PrivateJobMatch: A Privacy-Oriented Deferred Multi-Match Recommender System for Stable Employment

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Problem
- Coordination failure reduces match quality among employers and candidates in the job market, resulting in unstable, short-term employment.
- Generate stable pairings while requiring users to provide only a partial ranking of their preferences.
- Adaptations of the Gale-Shapley deferred acceptance algorithm which combine the flexibility of decentralized markets with the intelligence of centralized matching.
- Low-Rank Matrix Factorization/Collaborative Filtering

Algorithms

Input:
Set of candidates $C = \{c_1, c_2, \ldots, c_n\}$
Set of jobs/employers $E = \{e_1, e_2, \ldots, e_m\}$
Candidate $i$'s ranking: $RE_i = \{e_{i1}, e_{i2}, \ldots, e_{in}\}$
Job $j$'s ranking: $RC_j = \{c_{j1}, c_{j2}, \ldots, c_{jn}\}$

Init: Empty match set $M = \emptyset$

Algorithm 1: DAA Algorithm
Output: Set of matching pairs $M = \{(c_i, e_j)\}$
1. while $c_i \in C$ with $RC_i \not\in M$
2. $e_j \leftarrow RE_i$, head
3. if $e_j$ has empty pair then
4. Add pair $(c_i, e_j)$ to $M$
5. end
6. else if $(c_i, e_j) \in M$ and $(RC_j[k] - RC_j[i]) > 0$
7. Replace pair $(c_i, e_j)$ with $(c_i, e_{ji})$ in $M$
8. end
9. end
10. return $M$

Algorithm 2: MMDAA Algorithm
Output: Ranked job matches $ME_j$ and ranked candidate matches $MC_i$ for each candidate $i$
1. for $k = 1$ to $m$
2. $M \leftarrow$ DAA $(C, E, RE, RC)$
3. Append matches to $ME_j$ and $MC_i$
4. Remove matches from $RE_i$ and $RC_j$
5. end
6. return $(ME_j, MC_i)$

Experiments

LMF and Mixed MMDAA

Algorithm 3: Mixed MMDAA Algorithm
1. $RE_L \leftarrow LMF(REF)$
2. $RC_L \leftarrow LMCF(REC)$
3. $(ME^M, MC^M) \leftarrow$ MMDAA $(C, E, RE, RC, M)$
4. $(ME^C, MC^C) \leftarrow$ MMDAA $(C, E, RE, RC, M)$
5. Fill empty matches in $ME^M$ with best matches from $ME^C$
6. Fill empty matches in $MC^M$ with best matches from $MC^C$
7. return $(ME^M, MC^M)$

Recommendation System Architectures

DAA vs MMDAA

Input rankings
Output matches

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