Errata for "Selling Multiple Items via Social Networks"

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ABSTRACT

The generalised information diffusion mechanism proposed by us in [1] has a typo in one constraint. What we needed is a weaker constraint, which is implied by the misspecified constraint though, because the additional limitation given by the misspecified one may affect the properties of the mechanism. We correct the typo in this note. Note that, all the results and the proofs presented in [1] are not affected by this correction.

1 ERRATA FOR THE DESCRIPTION OF THE GENERALISED IDM FOR SELLING MULTIPLE ITEMS

Under the description of the generalised information diffusion mechanism:

(1) Under the payment definition, in the definition of $\mathcal{SW}_{-D_i}$, change the constraint

$$\forall j \in N_i^{out}, \pi_j(\theta') = 0$$

to

$$\forall j \in (N^{opt} \setminus D_i) \setminus N_i^{out}, \pi_j(\theta') = 1$$

(2) Under the allocation definition, in the definition of $\mathcal{SW}_{-C_i^{\mathcal{K}}}$, change the constraint

$$\forall j \neq i \in N_i^{out}, \pi_j(\theta') = 0$$

to

$$\forall j \neq i \in (N^{opt} \setminus C_i^{\mathcal{K}}) \setminus N_i^{out}, \pi_j(\theta') = 1$$

(3) In the third paragraph under the description of the generalised information diffusion mechanism, change the sentence "**all buyers in N_i^{out} except for i do not receive items**" to "all buyers in $(N^{opt} \setminus C_i^{\mathcal{K}}) \setminus N_i^{out}$ except for i still receive items".

2 THE INTUITION BEHIND THE CHANGES

The differences between the original constraints and the corrections are that:

- In the definition of $\mathcal{SW}_{-D_i}$, the original constraint

$$\forall j \in N_i^{out}, \pi_j(\theta') = 0$$

implies the correction

$$\forall j \in (N^{opt} \setminus D_i) \setminus N_i^{out}, \pi_j(\theta') = 1$$

The original constraint means that all buyers in N_i^{out} do not receive items, while the correction indicates that all buyers in $(N^{opt} \setminus D_i) \setminus N_i^{out}$ still receive items, i.e. buyers in N_i^{out} are allowed to receive items if their valuations are large enough under $\mathcal{SW}_{-D_i}$, but they cannot take items from the initial winners in $(N^{opt} \setminus D_i) \setminus N_i^{out}$. Under the original constraint, a buyer may over report her valuation to win one item but pays something less than her true valuation, which affects the IC property.

- a similar logic applies to the second correction.

The full description of the mechanism under the corrections is as follows.

Generalized Information Diffusion Mechanism (GIDM)

Given the buyers' type profile θ and their action $\theta' \in \mathcal{F}(\theta)$, compute the optimal allocation tree $T^{opt}(\theta')$.

Let W be the set of buyers who receive an item in GIDM (the winners), initially $W = \emptyset$. For each $i \in W$, we define $GetFrom(i) \in N^{opt}$ to be the buyer from whom the item was taken by i from the efficient allocation. $GetFrom(i) = i$ indicates that i takes the item from herself.

- **Allocation**: The allocation is done with a DFS-like procedure. Let Q be a last in first out (LIFO) stack, initially Q is empty. The seller s gives $w_i(T^{opt}(\theta'))$ items to each $i \in Children(s)$ and adds all $Children(s)$ into Q. Repeat the allocation process defined in the following until Q is empty.
- **Payment**: For all $i \in N$, her payment is:

$$\begin{cases} \mathcal{SW}_{-D_i} - (\mathcal{SW}_{-C_i^{\mathcal{K}}} - v'_i) & \text{if } i \in W, \\ \mathcal{SW}_{-D_i} - \mathcal{SW}_{-C_i^{\mathcal{K}}} & \text{if } i \in \bigcup_{j \in W} \mathcal{P}_j(\theta') \setminus W, \\ 0 & \text{otherwise.} \end{cases}$$

where $\mathcal{SW}_{-C_i^{\mathcal{K}}}$ is defined in the allocation section and $\mathcal{SW}_{-D_i}$ is defined by a feasible allocation π as:

