

Efficient matchmaking in assignment games with application to online platforms

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Research question: How can an online platform best help customers match with the right service provider at the right price, so as to minimize the time and effort both sides need to spend in order to find a suitable partner?

Why this is important: Two-sided matching platforms mediate many billions of dollars of economic activity around the world, and improving the matching process would generate large welfare gains.

1-minute elevator pitch: <https://youtu.be/enCVBYN7ygo>

18-minute presentation: <https://youtu.be/KPFhZBoCBSY>

Full paper: <https://ssrn.com/abstract=3536086>

Shortcomings of previous research on improving the efficiency of matching platforms

- 1. Field experiment** [Coles, Cawley, Levine, Niederle, Roth, Siegfried 2010] [Lee and Niederle 2015] [Fradkin 2017] [Horton 2017] [Horton 2018]
 - Cannot quantify potential for further improvements.
- 2. Search theory** [Coles, Kushnir, Niederle 2013] [Kanoria and Saban 2017] [Halaburda, Piskorski and Yildirim 2018] [Jagadeesan and Wei 2018] [Arnosti, Johari and Kanoria 2019] [Romanyuk and Smolin 2019] [Mekonnen 2019]
 - Requires strong assumptions on how agents behave and interact.
- 3. Communication complexity of stable marriages** [Segal 2007] [Chou and Lu 2010] [Gonczarowski, Nisan, Ostrovsky, Rosenbaum 2015] [Ashlagi, Braverman, Kanoria, Shi 2019]
 - Does not allow endogenous prices and suggests that low communication cost (poly-logarithmic) is not possible in typical markets.

All of the above shortcomings are overcome in this paper.

Contributions of this paper

1. Analyze the communication complexity of stable matchings with **endogenous prices**.
2. Characterize **easy and hard-to-match markets** based on the distribution of preferences.
3. Quantify the **minimum number of bits of information** needed to reach an ϵ -stable outcome for both easy and hard-to-match markets.
4. Derive **near-optimal matchmaking protocols** for both easy and hard-to-match markets, which suggest actionable insights for real-world platforms.

Summary of insights

	Easy-to-Match Markets	Hard-to-Match Markets
Definition:	Horizontal preference of one side is easy-to-satisfy; e.g., <ul style="list-style-type: none">- ride hailing;- routine home services;- accommodations.	Horizontal preferences of both sides are hard-to-satisfy; e.g., <ul style="list-style-type: none">- finding a nanny;- non-standard home improvement.
Minimum # of bits of communication per agent:	$\Theta(\log n)$	$\Omega(\sqrt{n})$ $O(\sqrt{n} \log n)$
Near-optimal matchmaking protocols:	<ul style="list-style-type: none">- Searchable directory of the easy-to-satisfy side, along with a price prediction tool;- If both sides are easy-to-satisfy, simply recommend a few feasible matches at pre-determined prices.	Searchable directory of both sides to allow both sides to initiate contact, along with a more advanced price prediction tool that helps agents limit the total number of contacts.