Long-term Data Sharing under Exclusivity Attacks

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High level summary

- Learning improves with scale & diversity of data
- Firms are hesitant to share data. They fear *Exclusivity Attacks*: Learn best model but mislead others
- We study different protocols, under strong/weak identity (sybil attacks), for clustering (k-center) and regression (d-LR) algorithms

Simple example: Sum

- N agents want to know the **sum** of their inputs, while misleading others.
- Attack: An agent shares $i' \neq i$, then subtracts $i' - i$

Attack fail: Max

- N agents want to know the **max** of their inputs, while misleading others.
- Attack: An agent shares M > m, and the computation result is M. The agent doesn't know true max

Protocols:

- **One shot** (the sum and max examples shown above)
- **Continuous**: Agents update at will, each update causes model re-evaluation shared with all
- **Periodic**: Agents update at constant times, at each period a model re-evaluation shared with all

Vulnerability

A strategy s_j of agent j is a successful exclusivity attack if:

- 1. There is a protocol run with last algorithm output different than under $truth_j$
- 2. Any two protocol runs with different observed histories under $truth_j$ have different observed histories under s_j

A stronger vulnerability* notion is if condition 1 holds **for every** protocol run.

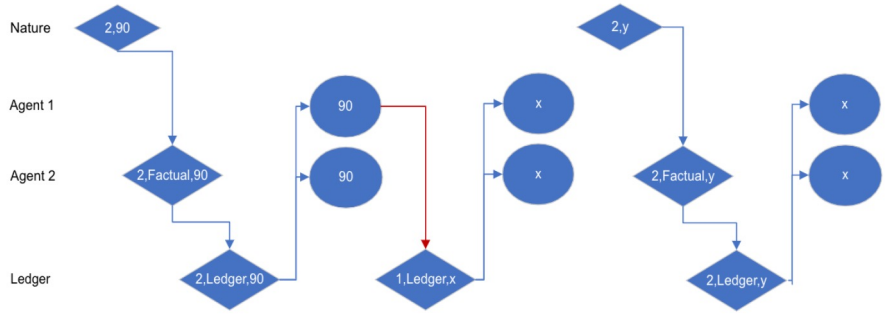
Algorithm Test Cases

	Vulnerable	Vulnerable*
d-LinearRegression	Yes, for any $\ell \geq 1$	Yes $\ell \geq d+2$; No $\ell \leq d-2$
k-Center	Yes, for any $\ell \geq 1$	No

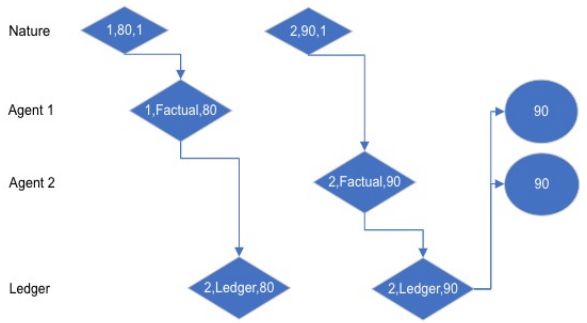
for continuous protocol, where ℓ is the number of subsequent updates by a single agent.

For the periodic protocol, both algorithms are not vulnerable.

Continuous
$(90 < y < x)$



Periodic



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For more information and Research Agenda

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