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# Friendship-aware task planning in mobile crowdsourcing

**Key words:** Mobile crowdsourcing; Task planning; Greedy algorithms; Simulated annealing

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# Introduction

- Current mobile crowdsourcing platforms simply list the tasks. Unfortunately, it is time-consuming for crowd workers to check such a long task list and select their preferences.
- In addition to resolving task planning by considering the three factors: (1) the distance between crowd workers and tasks, (2) the interest/skill similarity between crowd workers and tasks, and (3) the friendships among all crowd workers.
- In real world, a crowd-task arrangement strategy should consider that crowd workers may dynamically register into tasks online so that the available worker quotas for the tasks change at different times.

# Problem statement

- **Input:**
  - a weighted social graph $G = (U, E, W)$,
  - a set of tasks $v$, and
  - an assignment cost function $c: U \times V \rightarrow \mathbb{R}^+$.
- Task:
  - Assign each worker $u \in U$ to a class $s_v \in V$, so that the following function is maximized:

$$\mu(U, V, \alpha, \beta, \gamma) = \frac{\alpha}{\sum_{i=1}^{n} d(u_i, v_i)} + \beta \sum_{u \in U} s(u, v) + \gamma \sum_{\substack{e=(u_i, u_j) \in V, \\ i \neq j}} w(u_i, u_j)$$

# Example

- The circles represent workers
- the triangles represent tasks

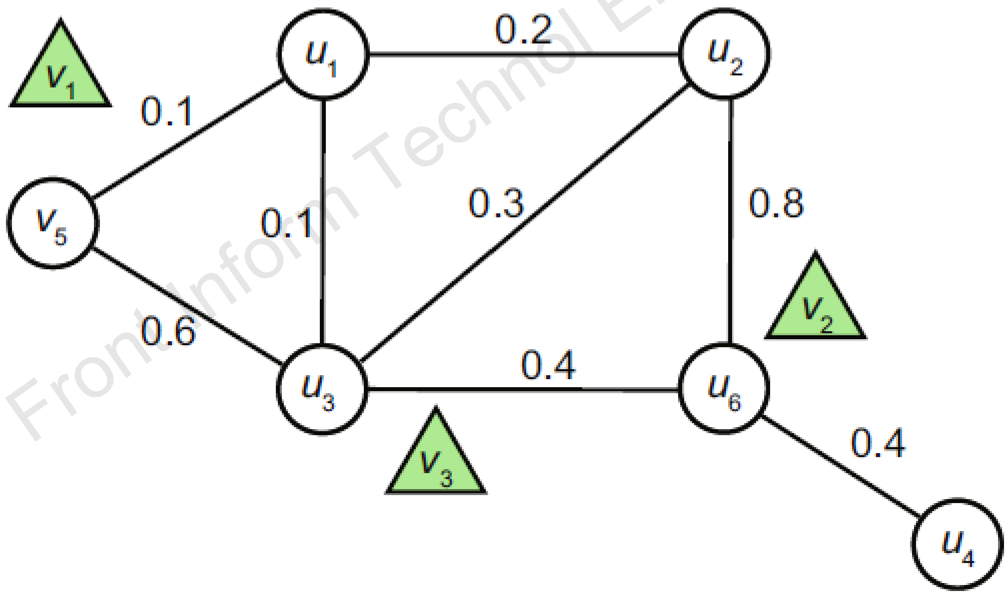



**Fig. 1 Social graph of all workers**

# Algorithms

- Characteristic of task planning (CTP)
- Greedy offline planning
- Improved simulated annealing (ISA)
- OnlineGreedy

