Introduction to Blockchains

Course Code - CS765

Assignment 3

Report

210050105,210050098,210050034

April 2024

1 Introduction

- The system is a decentralized fact-checking system
- The system has 2 types of users, the users who post the news articles and the fact checkers
- The users who post the news articles pay a fee to get the news article fact-checked
- The fact checkers vote on the fact check, and the fact checkers have to pay a fee to vote
- The trustworthiness or weight of the vote is based on the previous fact checks done by the fact checker
- If the fact check and the evaluated result both are same, then the weight is increased and if they are different then the weight is decreased
- The fact checkers have to vote before the timeout, and the result is evaluated based on the weighted votes
- The users who voted for the correct fact check get a reward based on the weight of the vote, and other users are penalized
- If the majority of the users are malicious initially, then the system will not work properly, and they control the system
- This works well on the assumption that the majority of the users are rational initially

2 Some issues taken care of

2.1 Sybil Attack

- There is a voting fee for each fact checker, So an attacker cannot create as many fact checkers as he wants
- The attacker can create multiple fact checkers, but he has to pay the voting fee for each fact checker, so it is not feasible to create a large number of fact checkers

2.2 Evaluating trustworthiness and Voting Weightage

- The trustworthiness is measured based on the number of correct fact checks done by the fact checker divided by the total number of fact checks done by the fact checker
- Each fact checker has a weight, which is updated based on the previous fact checks done by the fact checker
- If the fact check and the evaluated result both are same, then the weight is increased
- If they are different then the weight is decreased linearly proportional to the weight, so that the user with high weight will lose more weight.
- The weight is increased proportionally to the inverse of the weight to ensure no one gets a very high weight rapidly
- There is different weightage for different topics, so the fact checker can have different weights for different topics

Every factchecker wont have 100 percent accuracy, suppose a factchecker has a very high accuracy, so say he gets only one wrong in k fact checks (i.e k is very large)

As he has very high accuracy assume his weight is also very high, so 1/ weight does not change much
Let's consider the updated weight given by:

$$\text{updated weight} = w + k \times c1 \times \left(\frac{1}{w}\right) - c2 \times w$$

The weight reaches saturation when:

$$k \times c1 \times \left(\frac{1}{w}\right) = c2 \times w$$

The saturation weight w is calculated as:

$$w = \sqrt{\frac{k \times c1}{c2}}$$

c1,c2 can be chosen such that w is not large enough to control the system

Even if the fact checker has 100 percent accuracy, the weight will not increase rapidly, as the weight is inversely proportional to the weight, it takes very long time to gain a very high weight

2.3 Incentives for the rational voters

- The rational voters are Incentiviized to vote for the correct fact check, as they get a reward for voting for the correct fact check
- The reward is given proportional to the weight of the vote, so the rational voters are incentivized to vote for the correct fact check
- The reward is given from the money paid by the user who posted the news article for fact-checking and the fine paid by the fact checkers who voted wrong
- The reward is given to the voters who voted for the correct fact check
- The weight increases if the vote is correct, so the reward also increases

2.4 Identifying the news article

- The news article is identified by the article number, which is unique for each article
- The article number is assigned by increasing the article number by 1 for each new article

2.5 Bootstrapping

- The initial trustworthiness of all the fact checkers is equal, is equal to 0.5
- The initial weight of the fact checker is set to 1, and is updated based on the previous fact checks

3 Observations

- The system has more number of rational voters, so the weight of the fact checkers increases
- Even though the very trustworthy factcheckers have 90% accuracy, they reached a saturation

