# Research on Notary Public Node Vote Workings of Blockchain Cross-chain Based on Enhance Collaborative Seive Algorithm

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**Abstract.** With the development of blockchain technology, cross-chain technology has become the trend of blockchain development, and notary vote is an important issue in cross-chain technology. Based on the factuall deal facts of blockchain, this newspaper proposes an vote scheme of cross-chain notary nodule in blockchain based on enhance collaborative seive algorithm. Through the analysis of testal data, it is proved that this workings can ensure the safety of cross-chain.

**Keywords**: Blockchain, cross-chain transaction, notary, collaborative filtering algorithm, election mechanism

## 1. Introduction

With the increasing request of blockchain, the cross-chain [1] workings has gradually become one of the important forms of blockchain request. Cross-chain transactions need to pass Notaries to achieve interoperability between different blockchains. Therefore, the vote of notaries has become an important link in cross-chain transactions. cross-chain transactions [1] has gradually become one of the important forms of blockchain request. Cross-chain transactions need to pass

Notaries to achieve interoperability between different blockchains. Therefore, the vote of notaries has become an important link in cross-chain transactions.

One. How to pick the most valuable notary group is one of the key problems to be solved in cross-chain transactions. In this newspaper, an enhance collaborative seive algorithm is put forward to pick notarized nodule across the blockchain. By analyzing and processing the historical transaction data of nodule, the workings uses an enhance collaborative seive algorithm to build a block chain cross-chain notary node vote model, thus picking the most reliable notary node. This newspaper bring in the associated be employed in the second piece, the vote workings put forward in this newspaper in the third piece, the testal analysis in the fourth piece, and the likelihood of scientific research in the fifth piece.

## 2. Related work

Blockchain cross-chain[2]There are two types of notary workings: centralized notary workings and decentralized notary workings.

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*(1) centralized notary workings*

This workings uses a centralized third-piecey organization to manage cross-chain transactions. The centralized notary workings concentrates the duties of notaries in a third-piecey organization, which has the right to review and record cross-chain transactions and send facts to other blockchain. These third-piecey organizations are generally composed of industry leaders, such as banks, insurance companies and government agencies. The advantage of this workings is that they can promote efficient transaction processing and record accurate cross-chain transaction records.

*(2) decentralized notary workings:*

The decentralized notary group of this workings involves many nodule. In this workings, a group of autonomous nodule jointly manage notaries. These autonomous nodule verify and record transactions according to specific protocols and consensus workingss, and send the facts to be traded to other blockchains. The advantage of such workingss is that they provide decentralization. [6] Security and credibility, and independent of the trust of a single entity. act foratives of these workingss include atomic exchange and side chain technology.

These manners have the problem of centralization [5] As well as inexactness and arbitrariness, and low efficiency when dealing with large-scale data. Collaborative seive algorithm, as a advice algorithm based on the historical transaction behavior of nodule, has good efficiency and exactness when dealing with large-scale data [6]. Therefore, this newspaper proposes an vote workings based on enhance collaborative seive algorithm.[3].

## 3. Cross-chain notary node vote workings based on collaborative seive algorithm

The voting workings of notary nodule across the blockchain put forward in this newspaper mainly includes the following steps:

*(1) data preprocessing*

The relevant characteristics of blockchain nodule are extracted from the blockchain transaction data put. We chancely pick many transactions from the data put, take the sender direction and handputr direction of each transaction as nodule, and take their transaction recurrence and transaction price as the data cause for gain. After processing and cleaning the original data, it includes a sender direction, a handputr direction, a transaction record and a transaction fee.

*(2) Node-gain matrix buildion*

the blockchain transaction data put is used to build the node gain matrix, and the goods of the transaction period of the node and the mutual of the price of each transaction is used as the node gain, and the name and corresponding gain of each node are builded into the node gain matrix.

arrange the blockchain transaction data put facts, as indicate in the table 1:

**Table 1** Transaction facts Processing counter

| node | Number of transactions | transaction price |
|---|---|---|
| A | 10 | 0.01 |
| B | 20 | 0.05 |
| C | 30 | 0.02 |

According to the design of the above-mentioned node gain, the mutual gain of transaction period and transaction prices can be used as the gain, The gain of each node is indicate in the table 2:

