Adapting a Kidney Exchange Algorithm to Align with Human Values

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Why let AI make moral decisions?

1. Speed

   Autonomous Vehicles

2. Magnitude

   Advertising

3. Computational Complexity

   Kidney Exchanges...

Kidney Exchanges

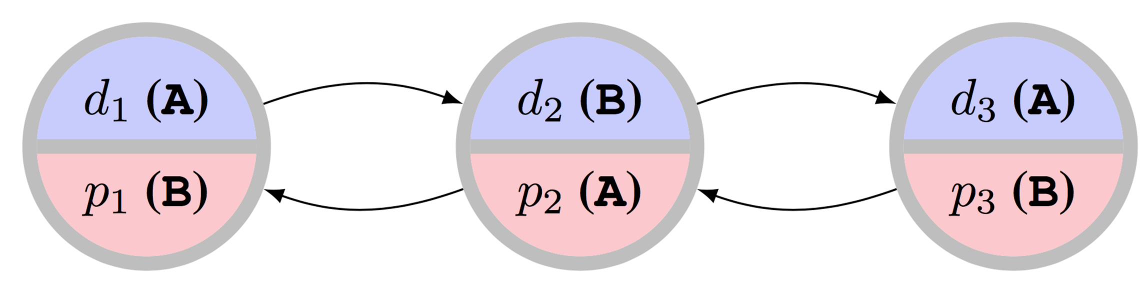


Figure 1: A compatibility graph with three patient-donor pairs and two possible 2-cycles. Donor and patient blood types are given in parantheses.

- There are **100,000 patients** on the US kidney transplant waiting list.
- Kidney exchanges allow patients with willing but incompatible live donors to **swap donors**.
- Algorithms developed in the AI community are used to find **optimal matchings**.

How to break ties between patients?

Patient A is **70 years old**, has **1 alcoholic drink per month**, and has **no other major health problems**.

Patient B is **30 years old**, has **5 alcoholic drinks per day**, and has **skin cancer in remission**.

...who should get the kidney?

Mturker Preferences

Profile	Age	Drinking	Cancer	Preferred
1 (YRH)	30	rare	healthy	94.0%
3 (YRC)	30	rare	cancer	76.8%
2 (YFH)	30	frequently	healthy	63.2%
5 (ORH)	70	rare	healthy	56.1%
4 (YFC)	30	frequently	cancer	43.5%
7 (ORC)	70	rare	cancer	36.3%
6 (OFH)	70	frequently	healthy	23.6%
8 (OFC)	70	frequently	cancer	6.4%

Table 2: Profile ranking according to Kidney Allocation Survey responses. The "Preferred" column describes the percentage of time the indicated profile was chosen among all the times it appeared in a comparison.

