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FNSNF

Incentive Schemes for Participatory Sensing

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Objective

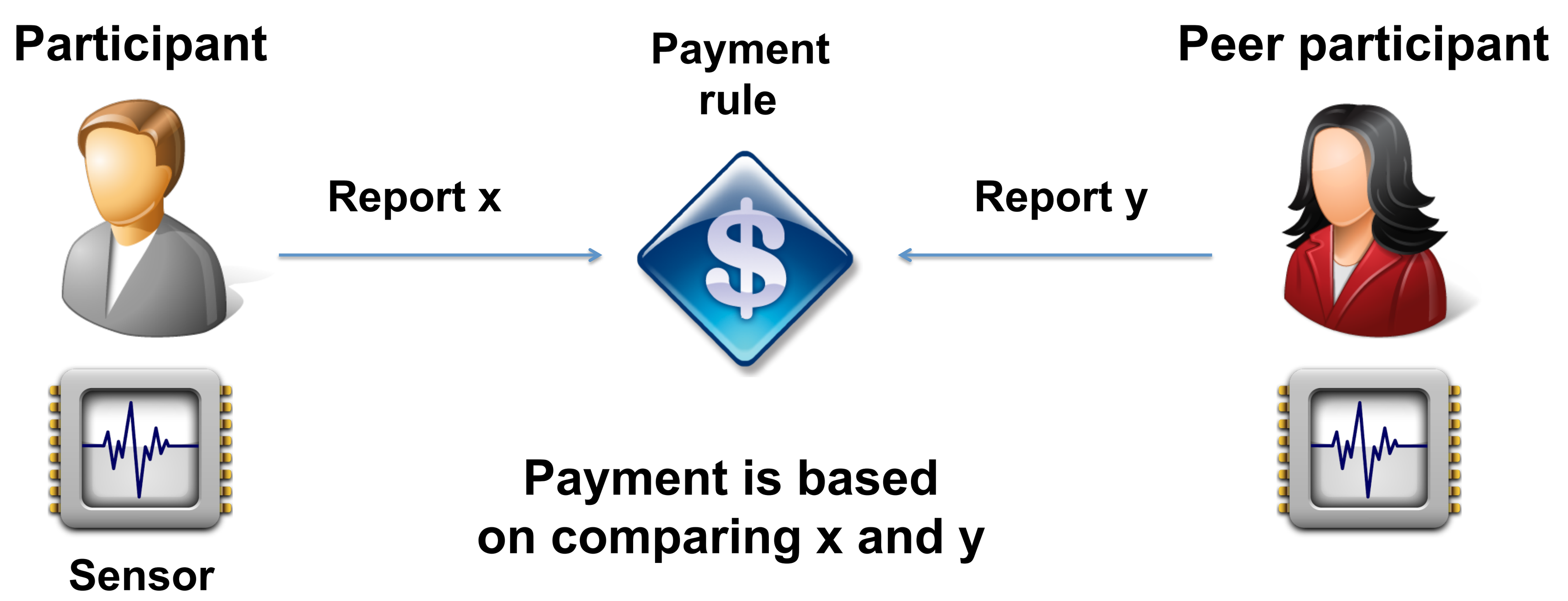
We want to elicit high-quality information in participatory sensing scenarios where participants might have different prior information.

