

TSP: Truthful Grading-Based Strategyproof Peer Selection for MOOCs

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1 Problem Addressed

Analyzing the fundamental challenges in using peer prediction to select best-k students in MOOC (massive open online courses) settings and designing a strategy-proof, truthful grading based peer prediction scheme.

2 Previous Work

- A strategy-proof selection mechanism called Dollar Partition was proposed. However, it didn't take into account that the agents instead of exerting effort and time would report arbitrary.
- There are mechanisms to motivate agents to put the effort in a setting that assumes the "gold standard" questions, but this paper has no such assumptions.
- Some of the mechanisms leverage correlation in peers reports eliciting truthful reports under a scenario of non-ground truth(ie: Output agreement), which is not incentive compatible.
- Peer Truth Serum(PTS) mechanism was proposed, which utilizes the distribution of the reported data from similar tasks as prior probability and proportionally scale the reward.

3 Basic Assumptions

- All participants enjoy the same situation and infer the final grading of all the students.

- No ground truth available and assumes no gold standard questions in the setting.

4 TSP Mechanism Framework

TSP scheme is composed of three components.

- **Component 1:** partitioning students uniformly into clusters and peer assessment.
- **Component 1:** Reward calculation according to the rule of surprisingly common.
- **Component 1:** Best k-students selection into winning set W.

Reward Function

Parameters: $R(x)$ is prior distribution, x_p, x_w are reports of agents p & w, $\alpha > 0$

Reward: $\tau(x_w, x_p) = \alpha \cdot (\tau_0(x_w, x_p) - 1)$, where

$$\tau_0(x_w, x_p) = \begin{cases} \frac{1}{R(x)}, & \text{if } x_w = x_p \\ 0, & \text{if } x_w \neq x_p. \end{cases}$$

Final Reward is the avg of rewards over all peers

$$\tau(w) = \alpha \cdot \left(\frac{1}{|S(w)|} \cdot \sum_{p \in S(w)} (\tau_0(x_w, x_p) - 1) \right)$$

5 Novelty

- Recognize the strategic aspect of agents and motivate them to report truthfully by making a proper effort.
- The Principle of rewarding surprisingly common answers is realized. Common because reports are consistent, Surprising because less likely answers lead to higher reward.
- Agents can't increase his/her chances of getting selected by manipulating their valuation for other agents outside the cluster because he/she only contributes to the probability weight of $1/n$.

6 Comparison with previous mechanisms

For traditional strategy-proof peer selection mechanisms, students may report random evaluation on other peers instead of exerting efforts to evaluate, especially for the case that those evaluations can't be verified (because of extreme difficulty or no ground truth existed).

7 Conclusion

A novel truthful grading based strategy-proof peer selection for MOOCs, TSP is proposed. The theoretical analysis proves that TSP can motivate students to put effort into peer assessment and also report their grading honestly. Even the simulation results show that the accuracy of the selection of best-k students in a strategy-proof way is better than that of the traditional non-incentive scheme.