

A Network-based Rating Mechanism Against False-Name Attack

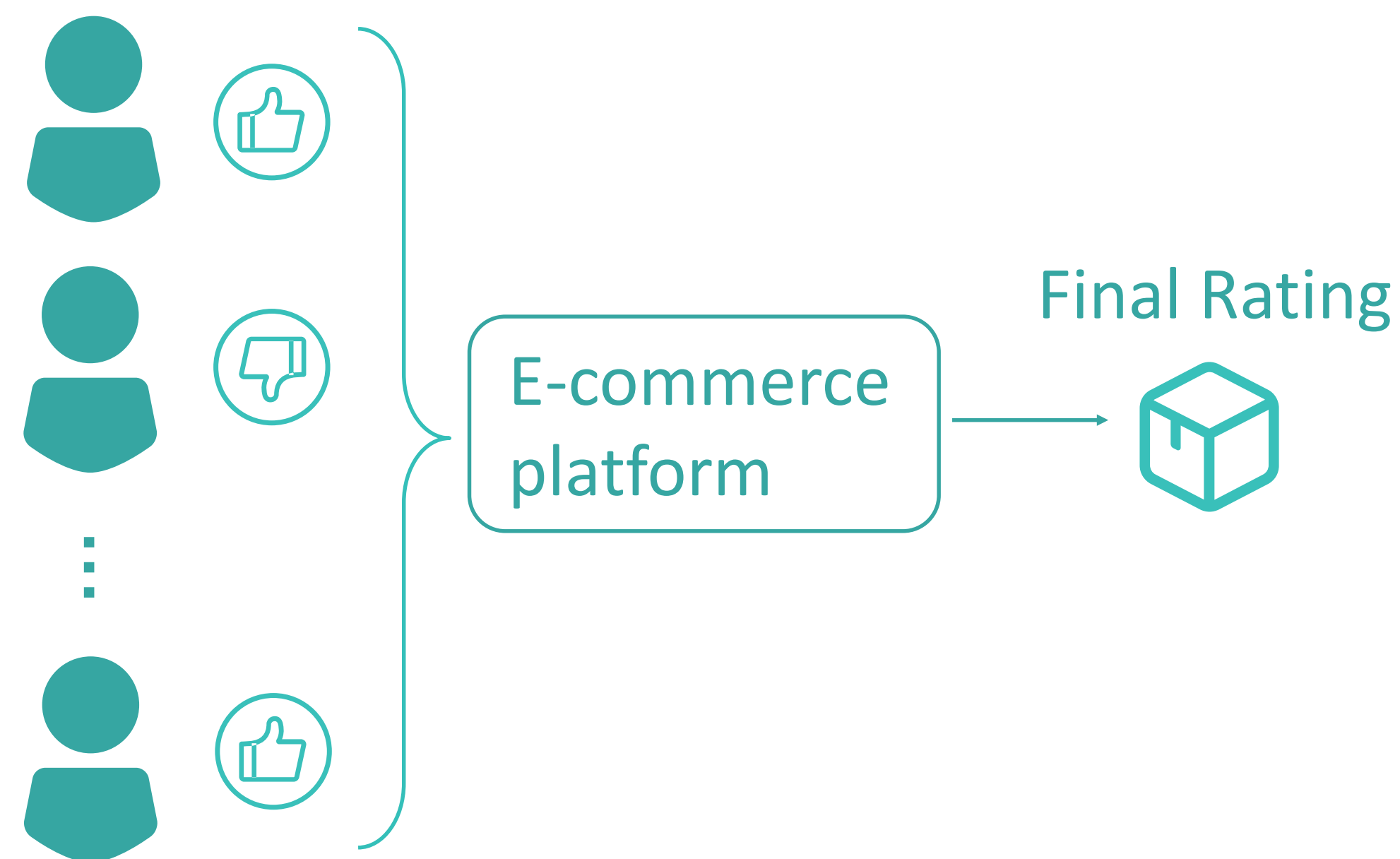
Xinyuan Lian and Dengji Zhao

ShanghaiTech University, Shanghai, China

Background

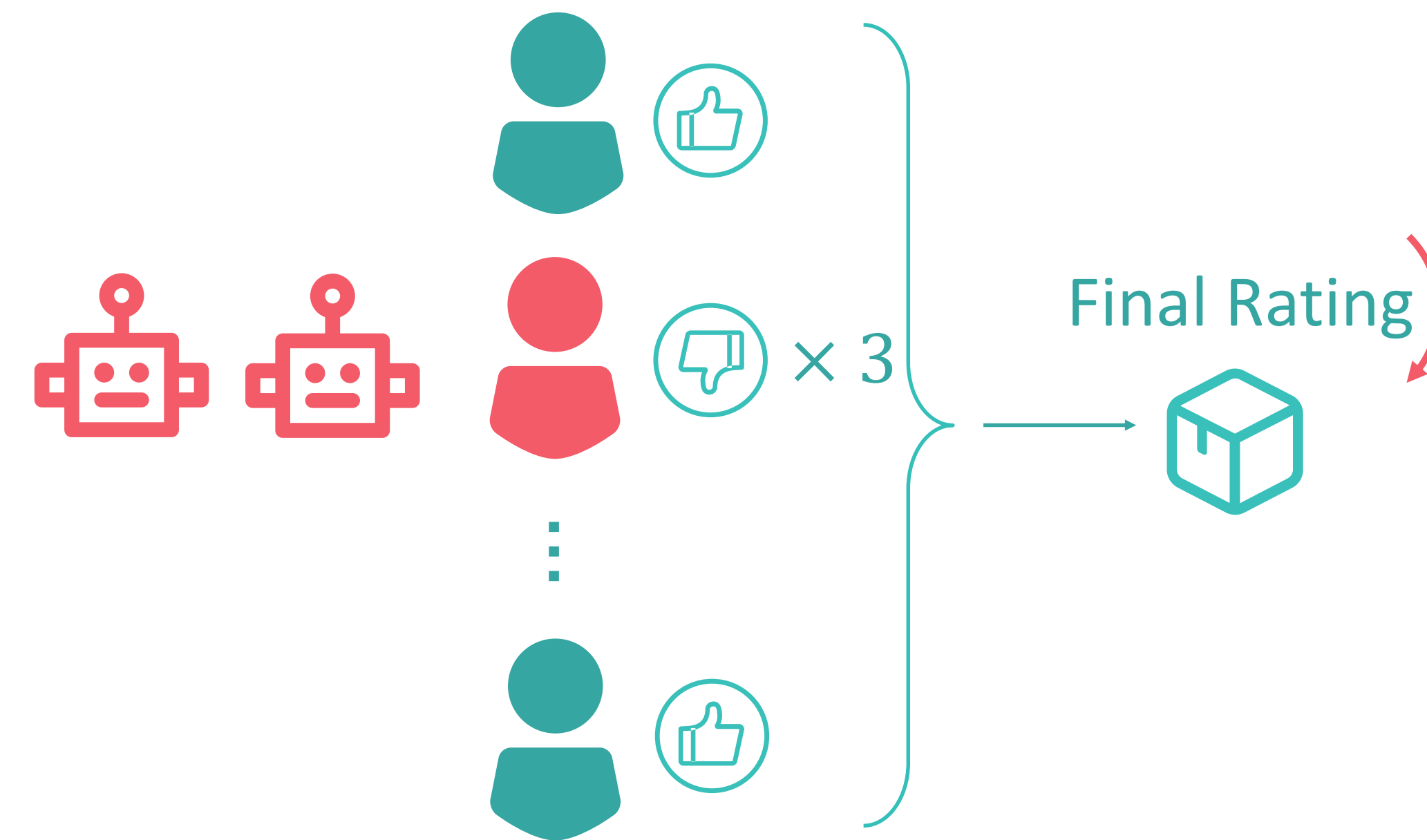


E-commerce platforms such as Amazon and Taobao allow users to report their feedback in the form of a **binary** discrete score after they buy the products.



The rating result of a product is generally obtained by aggregating all buyers' report and it is an essential part of a product's competitiveness. This process encourages sellers to provide better products because higher ratings can attract more business.

Main Challenge



Some buyers may create fake accounts to increase or decrease the rating of a product. Such malicious behaviors are commonly known as false-name attack.

The **goal** is to design a rating mechanism for the binary rating system which is **false-name-proof** and **monotonic** to ensure the final rating of a product is sensitive to all buyers' ratings.

Our Result

We consider all the agents are connected by an undirected graph $G = (V, E)$ where V is the set of agents who experienced the product and the edges represent trust between agents. We denote $N(i)$ as agent i 's neighbor set which includes all the agents connected with agent i .

Weighted Rating Mechanism:

Given a social network G and all agents' report on the product, the weighted rating mechanism \mathcal{M} is defined to compute the weight w_i for all $i \in V$ and output the final rating

