We regret to inform you that your submission

Sybil-Proof Diffusion Auction in Social Networks has not been accepted for publication at SAGT 2022.

This year we received (a record number of) 83 submissions, of which 34 have been accepted, leading to approximately 41% acceptance rate. There were many high-quality submissions, and unfortunately, several strong papers could not be accepted.

The reviews of your paper are included below. While the reviews may not always reflect the full discussion, we hope you find them helpful for preparing a future revision of your paper.

Best regards,
Panagiotis Kanellopoulos, Maria Kyropoulou, Alexandros Voudouris
SAGT 2022 PC chairs

SUBMISSION: 80
TITLE: Sybil-Proof Diffusion Auction in Social Networks

---------- REVIEW 1 ----------
SUBMISSION: 80
TITLE: Sybil-Proof Diffusion Auction in Social Networks
AUTHORS: Hongyin Chen, Xiaotie Deng, Ying Wang, Yue Wu and Dengji Zhao

---------- Overall evaluation ----------
SCORE: -1 (weak reject)
----- TEXT:
Summary: The authors explore the setting of designing incentive compatible diffusion auction mechanisms when there is the possibility of a sybil attack. The authors conclude that existing (non-trivial) mechanisms are not sybil proof, and they introduce two new mechanisms that are sybil proof. They then compare both theoretically and experimentally the performance of the sybil proof mechanisms to some other (non-sybil proof) mechanisms.

Comments:
Overall, I think that there is much to like in terms of the theoretical contributions in this paper. While it is not surprising that existing diffusion auction mechanisms fail to be sybil-proof, it is good to have this documented. I also think that the new mechanisms (STM and SCM) are reasonable extensions for diffusion auctions.

I think that the theoretical results around the social welfare and revenue ordering are also very nice contributions.

My main reservations around the paper are about readability. I feel that this paper, in it's current form, may have a more limited impact than it would otherwise due to the difficulty in reading it. I'll just list some comments roughly in the order in which I encountered them in the paper:

1. Page 1 paragraph 2 - sentence 1 - "The first work of diffusion auction" -> "The first work on diffusion auctions"
2. Page 2 paragraph 2 - I think you should state that it is VCG for combinatorial auctions that is not sybil proof. VCG for single item auctions (which I think is what most people think about when they hear VCG) is sybil proof.
3. Page 3 - preliminaries - I find the notation around the type profile to be very strange. Specifically, the type profile \theta includes the type of the seller \theta_s. I could not identify any place in the paper where it was actually useful to include the type of the seller in the type profile, nor do I think that this is standard notation. In most mechanism design papers I am familiar with, the type profile is only over the bidders, not the seller. I would change this. The other issue is that the reported type profile is not a fixed length (due to the issue of either not diffusing to legitimate agents or creating sybil agents). This is a notational issue that should be cleared up.
4. Related to 3, in the definition of the diffusion auction mechanism, you should make clear that the mechanism can (and must) deal with arbitrary length reported type profiles. This is again not the standard way to define a mechanism, but it is important for your setting.
5. You assume anonymity on page 4. Is that actually necessary? If it isn't, then I wouldn't assume it.
6. You define transfers t_i such that a negative transfer is a payment to the seller. This is also non-standard, a negative transfer is typically a payment to the buyer. This would change the utility to be v_i*\pi_i(\theta') - t_i(\theta'). Unless there is a good reason to use the non-standard convention for transfers, I would use the standard convention. If there is a good reason, I would explain why.
7. Page 4 last paragraph "We hope the diffusion auction mechanism to incentivize truthful bidding" Not grammatically correct sentence.
8. Page 5 - You introduce IC and IR. It should be pointed out that these are DSIC and ex-post IR notions.
9. Page 5 - I would explain more why the notion of IR does not rely on truthful diffusion to guarantee non-negative utility. You have a footnote, but I would explain the justification.
[在 IJCAI 的 rebuttal 里我们应该回答过这个问题，我们希望所有人参与进来无论他们是否愿意传播信息]
10. Page 5 - Notation in third sentence of paragraph 1 for section 2.2 is difficult to follow. I would replace x with i_j
[应该是指第四句]

of Sybil identities (or false-name identities) $i_1, i_2, \cdots, i_k$, each with a report $\theta'_{i_1}, \cdots, \theta'_{i_k}$. The set of all identities of i is denoted as $\phi(i) = \{i, i_1, \cdots, i_k\}$. For every $\theta'_x = (v'_x, n'(x)) \in \Theta'_i$ for $x \in \phi(i)$, it must be guaranteed that $n'(i_j) \subseteq n(i) \cup \phi(i)$, since i would not know any agent other than herself, her neighbors