# Measurement results (1)

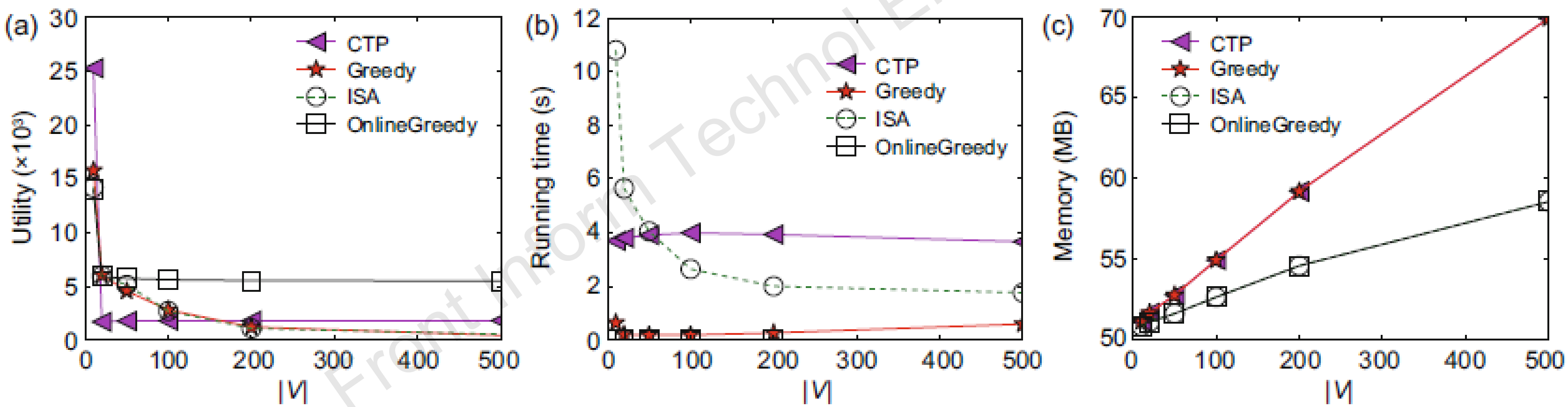
**Three real datasets from Meetup**:
VA(225 tasks, 2012 workers);
Auckland(37 tasks, 569 workers);
Singapore(87 tasks, 1500 workers).

**Synthetic dataset settings :**

| Factor | Setting |
|---|---|
| $\|V\|$ | 10, 20, **50**, 100, 200, 500 |
| $\|U\|$ | 100, 200, 500, **1000**, 2000, 5000 |
| $\alpha, \beta, \gamma$ | 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 |
| $\delta_v$ | Normal: $\mu \in \{25, 50, 75, 100, 125\}, \sigma = 50$<br>Uniform: $[1, 200]$ |
| $\|D\|$ | 0.1, 0.3, 0.5, 0.7, 0.9 |
| Scalability ($\|U\|$) | 10 000, 20 000, 30 000, 40 000, 50 000 |

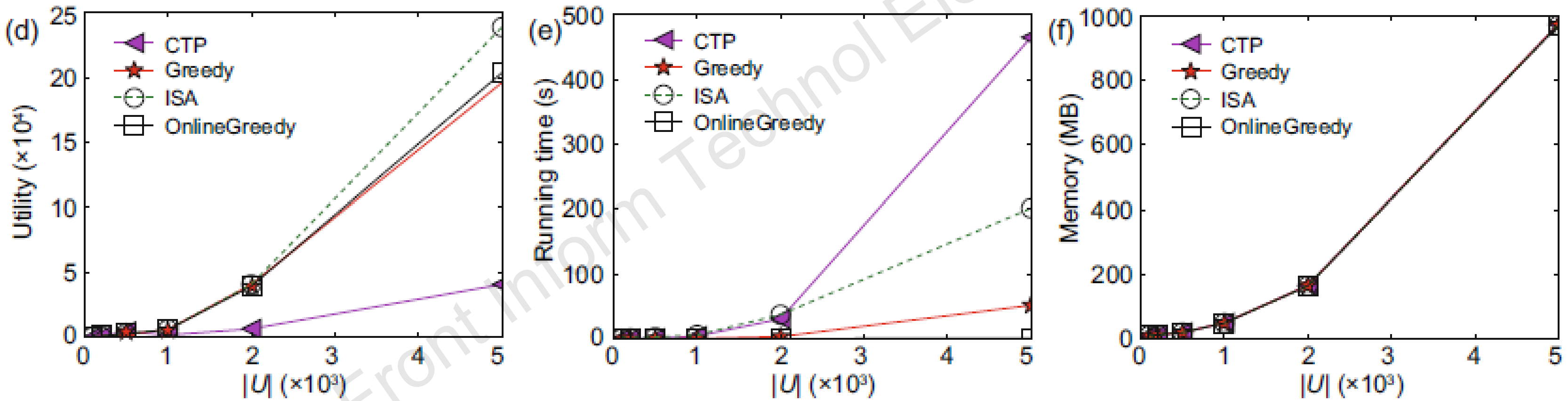
# Measurement results (2)

Varying tasks(|V|)