Contribution

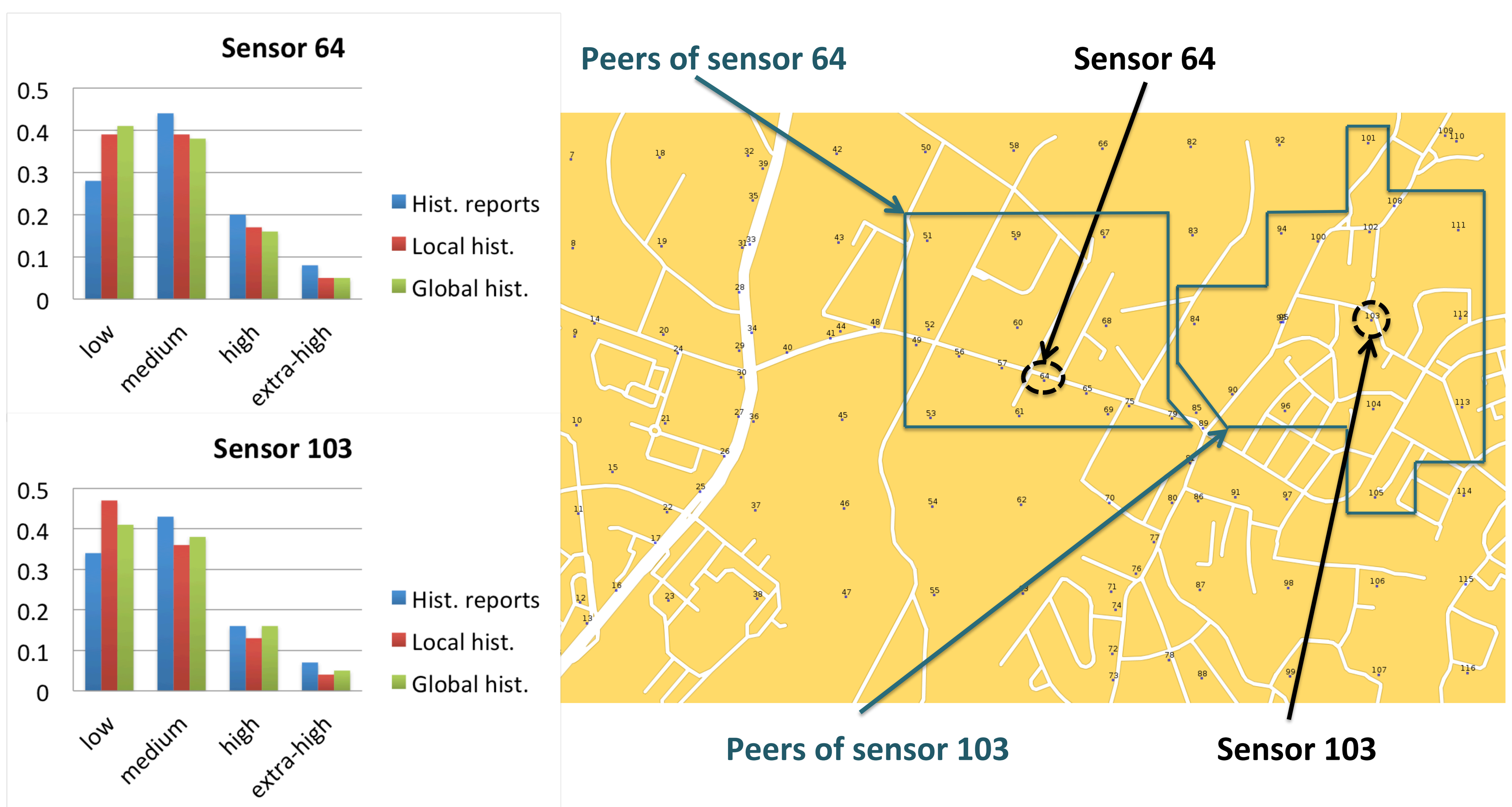
A novel peer incentive mechanism that:

- does not require participants to have a common prior belief;
- can elicit non-binary information;
- makes uninformed equilibria less desirable than truthful reporting.

Peer incentive mechanisms



Novel idea: *Use spatial correlations to discourage collusion and remove bias towards prior information.*



Measurements taken from the same area should be more correlated than the ones taken from different areas.

Related Work

- *Crowdsourced judgement elicitation with endogenous proficiency*, A. Dasgupta, A. Ghosh, 2013.
- *Learning the prior in minimal peer prediction*, J. Witkowski, D. C. Parkes, 2013.
- *Incentives for subjective evaluations with private beliefs*, G. Radanovic, B. Faltings, 2015.

