Proposed Model:

The proposed model for our discussed problem can be seen below. Initially, we define the sets for the model:

G: index {k} for all grants in a funding round.

A: index {i} for all accounts in a funding round.

Data for the model:

p_i = Penalty that an account incurred

c_{ik} = Contribution that an account made to a specific grant.

o_{ik} = 0 or 1 indicating account ownership of grant

s_i = 0 or 1 indication sybil status for each account

CLR   = CLR subsidy coefficient

DCC_{ij} = Discoordination coefficient between 0 and 1. Closer to 0 penalizes coordinated funding patterns

M   = M is a tweakable parameter within DCC. Seems to act like modifier for the degree to which the DCC penalizes coordination

CLR Formulas (Original):

CLR Subsidy Formula (Match):

$$CLR*[(\sum_{i=1}^{A} \sqrt{c_{ik}})^2 - \sum_{i=1}^{A} c_{ik}] \ \forall \ k \ \in G$$

CLR Subsidy Formula with penalty (Match with penalty):

$$CLR*[(\sum_{i=1}^{A} \sqrt{p_i c_{ik}})^2 - \sum_{i=1}^{A} p_i c_{ik}] \ \forall \ k \ \in G$$

Stolen CLR Subsidy Formula with penalty (Match with penalty):

$$CLR*[(\sum_{i=1}^{A} \sqrt{p_i o_{ik} c_{ik}})^2 - \sum_{i=1}^{A} p_i o_{ik} c_{ik}] \ \forall \ k \ \in G$$

Working Formulas (Original):

$$Subsidy(k) = CLR*[(\sum_{i=1}^{A} \sqrt{p_i c_{ik}})^2 - \sum_{i=1}^{A} p_i c_{ik}]$$

$$Stolen(k) = CLR*[(\sum_{i=1}^{A} \sqrt{p_i o_{ik} c_{ik}})^2 - \sum_{i=1}^{A} p_i o_{ik} c_{ik}]$$

CLR Formulas (Pairwise Coordination Subsidies)

Example Discoordination Coefficient

$$DCC_{ij} = \frac{M}{M + \sum_{p=1}^{G} \sqrt{c_{ip}} \sqrt{c_{jp}}}$$

CLR Subsidy Formula (Match):

$$\sum_{i=1}^{A} \sum_{j=1}^{i-1} DCC_{ij}*[2\sqrt{c_{ik}}\sqrt{c_{jk}}] \ \forall \ k \ \in G$$

CLR Subsidy Formula with penalty (Match with penalty):

$$\sum_{i=1}^{A} \sum_{j=1}^{i-1} DCC_{ij}*[2\sqrt{p_i c_{ik}}\sqrt{p_j c_{jk}}] \ \forall \ k \ \in G$$

Stolen CLR Subsidy Formula with penalty (Match with penalty):

$$\sum_{i=1}^{A} \sum_{j=1}^{i-1} DCC_{ij}*[2\sqrt{p_i o_{ik} c_{ik}}\sqrt{p_j o_{jk} c_{jk}}] \ \forall \ k \ \in G$$

Decision Variable:

$P_i = [0,1]$

Representative of the aggregate suspicion level of an account being a participant in a sybil attack.

The penalty parameter could be chosen from the level of human verification, account profile, a tax, contributing to grants with suspicious grant donation distributions, and on-chain sybil score.

Objective Function:

$$Minimize \sum_{k \in G} Stolen(k)$$

OR

$$Minimize \sum_{k \in G} Stolen(k) + \sum_{i \in A} |p_i - s_i|$$

OR

....?

Constraints:

Sensitivity and Specificity level constraints.

Set constraints on certain types of on-chain behaviors or attributes that either make account data non-public or which severely limit a models judgement capability for penalty allocation.

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