$$\text{Maximise: } \mathcal{SW}_{-D_i} = \sum_{j \in N_{-D_i}} \pi_j(\theta') v'_j$$

$$\text{Subject to: } N_{-D_i} = N \setminus D_i$$

$$D_i = \{i\} \cup C_i(\theta')$$

$$\forall j \in N_i^{received}, \pi_j(\theta') = 1$$

$$N_i^{received} = W \cap \mathcal{P}_i(\theta')$$

~~$\forall j \in N_i^{out}, \pi_j(\theta') = 0$~~

$$\forall j \in (N^{opt} \setminus D_i) \setminus N_i^{out}, \pi_j(\theta') = 1$$

$$N_i^{out} = \{j \notin N_i^{received} | j = GetFrom(l), \forall_{l \in N_i^{received}}\}$$

The Allocation of GIDM

(1) Remove a node i from Q, add i to W if i receives an item in the following feasible allocation π:

$$\text{Maximise: } \mathcal{SW}_{-C_i^{\mathcal{K}}} = \sum_{j \in N_{-C_i^{\mathcal{K}}}} \pi_j(\theta') v'_j$$

$$\text{Subject to: } N_{-C_i^{\mathcal{K}}} = N \setminus C_i^{\mathcal{K}}$$

$$C_i^{\mathcal{K}} = C_i(\theta')^{\mathcal{K}} \cup \mathcal{P}(C_i(\theta')^{\mathcal{K}}) \cup C(\mathcal{P}(C_i(\theta')^{\mathcal{K}}))$$

$$\mathcal{P}(C_i(\theta')^{\mathcal{K}}) = \bigcup_{j \in C_i(\theta')^{\mathcal{K}}} \{l | l \in \mathcal{P}_j(\theta') \wedge i \succ_{\theta'} l\}$$

$$C(\mathcal{P}(C_i(\theta')^{\mathcal{K}})) = \bigcup_{j \in \mathcal{P}(C_i(\theta')^{\mathcal{K}})} C_j(\theta')$$

$$\forall j \in N_i^{received}, \pi_j(\theta') = 1$$

$$N_i^{received} = W \cap \mathcal{P}_i(\theta')$$

~~$\forall j \neq i \in N_i^{out}, \pi_j(\theta') = 0$~~

$$\forall j \neq i \in (N^{opt} \setminus C_i^{\mathcal{K}}) \setminus N_i^{out}, \pi_j(\theta') = 1$$

$$N_i^{out} = \{j \notin N_i^{received} | j = GetFrom(l), \forall_{l \in N_i^{received}}\}$$

where $C_i(\theta')^{\mathcal{K}}$ is the set of top $\mathcal{K}$ ranked critical children of i according to their reported valuation (from high to low). If $|C_i(\theta')| < \mathcal{K}$, then $C_i^{\mathcal{K}} = C_i(\theta')^{\mathcal{K}} = C_i(\theta')$.

(2) If $i \in W$:
- if $\sum_{j \in Children(i)} w_j(T^{opt}(\theta')) = w_i(T^{opt}(\theta')) - 1$, set $GetFrom(i) = i$,
- otherwise, let $k_i = w_i(T^{opt}(\theta'))$, and out be the buyer with the k_i-th largest valuation report in the subtree (of $T^{opt}(\theta')$) rooted at i and $w_{out}(T^{opt}(\theta')) \neq 0$, for all $j \in \mathcal{P}_{out}(\theta') \cup \{out\}$ if $i \succ_{\theta'} j$, set $w_j(T^{opt}(\theta')) = w_j(T^{opt}(\theta')) - 1$, and set $GetFrom(i) = out$.

(3) For each child j of i, if $w_j(T^{opt}(\theta')) > 0$, give $w_j(T^{opt}(\theta'))$ items to j and add j into Q.

REFERENCES

[1] Dengji Zhao, Bin Li, Junping Xu, Dong Hao, and Nicholas R. Jennings. 2018. Selling Multiple Items via Social Networks. In *Proceedings of the 17th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS '18)*. International Foundation for Autonomous Agents and Multiagent Systems, Richland, SC, 68–76. http://dl.acm.org/citation.cfm?id=3237383.3237400