Logarithmic Peer Truth Serum

Approach

Assign higher rewards to those sensors that report *surprisingly common* information – information that is more common than expected.

Structure

To reward a sensor *s*, calculate two empirical frequencies:

- $\mathbf{x}_{local}(x)$: frequency of reports equal to *x* among the reports of sensor *s*'s peers.
- $\mathbf{x}_{global}(x)$: frequency of reports equal to *x* among the reports of reference sensors (e.g. all the sensors).

Sensor *s* is then rewarded for providing a report x_s with:

$$score = a \cdot \log \frac{\mathbf{x}_{local}(x_s)}{\mathbf{x}_{global}(x_s)} + b$$

where $a > 0$ and b are constants.

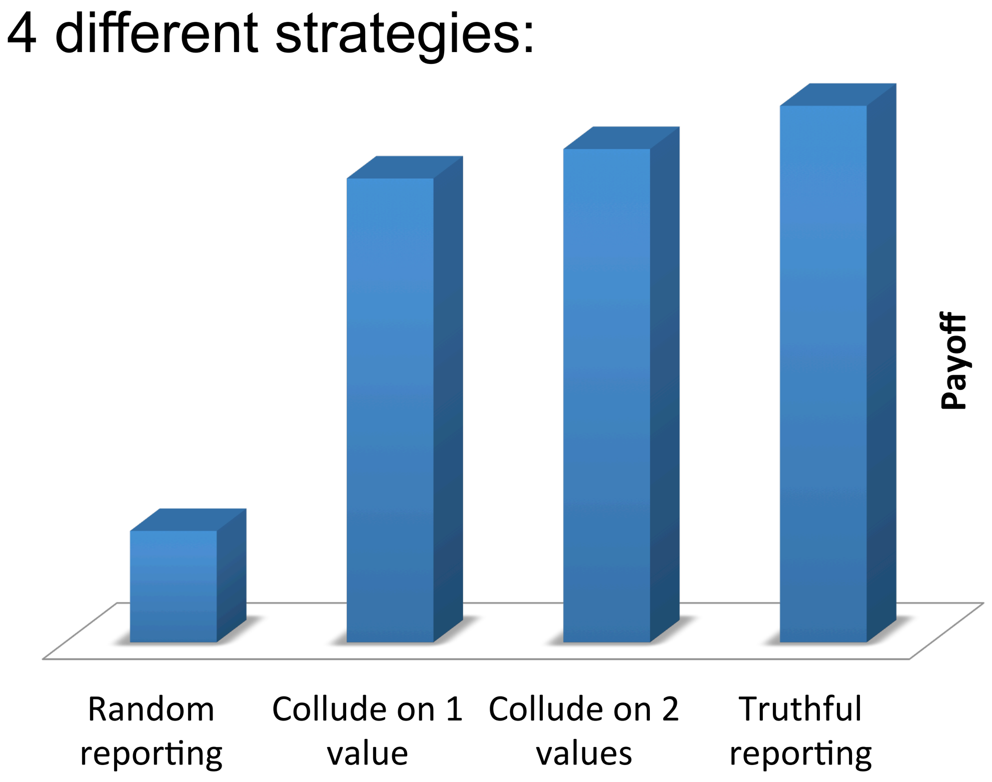
Theoretical properties

- *Incentive compatibility*: Truthful reporting is an equilibrium strategy with strictly positive expected payoff.
- *Scaling to cover the cost of sensing*: Uninformed equilibria result in 0 expected payoff. If a sensor reports randomly and the other sensors are honest, it expects to obtain a negative payoff. Thus, payments can be scaled so that sensors are incentivized to perform measurements.
- *Collusion resistance*: If sensors base their strategies solely on their measurements, their expected payoff is not greater than for honest reporting.

Simulation results

We show average payoff for 4 different strategies:

- Truthful reporting
- Random reporting
- Collusion on 1 value
- Collusion on 2 values



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