Applied Data Science for Offer Response in Deceased Kidney Organ Transplantation

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Introduction

Background

The goal of **organ matching for transplantation** is to **save lives** while **minimizing health risks**, **maximizing organ utilization**, while remaining **equitable to candidates**.

An organ from a deceased *kidney* donor is **offered** through a "*match run*" – a process in which all applicable waitlisted candidates are notified in sorted batches.

- *Offer responses* can arrive in any order as one of *accept*, *decline*, or *provisional accept* (if not *bypassed* by the procuring organization)
- **Predicting response likelihood** could explain decisions and be used to find likely acceptors

Problems

- Complex hierarchical interactions of **medical**, **behavioral**, and **logistical** factors *across time*
- **Policy** biases leak into model discrimination

Goals

This poster presents initial efforts by the authors to **understand and predict offer response** in deceased kidney organ donation.
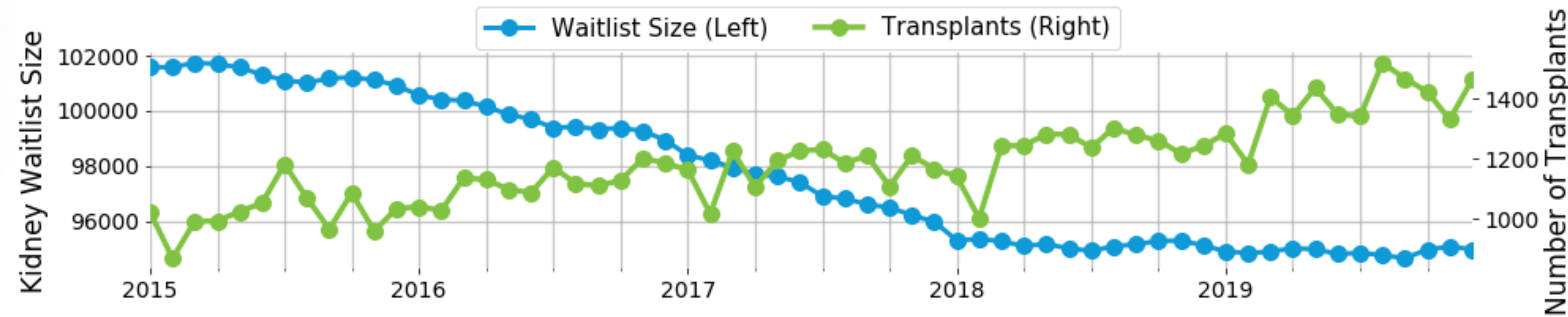
Data and Methods

Match run data from 2018 and 2019

- 17,678 match runs with 2,132,388 responses
- Deceased kidney match runs with acceptance
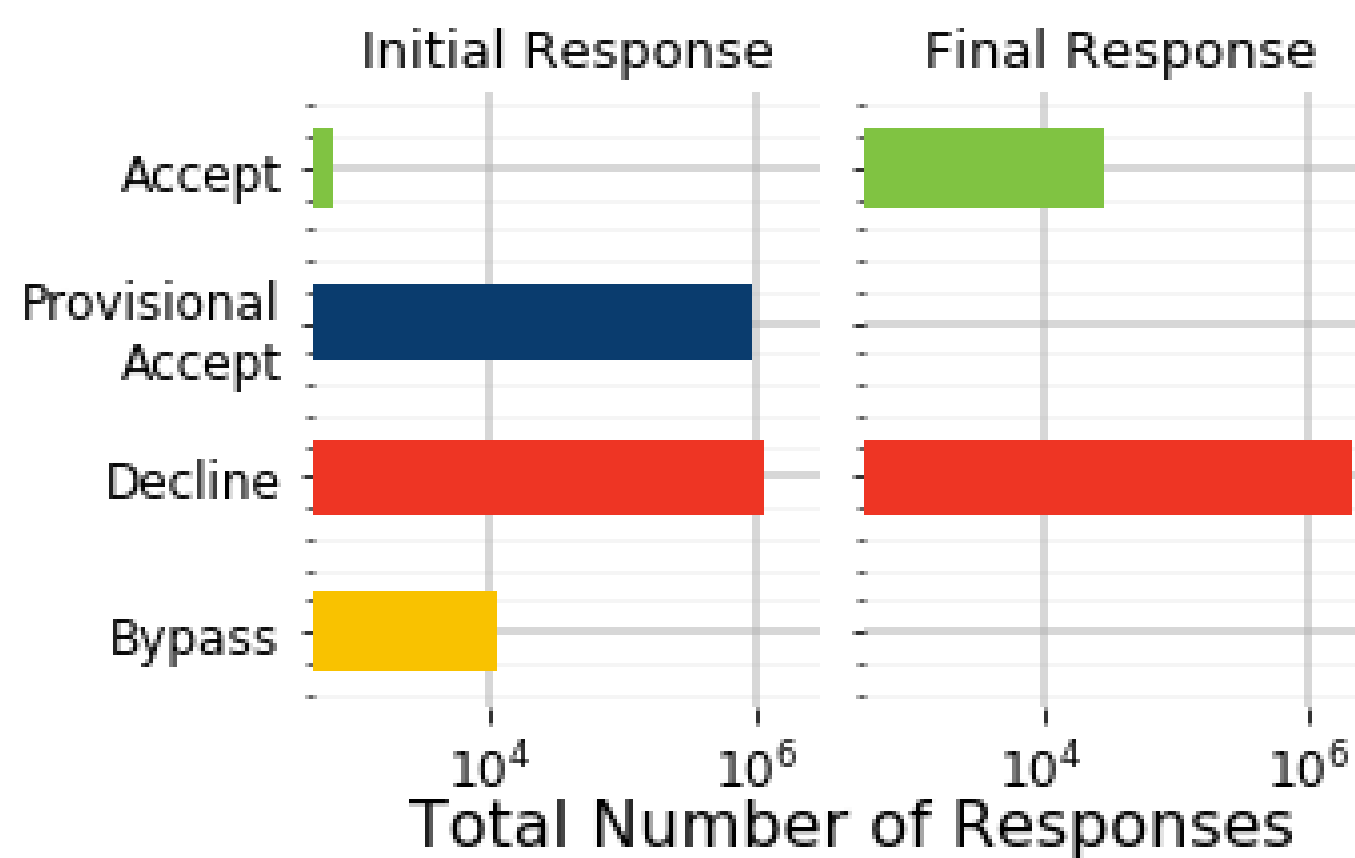- Repeated match runs for a donor are combined