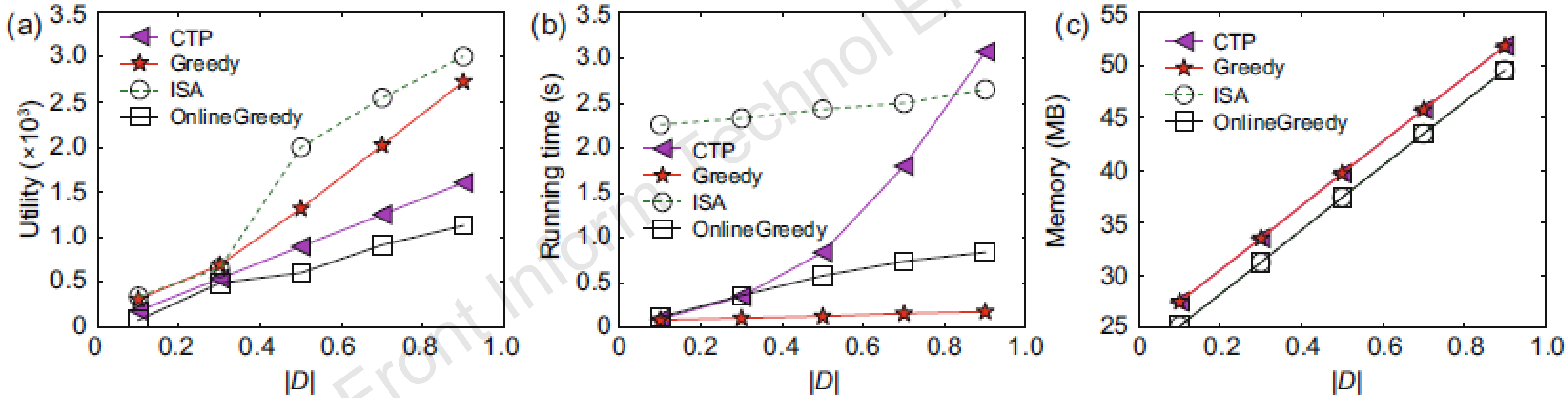
# Measurement results (3)

Varying workers(|U|)



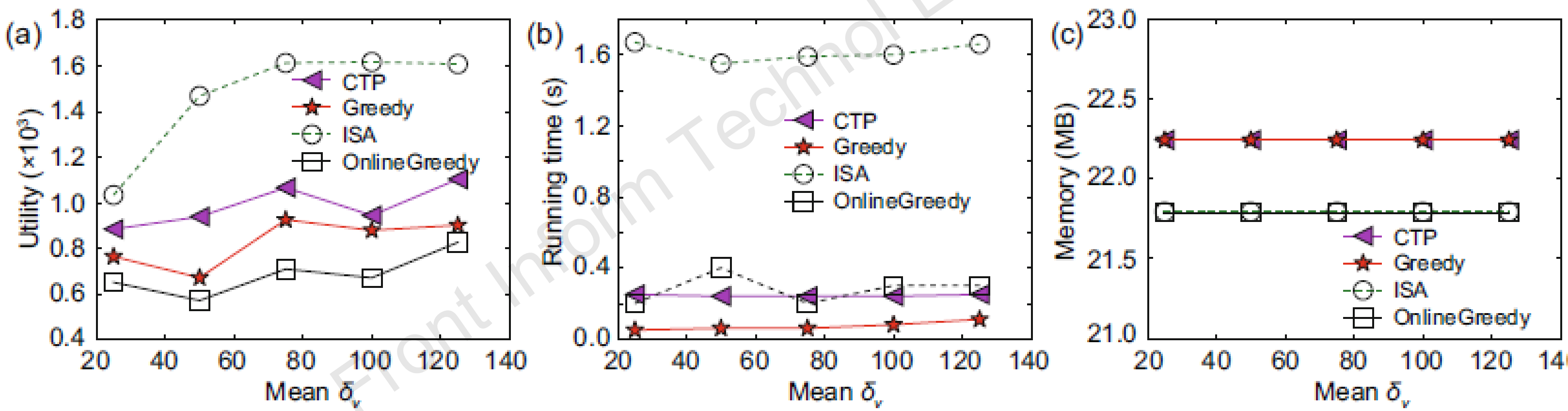
# Measurement results (4)

Real datasets



# Measurement results (5)

Scalability test



# Conclusions and future work

- We devised three algorithms to solve the offline setting, named CTP, Greedy, and ISA. For online planning, we also proposed an OnlineGreedy algorithm, which resolves the problem scenario in which the full information is unknown.
- There is a challenging problem: How to assign the tasks to suitable workers in real-time dynamic environments and model the two-online scenario?