CVPR 2019

Reviewer paper assignments

Reviewer paper assignments: Overview

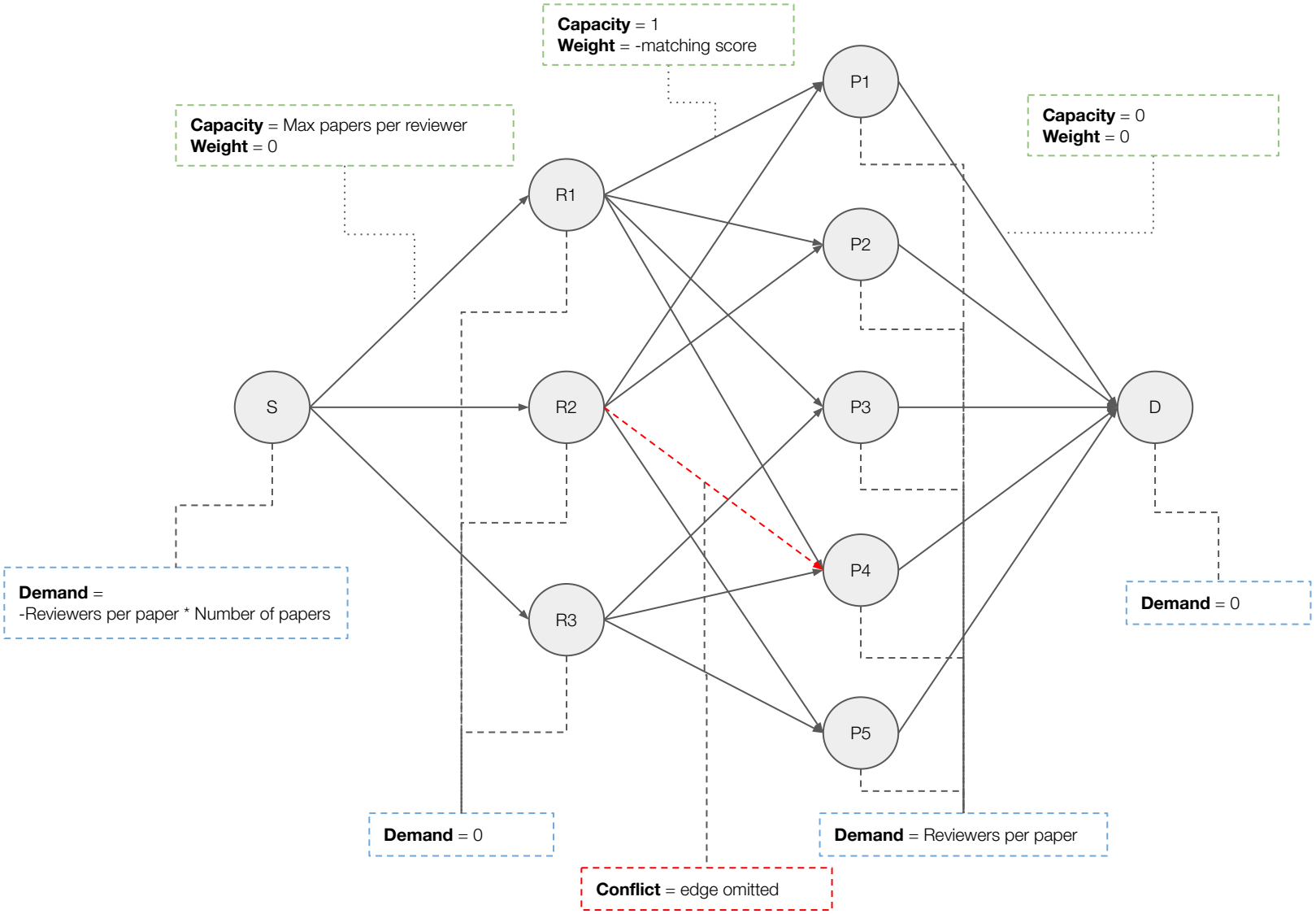
Problem

- Assign papers to appropriate reviewers under the following constraints
  - Objective: Maximize sum of assignment scores
  - Hard constraint: Limit of N_i papers for each reviewer
  - Hard constraint: Cannot be assigned to a reviewer that is conflicted.