11. Page 5 - bottom of page "strategical" is not a word.
12. Page 6 - There is something strange happening with IDM (and the whole idea of sybil attacks). The seller would also benefit from a sybil attack (and this is generally true even in a standard second price auction). However, in your case, the way that the seller benefits is exactly the same way that the the bidder benefits (since the bidder is just selling the item along). So, it is a little weird to let all bidders engage in sybil attack, but to not allow the original seller, even though IDM is really some kind of sequential NSP mechanism. Can you justify this?
13. Definition 6 is hard to parse. I would explain a little more what is going on.

Definition 6 (Graphical non-Sybil agents). *The set $\Gamma \subseteq V$ is defined as follows:*

1. $\{s\} \cup n(s) \subseteq \Gamma$.
2. $\Gamma_0 \subseteq \Gamma$.
3. If $x, y \in \Gamma$, and z is a meeting point of them, then $z \in \Gamma$.
4. No other identities, other than those included above, are in Γ.

14. In the statement of Theorem 2 and 3, there is this condition that "as long as \Gamma_0 does not contain any Sybil identity". I have no idea why this statement is necessary. I thought that \Gamma_0 was defined as a set of trusted vertices that cannot have any sybil identities. Am I confused? If this statement is redundant, please remove it.
15. Figure 5, I don't believe that part (b) of the figure actually shows a shortest path tree. Specifically, once you remove the bottom right edge, then it takes three steps to get to the bottom most node, when in the original graph, you could do it in two steps. Please clarify or fix.
[这是一个 bug]

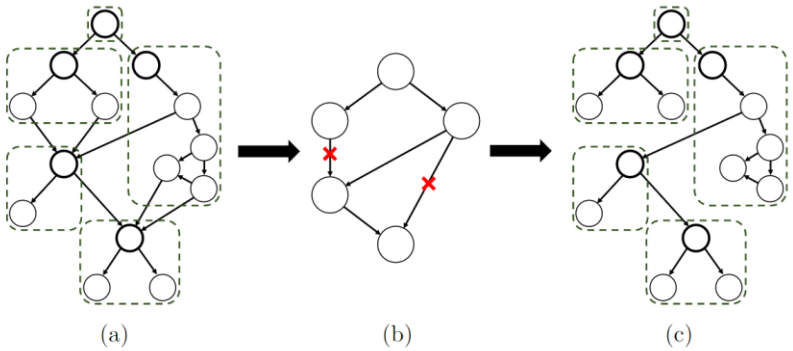

Fig. 5: A sketch for SCM.

16. You use Figure 4b) as the example for SCM in the text of page 12 instead of Figure 5, which is the figure to explain SCM. This seems both confusing and unnecessary. I think you should use figure 5 to fully explain SCM.

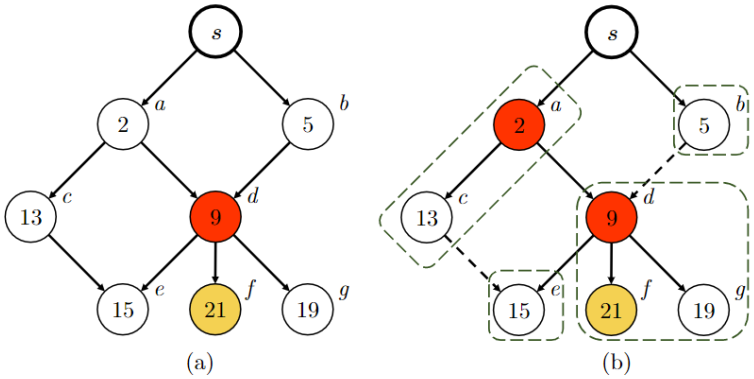

Fig. 4: Examples of the Sybil tax mechanism and the Sybil cluster mechanism.

Overall, I would be in favor of accepting a version of this paper in which the writing has been significantly improved for the sake of clarity of exposition. As it is, I worry that the paper will have a lesser impact due to the difficulty in internalizing the (generally nice) ideas of the paper.

