I Will Have Order!
Optimizing Orders for Fair Reviewer Assignment

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Fairness in Peer Review

Peer review is a central component in academic decision-making

For it to work, papers must be reviewed by suitable reviewers!

Wrong reviewers = poor feedback, unfair rejection, acceptance of flawed papers

Reviewer Assignment Problem (RAP)

Assign reviewers to papers. Maximize welfare, subject to any hard constraints

Welfare Parametrized by *Affinity Scores*:

- Estimate reviewer expertise/interest
- Widely used (OpenReview, CMT, etc)
- Conferences and papers both prefer high affinity assignments

Typical Constraints

- Papers require certain # of reviewers
- Limits on # of papers per reviewer
- Can't assign reviewer to a paper 2x

Example – papers require 2 each, reviewers get 1 each

6	5	3	2
9	6	3	1

Simply maximizing total welfare can harm individual papers, so we seek to guarantee fairness for all papers

Maximize total welfare (USW)

6	5	(3)	(2)
(9)	(6)	3	1

Max USW w/ fairness constraint

6	(5)	3	(2)
(9)	6	(3)	1

Picking Sequences: Fair & Simple

Round Robin

Papers pick one reviewer per round in fixed order over rounds. Requires uniform demands.

Weighted Picking

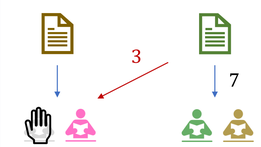
Priority goes to paper i with lowest a_i/k_i (a_i = current # revs, k_i = demand). Works for any set of demands.

Goal: Approximately maximize welfare under Round Robin & Weighted Picking

Fairness and Welfare under Picking Sequences

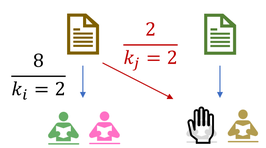
Round Robin

Envy-free up to 1 Item (EF1)



Weighted Picking

Weighted EF1



Picking sequences are fair, but overall welfare depends on order

Round-Robin Example

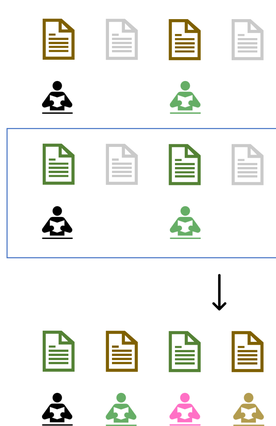
$USW = 16$

Welfare depends on choice of starting paper

$USW = 19$

Greedy Reviewer Round Robin (GRRR)

Maintain a partial order for Round Robin
Append the paper which maximizes USW of partial order



$USW = 11$

$USW = 15$

$USW = 19$

$1 + \gamma^2$ factor of optimal, for γ-weakly submodular welfare

Greedy Weighted Picking (FairSequence)

Execute Weighted Picking, break ties in priority greedily

$USW = 9$

$USW = 6$

Guaranteed fairness & very fast
High welfare in practice (no welfare guarantees)

Real Conference Results

MIDL

	TPMS (OPT)	FairFlow	PR4A	GRRR	FairSeq
USW (% of OPT)	100%	100%	98%	98%	99%
# EF1 Viol.	0	0	0	0	0

CVPR

	TPMS (OPT)	FairFlow	PR4A	GRRR	FairSeq
USW (% of OPT)	100%	96%	94%	88%	92%
# EF1 Viol.	473545	23344	82	0	0

CVPR '18

	TPMS (OPT)	FairFlow	PR4A	GRRR	FairSeq
USW (% of OPT)	100%	97%	97%	94%	96%
# EF1 Viol.	134	25	2	0	0

Our Approaches

Fairness GRRR and FairSeq are the only approaches that satisfy EF1

Welfare High USW w.r.t. TPMS (OPT) and algorithms used in practice

Speed > 5x speedups compared to FairFlow/PR4A

Flexibility Simplicity ➔ flexibility

FairSequence is now available in OpenReview!

Ask your conference organizer today if FairSequence is right for you!

Read the full paper on arxiv: arxiv.org/abs/2108.02126

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