Solution

- Information extraction (from CMT)
- Assignment Algorithm
  - Preprocessing
  - Min cost flow assignment

Reviewer paper assignments: Algorithm



- Solved by linear programming

Reviewer paper assignments: Example

Inputs

- Scores matrix: N x M (reviewers x papers)
- Conflicts matrix: N x M
- Capacities matrix: N x 1

Scores

0.44594859	0.24831998	0.20821929	0.96067386	0.59818093
0.99525685	0.87566416	0.92307729	0.50964754	0.62490232
0.04263246	0.59708164	0.92083302	0.10097003	0.25485641

Conflicts

0	0	0	0	0
0	0	0	0	0
0	0	1	0	0

Capacities

5
3
3

Solution

Assignments

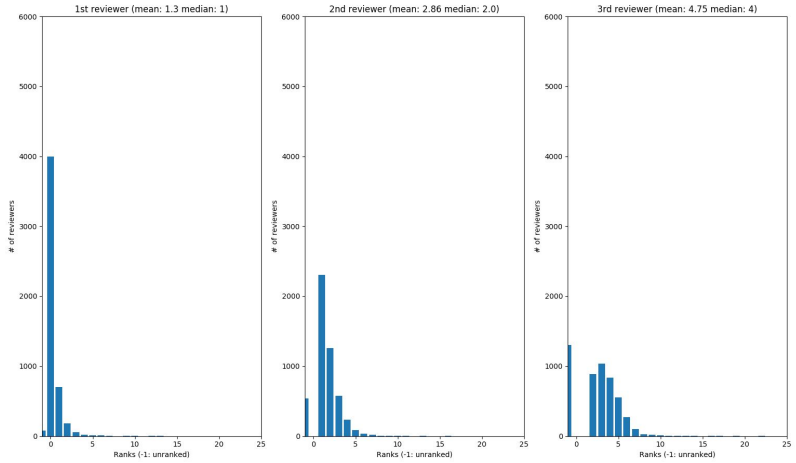
1	0	1	1	1
1	1	1	0	0
0	1	0	1	1

Reviewer paper assignments: Greedy approach

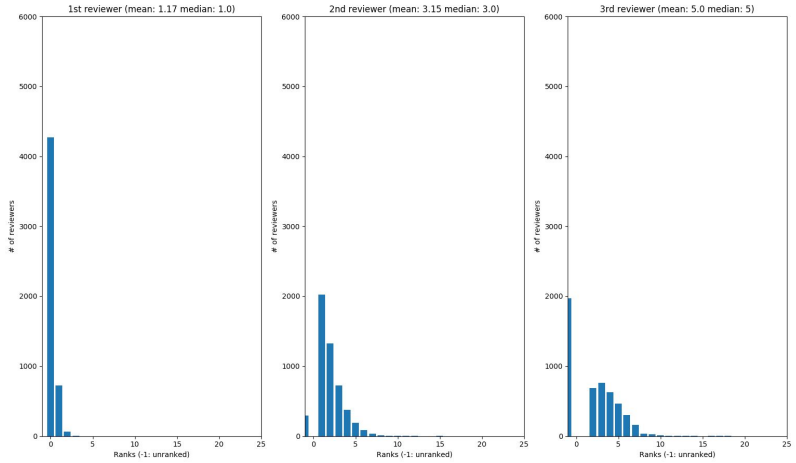
- Not a globally optimal solution!
  - 3 iterative steps:
    - Set number of reviews per paper: 1
    - Run assignment algorithm
    - Adjust reviewer capacities (for those who were assigned papers)
    - Set conflicts for reviewers with assigned paper (to ensure they cannot be assigned this paper again)
    - Repeat

- The greedy approach has more desirable statistics
  - Every paper is assigned a suggested reviewer

Globally optimal



Greedy



Reviewer paper assignments: Additional Notes

- Conflicts
  a. Common organizations
     i. Extracted from CMT
  b. Co-authors
     i. Co-authors of one paper cannot review each others papers (different papers)

- Emergency Reviewers
  a. Capacity decreased by 1 (since they may have to review additional papers)