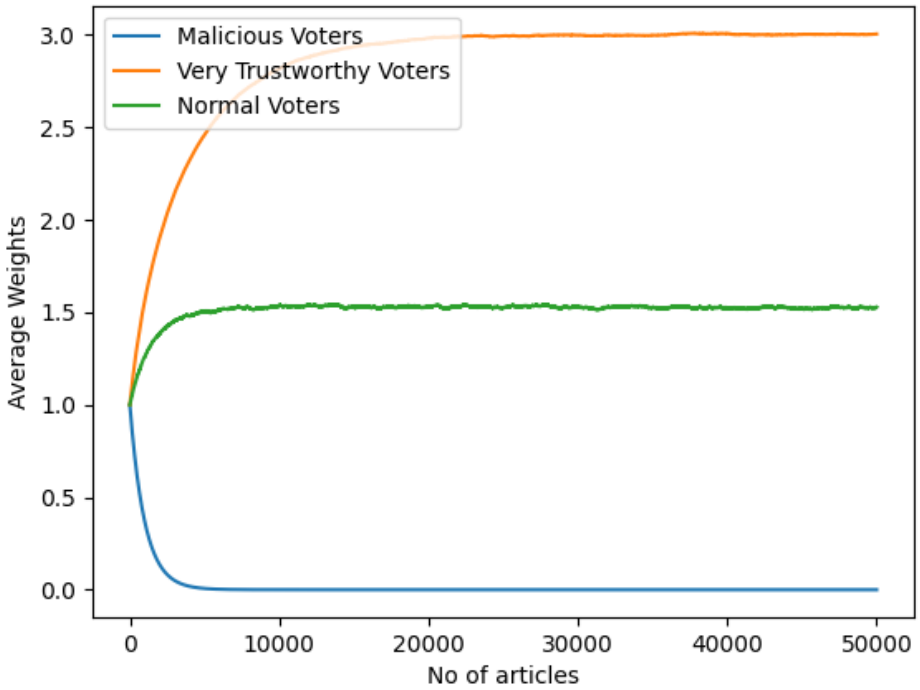


Figure 1: Average Weight vs No of Fact Checks, p=0.2, q=0.9

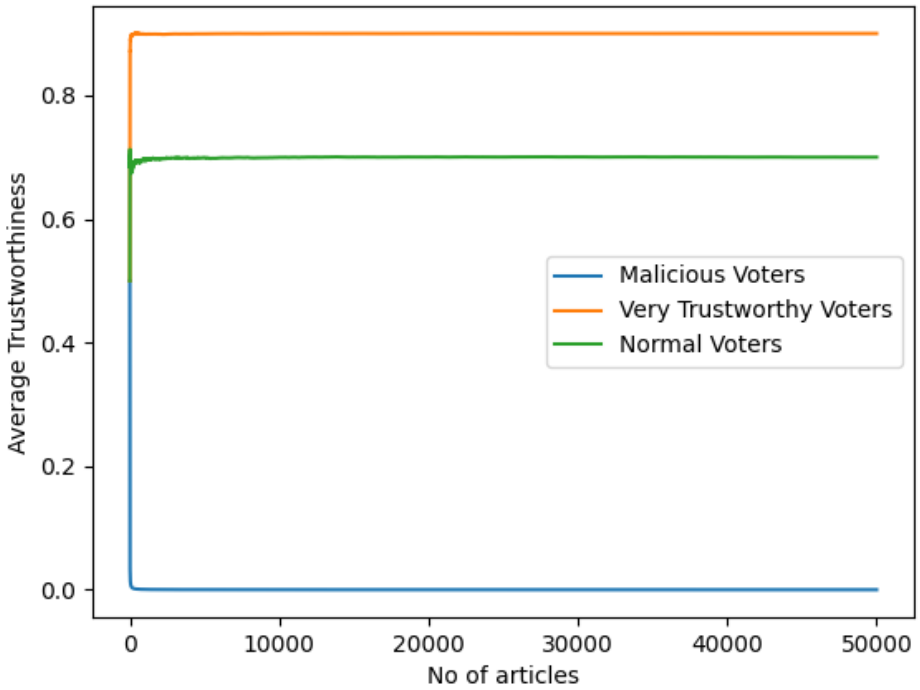
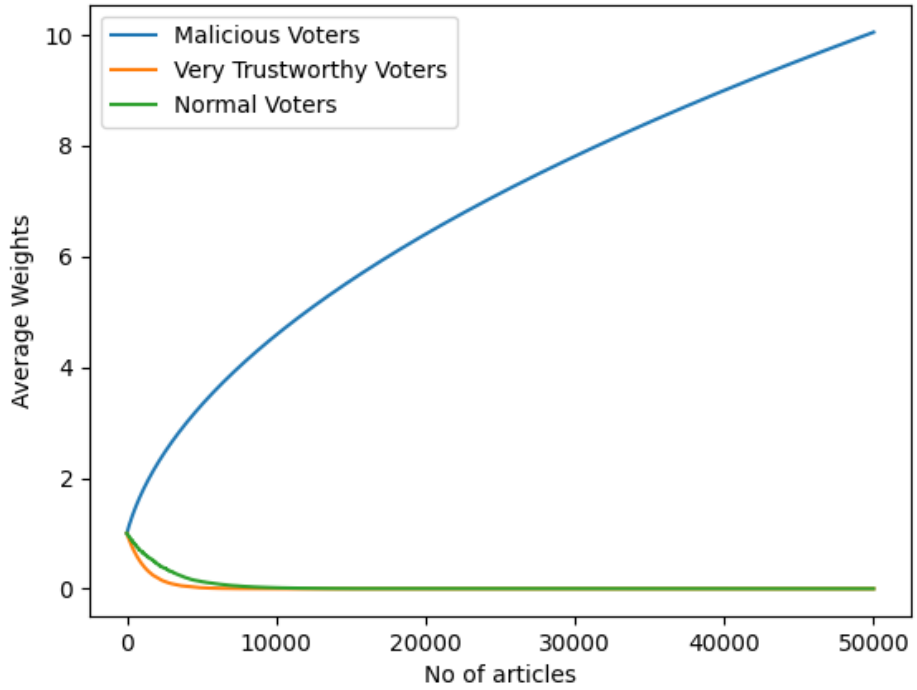