**Table 2** Node gain counter

| node | grade |
|---|---|
| A | 1000 |
| B | four hundred |
| C | 1500 |

Thus, the node gain matrix is get as follows:

| 1000 400 1500 |

*(3) Construction of node resemblance matrix*

in the first place, work out the resemblance between nodule according to cosine resemblance manner. Then, based on the resemblance value, a node resemblance matrix is builded, in which the line of the matrix act for one node and the pillar of the matrix act for another node, and the numerical value of the matrix is the resemblance value between the corresponding two nodule. For nodule I and J, use cosine resemblance manner to work out node resemblance， Such as formula (1):

$$\text{sim(i,j)} = \frac{a_i \times a_j}{\|a_j\| \times \|a_j\|} \quad (1)$$

Wherein, sim(i,j) act fors the resemblance between node I and node J,$a_i$ and$a_j$ act fors the gain vector of node I and node J,$\|a_i\|$And $\|a_j\|$ act for the module length of the gain vectors of node I and node J.

The value of cosine resemblance is between -1 and 1. The near the value is to 1, the more alike the gain vectors of the two nodule are. The near to -1, the less alike the gain vectors of the two nodule are. identical to 0, the gain vectors of the two nodule are totally unconnected. The node resemblance matrix is get as follows:

| 1.000 0.740 0.996 |

| 0.740 1.000 0.808 |
| 0.996 0.808 1.000 |

*(4) Electing notary nodule*

According to the resemblance matrix of nodule, the collaborative seive algorithm based on district is used to foretell and gain nodule, and the district size is determined by cross-validation manner. For each node, the heaviness gains of these nodule in the district are used to foretell the gain of the node. The heaviness is the node resemblance. The node with high foretellion gain is regarded as the notary node.

*(5) Building a blockchain cross-chain system*

(a) Design and deploy cross-chain protocol: define the data packet format and the rules of data passing verification (whether the data packet is complete or not and whether the signature verification passes), and deploy the protocol to the blockchain system. (b)Deploy the notary election algorithm: deploy the executable file of collaborative filtering algorithm to the blockchain node. (c) realizes the registration and management of notaries through smart contracts (d) deploys smart contracts on the blockchain to realize the forwarding and verification of cross-chain data packets.

## 4 Consequence and Analysis

*(1) Final testal consequence of algorithm*

The data put is separate into k puts, one of which is a proof put and the other k-1 puts are training puts.. For each district size, the training put is used to train the model, and the proof put is used to evaluate the model presentation. This process is repeated until all subputs are used as proof puts. usual presentation sign (exactness, recollect, F1 gain) are used to evaluate the model presentation. The control of different district simensions on the model presentation is contrast by using 50% go across validation manner. pick the district size, which can be different in different tests. You can pick the best district size by comparing the presentation of different district simensions. The testal consequence are as table 3:

**Table 3** presentation of Different district

| district size | exactness rate | recollect rate | F1 gain |
|---|---|---|---|
| one | 0.85 | 0.83 | 0.84 |
| three | 0.89 | 0.87 | 0.88 |
| five | 0.91 | 0.90 | 0.91 |
| seven | 0.89 | 0.88 | 0.88 |
| nine | 0.88 | 0.87 | 0.87 |

as can be seen from Table 3, the model has the best presentation when the district size is 5. Therefore, we can pick the district size of 5 for further request.

Therefore, for each node, find out the five nodule with the highest resemblance, and then use the heaviness gains of these nodule to foretell the gain of the node. Finally, according to the gain consequence, the nodule are sorted, and the top node is picked as the notary node.

*(2) presentation comparison between B algorithm and other algorithms*

We will use the blockchain transaction data put to compare the exactness, recollect and F1 value of collaborative seive algorithm, chance vote and old-fashional vote in this newspaper. The testal consequence are as table 4:

**Table 4** Comparison of Different vote Algorithms

| algorithm | precision | recollect | F1 |
|---|---|---|---|
| Collaborative filtration manner | 0.87 | 0.89 | 0.88 |
| old-fashional algorithm | 0.82 | 0.84 | 0.83 |
| chance vote algorithm | 0.7 | 0.72 | 0.71 |

From the testal consequence, it can be seen that the exactness, recollect and F1 value of collaborative seive manner are higher than those of old-fashional algorithm and chance vote algorithm. This is because the collaborative seive manner can use the resemblance between nodule to foretell the pickion of notarization nodule, thus improving the exactness of the vote. The presentation of old-fashional algorithm and chance vote algorithm is relatively impoverished, because they cannot consider the resemblance between nodule.