Running code

Command line:

```
python -u calculate_scoring_matrix.py \
    -u ./$inputs_folder/Users.txt \
    -r ./$inputs_folder/reviewers.csv \
    -t ./$inputs_folder/ReviewerTpmsScores_CVPR2019.csv \
    -p ./$inputs_folder/Papers.csv \
    -q ./$inputs_folder/quotas.csv \
    -s ./$inputs_folder/ReviewerSuggestions.txt \
    -c ./$inputs_folder/ReviewerConflicts.txt \
    -n 3 \
    -g $g \
    -w_t $t \
    -w_a $a \
    -w_s $s \
    -w_e $e \
    -o $c \
    --cached_folder ./output-w_t-$t-w_a-$a-w_s-$s-w_e-$e-g-$g-n-3-config-$c/
```

Bash script (specific arguments in the script):

```
bash o-run.sh
```

Outputs

Under ***output-w_t-$t-w_a-$a-w_s-$s-w_e-$e-g-$g-n-3-config-$c*** folder:

Cached files:

- Cache inputs in a format used by our algorithm
- paper_conflicts.json; papers.json; reviewer_quotas.json; reviewers.json; reviewer_suggestions.json; users.json
- capacities.npy; conflicts.npy

Mapping files:

- Mapping paper and reviewer ids to integer (and vice versa). Used to lookup entries into the scoring and assignment matrices
- paper-mapping.json; reverse-paper-mapping.json; reverse-reviewer-mapping.json; reviewer-mapping.json

Debugging files:

- Files used for debugging purposes
- assignments-R0.npy; assignments-R1.npy; assignments-R2.npy
- v-capacities-step-0.json; v-capacities-step-1.json; v-capacities-step-2.json

Results files:

- Scoring matrices and final assignments
- Assignments.npy; assignments.xml; experience_scores.npy; subject_area_scores.npy; suggestion_scores.npy; tpms_scores.npy;

Statistics:

- Charts on assignment statistics
- O-assignments-of-suggested-reviewers-detailed.png; o-assignments-of-suggested-reviewers.png; o-capacity-limits-of-reviewers.png; o-max-scores-per-paper.png; o-mean-scores-non-suggested-reviewers-detailed.png; o-mean-scores-per-paper.png; o-reviewer-distribution.png

OpenReview files:

- Files for openreview algorithm (produces identical results as our fully optimal solution)
- o-conflicts.csv; o-matching-scores.csv; o-max-reviewers-per-paper.csv; o-papers.csv; o-reviewers.csv; o-reviewers-per-paper.csv

Input Files - Unmodified

- **Users.txt:**
  a. **How it's used:** To identify domain conflicts (in addition to what CMT identifies). Allows us to identify same institutions with different domains (uiuc.edu = illinois.edu; facebook.com = fb.com, etc.)
  b. **Extraction:** Users -> Conference User -> Actions -> Export

- **ReviewerConflicts.txt:**
  a. **How it's used:** Conflicts identified by CMT
  b. **Extraction:** Submissions -> Actions -> Export to Tab Delimited -> Reviewer Conflicts

- **ReviewerSuggestions.txt:**
  a. **How it's used:** Used in calculating scoring matrix (reviewer/paper scoring matrix).
     i. If reviewer is not suggested: Score = 0.0
     ii. If rank <= 7: Score = (8.0 - rank of reviewer for paper / 8.0)
     iii. Otherwise: Score = 0.1
  b. **Extraction:** Submissions -> Actions -> Export to Tab Delimited -> Reviewer Suggestions

- **ReviewerTpmsScores_CVPR2019.csv:**
  a. **How it's used:** Part of the scoring matrix along with the reviewer suggestion score
  b. **Extraction:** Submissions -> Actions -> TPMS -> Download Scores

Input Files - Modified

Slightly modified - Deleted first 3 rows and saved it as a csv file

- **Papers.csv:**
  a. **How it's used:** To identify co-author conflicts and assign reviewers to papers that are "Awaiting Decision", i.e., not desk rejected
  b. **Extraction:** Submissions -> Actions -> Export to Excel -> Submissions

Manually extracted - Copied and pasted the data from the from browser directly

- **quotas.csv:**
  a. **How it's used:** Limits the number of papers assigned to the author based on the quota
  b. **Extraction:** Submissions -> Actions -> Automatic Assignment -> Reviewer -> Next

