS attack, DDoS attack and single point of failure can be avoided. Meanwhile, the data integrity, tampering-proof of data are guaranteed through the blockchain. And we use locality-sensitive hashing algorithm to recommend the services for users. Finally, it is proved through the security analysis that *BC*-*SRDS* is capable of achieving data confidentiality, data integrity and tampering-proof. A series of experiments show that *BC*-*SRDS* achieves better recommendation accuracy compared with the existing schemes.

**EXISTING SYSTEM**

* Sarwar *et al.* [6] proposed a collaborative filtering algorithm based on items, which mainly calculates the similarity between items by analyzing the user's historical data. Because the number of users are much larger than the number of items, the computing of similarity between items is less sparse than that between users. Meanwhile, because the properties of items are fixed, we can calculate the similarity between items offline. Moreover, the calculation performance between items is high. Compared with collaborative filtering algorithm based on users, the recommendation quality is greatly improved. However, the item-based collaborative filtering algorithm also brings new challenges: Firstly, the algorithm does not consider the difference between users, thus, the recommendation quality is poor; secondly, when a new item is added to the system, it is difficult to recommend the items that are similar to the new item to users, because it is not scored or there are few scores about the new item.
* In order to solve these problems, Jiang *et al.* [4] proposed a hybrid recommendation algorithm, which takes the advantages of the two algorithms that are item-based collaborative filtering algorithm and user-based collaborative filtering algorithm. They use the characteristics of attributes of users or items to obtain a better recommendation effect. However, the algorithm is based on specific applications and it is difficult to transplant and expand.
* Cheng *et al.* [7] proposed a method to improve the recommendation quality by introducing metric learning into collaborative filtering algorithm. By measuring the distance between target user and candidate set, it separates th candidate set. And the items that have high similarity to user preference are close to the users while the items that have low similarity to user preference are far away from users, which reduces the influence of sparse data on the recommendation. Although the algorithm can alleviate the influence of sparsity on the recommendation, but it does not propose an effective method to deal with sparse data.
* In [8], Mnih proposed the matrix decomposition algorithm, which is one of the most popular collaborative filtering algorithms based on model. Compared with user-based collaborative filtering algorithm, it shows better performance in dealing with sparse problems. In [9], Yu *et al.* added the dimension of geographic location. They pointed out that users in similar geographical location usually invoked the same service, and they often have the same service requirements. Besides, the quality of web service is highly related to time.

**Disadvantages**

* The system is less secured since the system is not implemented Collaborative service recommendation.
* The system is not implemented CP-ABE (ciphertext-policy attribute based encryption)which is to promote the data sharing among the cloud platforms and combine blockchain to ensure the security of data provenance

Proposed System

* The system proposes a blockchain-assisted collaborative service recommendation scheme with data sharing. Different from the scheme4 in [25], the system adopts CP-ABE to realize secure data sharing so that we can share data securely while guaranteeing that the cloud platforms can control their own data. CP-ABE embeds the access strategy into the ciphertext, which means that the data owners can determine that who can access these user data. Further, it prevents user historical service data from being illegally accessed. Therefore, the scheme can meet the needs for security of user historical service data.
* Moreover, our scheme also introduces blockchain to realize data sharing. Its features of tampering proof, decentralization can further ensure the security of ciphertexts. Our scheme can easily detect whether the data has been tampered with. Therefore, our scheme is secure for recommendation. Moreover, the system model of our scheme is shown in this system. In this scheme, it mainly includes three layers: User layer, Data sharing layer, and Data layer.

1) User layer: This layer mainly includes various devices belonged to users, through which users can access the web services. They will produce large-scale data on the cloud platforms. Note that these users are distributed in different platforms.

2) Data sharing layer: The cloud platforms that agree to share the data construct a consortium blockchain, on which they can share and utilize message. They will record the shared data on the consortium blockchain. Using the data on consortium blockchain, the platforms can merge it with their own data to perform accurate recommendation, obtaining more profits. Every platform maintains a public ledger together.

3) Data layer: In this layer, assisted with the cloud servers, we store the large les (e.g. videos, images) on it, because blockchain is not suitable for storing large

amounts of data.

**Advantages**

* The system proposes for **Defending against DoS or DDoS attacks.**
* **Tamper-proofing.** All nodes should hardly tamper with the shared data. Once the shared data is tampered with by a node, the data can be detected.
* **Avoiding single point of failure.** The scheme should meet the requirement that when a cloud platform was attacked, other cloud platforms can also run normally.
* **Data integrity.** When the shared data is tampered with,the scheme can quickly determine whether the data is complete.

**SYSTEM REQUIREMENTS**

➢ **H/W System Configuration:-**

➢ Processor - Pentium –IV

➢ RAM - 4 GB (min)

➢ Hard Disk - 20 GB

➢ Key Board - Standard Windows Keyboard

➢ Mouse - Two or Three Button Mouse

➢ Monitor - SVGA

**Software Requirements:**

* Operating System - Windows XP
* Coding Language - Java/J2EE(JSP,Servlet)
* Front End - J2EE
* Back End - MySQL