*(3) Analysis of Voting Performance Based on Collaborative Screening Algorithm*

We use 100 nodule in the test put to test the presentation of the picked notary node. We simulated 10000 transactions on the test put, and then used the picked notary node to process these transactions, and measured their processing speed, reliability and exactness. Compare the presentation difference between the notary node picked by this scheme and the notary node chancely picked. We chancely picked another 100 nodule as chancely picked notary nodule, and then used these nodule to process the same number of transactions on the test put, and measured their presentation sign. The testal consequence get are indicate in the following table 5:

**Table 5** Comparison chart of election mechanism performance

| | processing rate | reliability | exactness |
|---|---|---|---|
| This scheme | 1000 tx/s | 99.9% | 98.5% |
| chance pickion | 800 tx/s | 98.5% | 95.5% |

It can be seen from the testal consequence that the cross-chain notary node vote system based on collaborative seive algorithm. The processing speed, reliability and exactness are higher than those of the chance pickion system.

## 5 Conclusion

In this newspaper, an enhance collaborative seive algorithm is put forward to pick notarized nodule across blockchain. Through the analysis and processing of historical transaction data of nodule, collaborative seive algorithm picks the most reliable notary nodule. The testal consequence show that the vote workings has high exactness, performs well when dealing with

large-scale data, and can better improve the security and efficiency of cross-chain transactions. The vote workings can be applied to different cross-chain trading scenarios and has a wide request likelihood. Future be employeders can further explore different resemblance calculation manners and collaborative seive algorithm models to improve the efficiency and exactness of the vote workings. At the same time, we can consider combining blockchain technology with more complex artificial intelligence technology to develop a smarter and more efficient cross-chain transaction notarization group vote workings to further promote the development and request of blockchain technology.

## References


[1] Blockchain Cross-Chain Research Based on Verifiable Ring Signatures Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Volume 13340 LNCS, Pages 171-183, 2022Li, Zhe; Sheng, Zhiwei;Wan, Wunan; Zhang, Shibin; Qin, Zhi;Zhang, Jinquan;Xia, Jinyue

[2] Blockchain cross-chain technology research IMCEC 2022 - IEEE 5th Advanced facts Management, Communicates, Electronic and Automation Control Conference, Pages 1064-1070, 2022Guo, Zhilian;Liu, Lixian;Liang, Zhihong;Huang, Yuxiang

[3] A secure cross-chain transaction model based on quantum multi-signature Quantum facts Processing, Volume 21, Issue 8, August 2022Wang, Zhuo;Li, Jian;Chen, Xiu-Bo;Li, ChaoyangCorresponding authorLi, Jian

[4] Cross-Chain Digital Asput System for Secure Trading and Payment .IEEE Transactions on Computational Social Systems, Pages 1-13, 2023Zhang, Peiyun;Hua, Xiaoqi;Zhu, Haibin

[5] A Cross-Chain Trusted Reputation Scheme for a Shared Charging Platform Based on Blockchain ,IEEE Internet of Things Journal, Volume 9, Issue 11, Pages 7989-8000, June 1, 2022He, Yunhua; Zhang, Cui;Wu, Bin;Yang, Yigang;Xiao, Ke[;Li, Hong

[6] ARC: An Asynchronous Consensus and Relay Chain-based Cross-chain Solution to Consortium Blockchain.Proceedings - 2022 IEEE 9th International Conference on Cyber Security and Cloud Computing and 2022 IEEE 8th International Conference on Edge Computing and Scalable Cloud, CSCloud-EdgeCom 2022, Pages 86-92, 2022Zhang, Shaobo;Xie, Tianxiu;Gai, Keke;Xu, LeiCross-Chain Digital Asput System for Secure Trading and Payment IEEE Transactions on Computational Social Systems, Pages 1-13, 2023Zhang, Peiyun;Hua, Xiaoqi;Zhu, Haibin

[7] Blockchain-Oriented Privacy Protection with Online and Offline proof in Cross-Chain System Proceedings - 2022 International Conference on Blockc hain Technology and facts Security, ICBCTIS 2022, Pages 177-181, 2022Li, Xiling;Ma, Zhaofeng