$$u = \frac{\sum_{i \in V} w_i r_i}{n}$$

In our weighted rating mechanism, we define each agent i 's weight as following

$$w_i = \frac{1}{|N(i)| + 1} + \alpha + \sum_{j \in N(i)} \left(\frac{1}{|N(j)| + 1} - \frac{\alpha}{|N(j)|} \right)$$

Properties:

- Agents in weighted rating mechanism will truthfully report their observations.
- The weighted rating mechanism is false-name-proof and monotonicity if

$$\alpha \in \left[0, \min \left\{ \frac{1}{3}, \frac{(1+n)(n \times \inf f_c - 1)}{n} - 1 \right\} \right)$$

where $\inf f_c$ is the infimum of all the attacker expected change on the final rating.

Conclusion & Future Work

- This paper introduces a novel framework to design a weighted rating mechanism for the binary rating system in a social network. The goal is to let the mechanism be robust to the false-name attack and monotonicity.
- Considering the n-ary rating system is an interesting future work. For instance, if an attacker intends to decrease the final rating of a product, she may create many false nodes with the same report and choose to report lower rating level. Another challenging work is to develop more generalized rating mechanisms without the prior knowledge of the infimum of the mapping functions. It is theoretically worth to considering to relax the assumption in this paper.

Contact

If you have any questions, please feel free to contact us. You can find me at lianxy@shanghitech.edu.cn