Figure 2: Average Trustworthiness vs No of Fact Checks, p=0.2, q=0.9

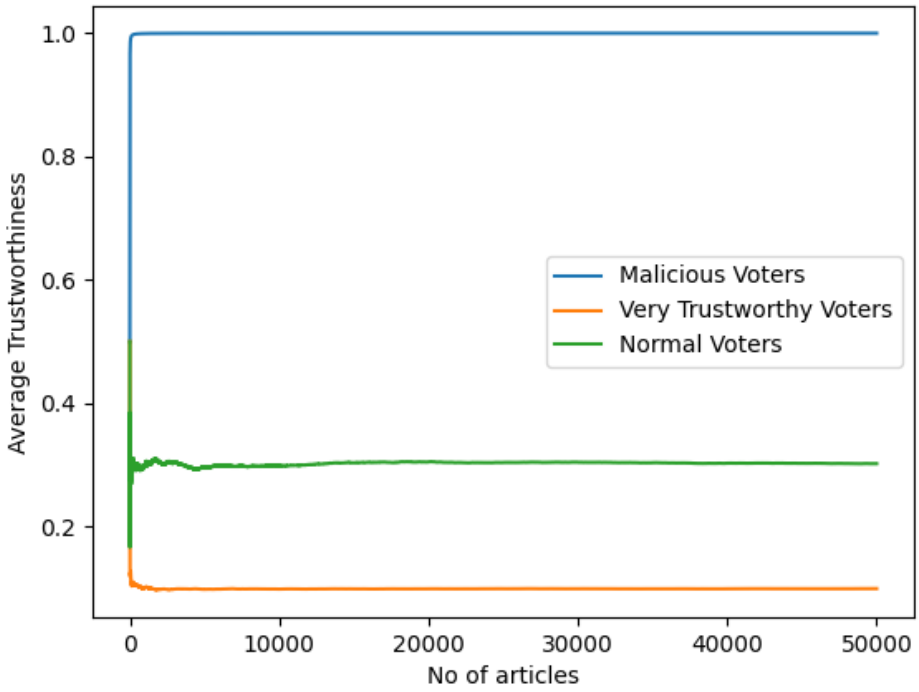
- The trustworthiness is calculated based on the average number of correct fact checks done by the fact checker
- So it does not change much, as the number of news articles increases
- Note that the values of trustworthiness calculated is almost equal to 0.9,0.7 and 0.0 as expected

3.1 What happens if malicious users are more?

The assumption is rational users are more than the malicious users, lets see what happens if the malicious users are more.
Below results are for p=0.9, q=0.9



- The malicious users are very large in number initially, so they control the system
- This makes the evaluated result to be wrong, and the rational users are penalized
- Thus increasing the weight of malicious users and decreasing the rational users



- The trustworthiness is reversed, as the malicious users are more, the trustworthiness of the malicious users is high
- The values are around 1.0, 0.3, 0.0