- **reviewers.csv:**
  a. **How it's used:** Primarily used for subject area based scoring
    i. Primary subject area of reviewer(psar) == primary subject area of paper(psap): Score = 0.6
    ii. Secondary subject area of reviewer(ssar) == primary subject area of paper(psap): Score = 0.4
    iii. Score = 0.4 * len(ssap ∩ ssar) / len(ssap)
  b. **Extraction:** Users -> Reviewers -> [Click All]

Command line arguments

-u, -r, -t, -p, -q, -s, -c: input files discussed in the previous slides
-n: number of reviewers per paper ***(int)***
-g: number of greedy steps for assignment problem ***(int)***
- ***0***: fully optimal solution
- ***1***: first step is greedy and second step optimally assigns 2 more reviews per paper
- ***2***: assignment is performed in 3 different steps, each step is greedy (CVPR solution)

-w_t: weighting for TPMS scores ***(float)***
-w_a: weighting for subject area scores ***(float)***
-w_s: weighting for reviewer suggestion scores ***(float)***
-w_e: weighting for experienced reviewer scores ***(float)***
-o: configuration key for different quotas for different user types ***(str)***

Derek:

```
'Faculty/Researcher, >10 times as reviewer for CVPR, ICCV, or ECCV': 10,
'Faculty/Researcher, 3-10 times as reviewer for CVPR, ICCV, or ECCV': 10,
'Faculty/Researcher, 0-2 times as reviewer for CVPR, ICCV, or ECCV': 6,
'Student, >3 times as reviewer for CVPR, ICCV, or ECCV': 6,
'Student, 0-2 times as reviewer for CVPR, ICCV, or ECCV': 4,
'': 4
```

Abhinav:

```
'Faculty/Researcher, >10 times as reviewer for CVPR, ICCV, or ECCV': 9,
'Faculty/Researcher, 3-10 times as reviewer for CVPR, ICCV, or ECCV': 9,
'Faculty/Researcher, 0-2 times as reviewer for CVPR, ICCV, or ECCV': 7,
'Student, >3 times as reviewer for CVPR, ICCV, or ECCV': 7,
'Student, 0-2 times as reviewer for CVPR, ICCV, or ECCV': 4,
'': 4
```

--cached_folder: output location of results and intermediate files (used for faster future runs) ***(str)***

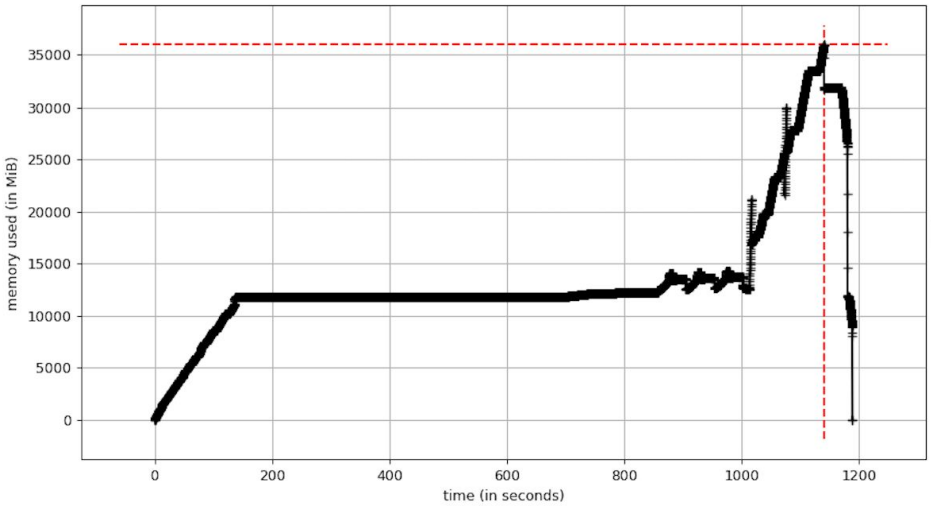
Code Profiling

Tested on Ubuntu 16.04 - 12 CPU Cores with 64G RAM

Time:
Cached run: 289.56s
Complete run: 1178.83s

Memory consumption
Cached run usage: 46G
Complete run: 36G

Complete Run



Cached Run