---------- REVIEW 2 ----------
SUBMISSION: 80
TITLE: Sybil-Proof Diffusion Auction in Social Networks
AUTHORS: Hongyin Chen, Xiaotie Deng, Ying Wang, Yue Wu and Dengji Zhao

---------- Overall evaluation ----------
SCORE: 1 (weak accept)
----- TEXT:
Paper Summary
This paper introduces two (first) Sybil-Proof (SP) mechanisms for diffusion one-item auctions, the Sybil Tax Mechanism (STM) and the Sybil Cluster Mechanism (SCM). The key point in both mechanisms, which is the main innovative contribution of the paper, is that participants are rewarded for propagating the information through the social network, but only to "reliable" potential buyers, i.e. those that are without a doubt real network users and rather than self-copies of some user. Especially, the SCM poses strict incentives for buyers to diffuse information.

The SP property comes at the expense of maximizing social welfare and/or revenue for the seller, and the authors address that in Section 6.1 . First, the performances of STM and SCM are compared with three common baseline auctions, Namely the NSP, IDM and VCG auctions, which are all not SP. Then, they show that the socially optimal SP mechanism cannot be determined decisively. As theory cannot provide clear answers to the efficiency loss caused by SP, the article is completed with experimental results, comparing the average performance of SCM, STM, IDM and

NSP over 1000 simulations in different social-networks simulations models. The main positive take-away from these experiments might be that STM and SCM fall behind IDM in a much smaller rate the gap between them and NSP (neighbors second price auction), that includes no information diffusion at all.

Strengths, weaknesses, and overall evaluation
Overall, I find the article interesting, well written and introducing valuable results. However, some assumptions in the model lack a satisfactory justification in my opinion. Especially, the assumption that if y is a neighbor of x then a fake identity created by x can reach (meaning, send information to) y , but not vice-versa. It stems, I infer, from the assumption that the underlying social network is represented by a directed graph, which I find on itself questionable. Connections in social media networks – which seem like the main motivation of the article – are in a lot of cases reciprocal, and moreover, the authors argue that the model is embedded naturally in undirected networks as well. In that case, it is either that we assume that the (directed) information diffusion graph H is formed only on a subset of the edges that already existed in the network graph G, or that H is not limited in this way. For example, I don't see how a Facebook user can create a fake user that can connect with her friends while they cannot do the opposite. I am aware that this assumption prevails in the sybil-attacks literature, but you have to consider it in your specific context. (for example, a plausible explanation is that fake identities pass on the information instantaneously as they are created, therefore denying the opportunity of receiving the information from nodes other than their creator. However, that would mean that the diffusion graph only considers the first sender to any node, which contradicts the fact that H includes meeting points).

I am not sure how crucial that assumption is for your results, but I think the motivation for the model as a whole , and that assumption in particular, must be provided with a more solid clarification.
Other than that, while the paper as a whole is well written and reads quite fluently, it could be clearer at some points. The introduction of the IDM, STM and SCM algorithms are, in my opinion, not very intuitive for the unfamiliar reader, and could benefit from a more detailed explanations (although the examples indeed help much).

Specifically, in the STM definition, the formula of q_j does not match its description in words, and the description of c_j is a bit vague.

---------- REVIEW 3 ----------
SUBMISSION: 80
TITLE: Sybil-Proof Diffusion Auction in Social Networks
AUTHORS: Hongyin Chen, Xiaotie Deng, Ying Wang, Yue Wu and Dengji Zhao

---------- Overall evaluation ----------
SCORE: 2 (accept)
----- TEXT:
This paper studies an interesting problem, which seems applicable considering the rise in use of social networks. It is written well and is easy to follow. The results (to my knowledge) are novel and interesting.

An assumption made in the paper is that ''fake nodes can be easily created''. I'm not sure how realistic this assumption is (thinking about the existing social networks I use or familiar with, this assumption does not seem to hold). But I think nevertheless this is a good start and perhaps future work can focus on tightening this assumption (e.g. limiting the number of fake nodes a real node can easily create, or add costs to creating new nodes).

Neighbourhood of a node is assumed to be private knowledge. I wonder again how realistic this assumption is (e.g. on FB I believe you can see the list of friends of at least some people; I'm not a FB user though).

The paper defines truthful behaviour as ''bidding their private values and diffusing the information to *all* their neighbours''. Again I wonder whether it makes sense to consider weaker notion of truthful behaviour. I find *all* strong. Maybe relaxing it to have a weaker truthful notion in which the information is diffused to say k number of neighbours, or k% of neighbours, will be a good direction for future work.