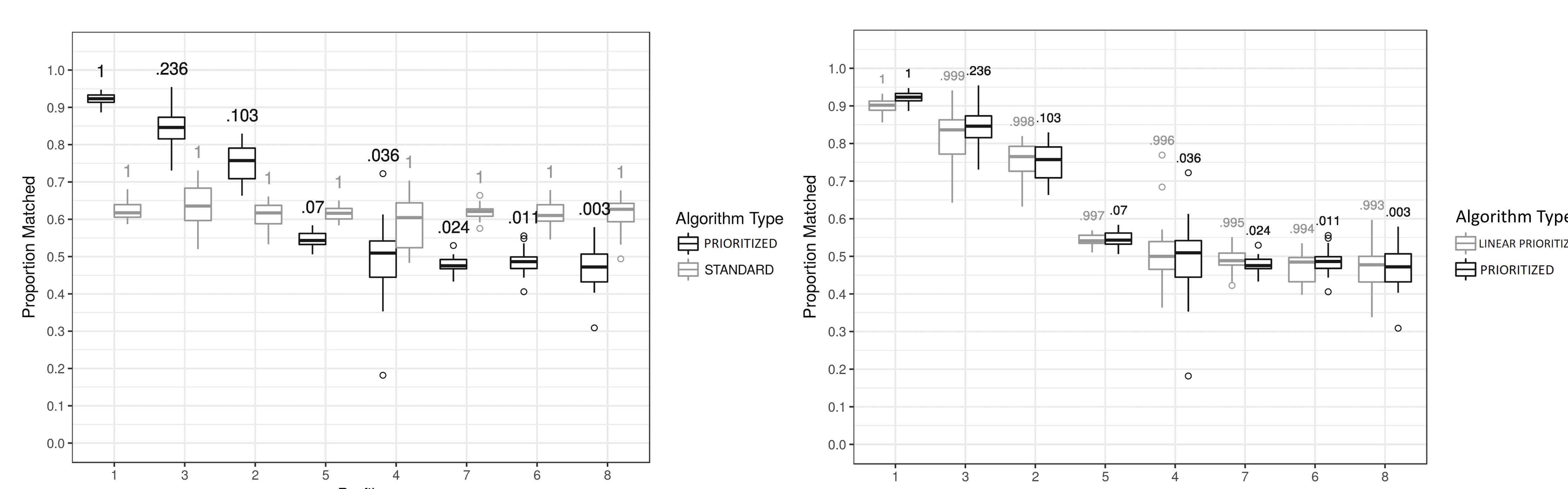
Incorporating these values

1. Aggregate into "scores" using the **Bradley-Terry model**:

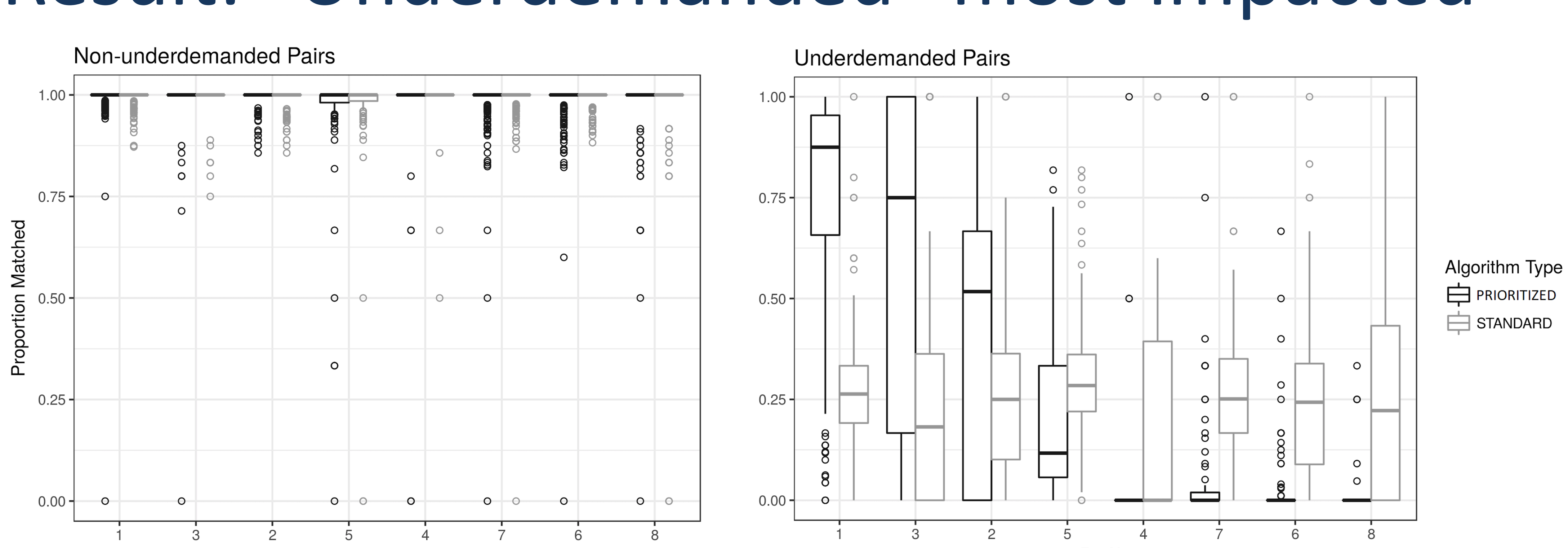
$$P(i > j) = \frac{p_i}{p_i + p_j}$$

2. Use these scores to break ties between otherwise optimal matchings

Result: Order matters; differences don't



Result: "Underdemanded" most impacted



Underdemanded *patient-donor pairs have blood types that make them difficult to match.*

This paper will be presented at the AAAI main conference at **10am, Feb 7th**. It received an honorable mention for outstanding student paper.

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