Model Building

- Features match existing methods
- Time-based K-Fold to choose hyper-params
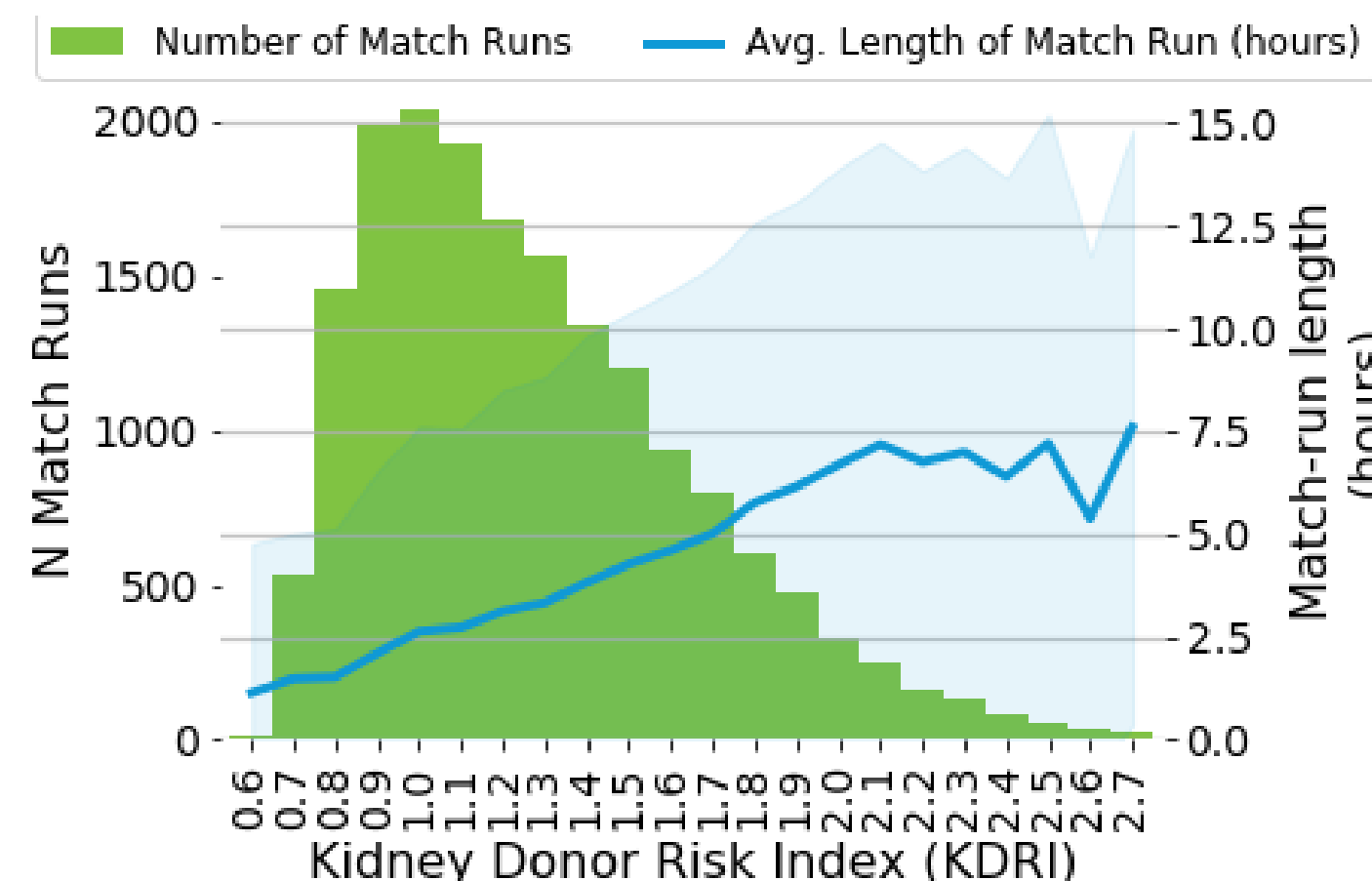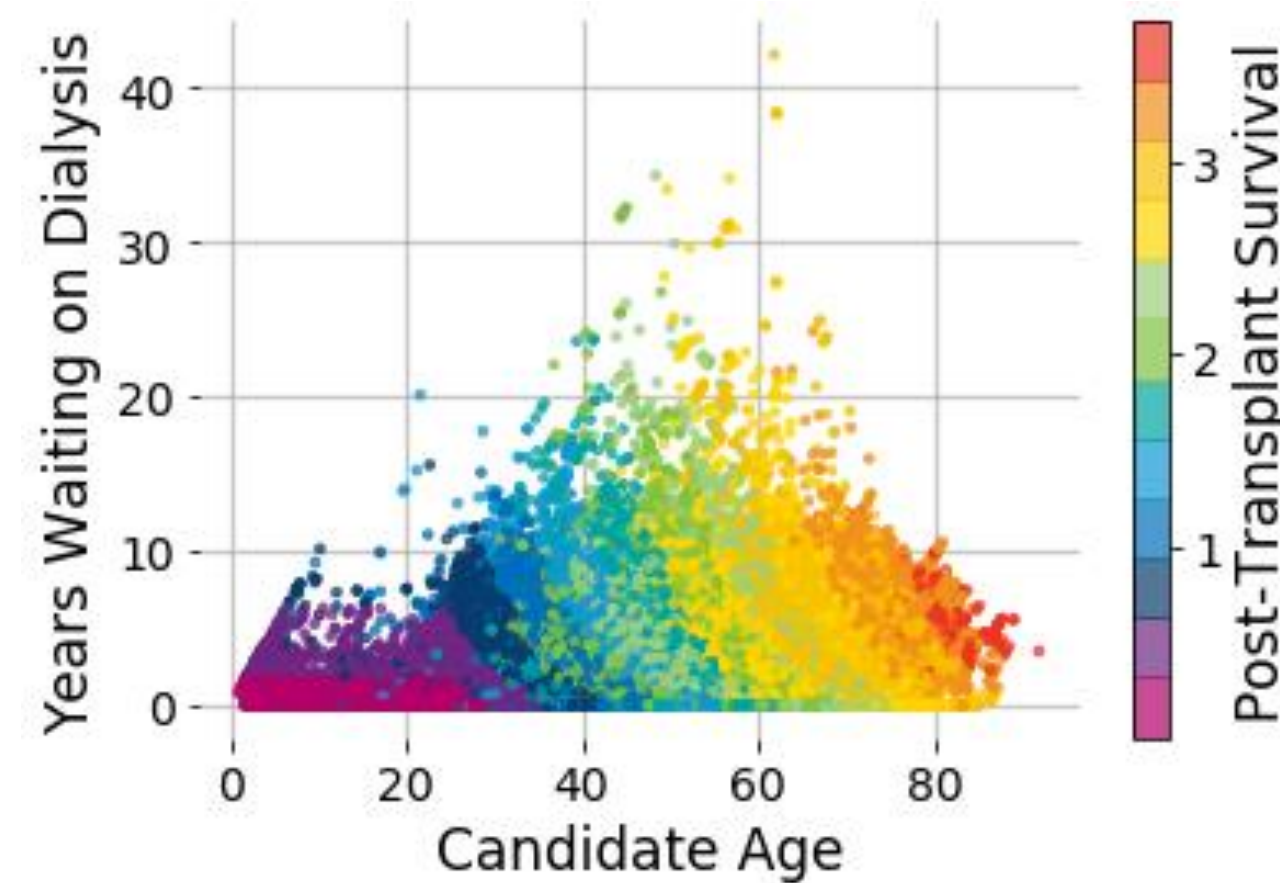- Re-balanced training & Out of time holdout
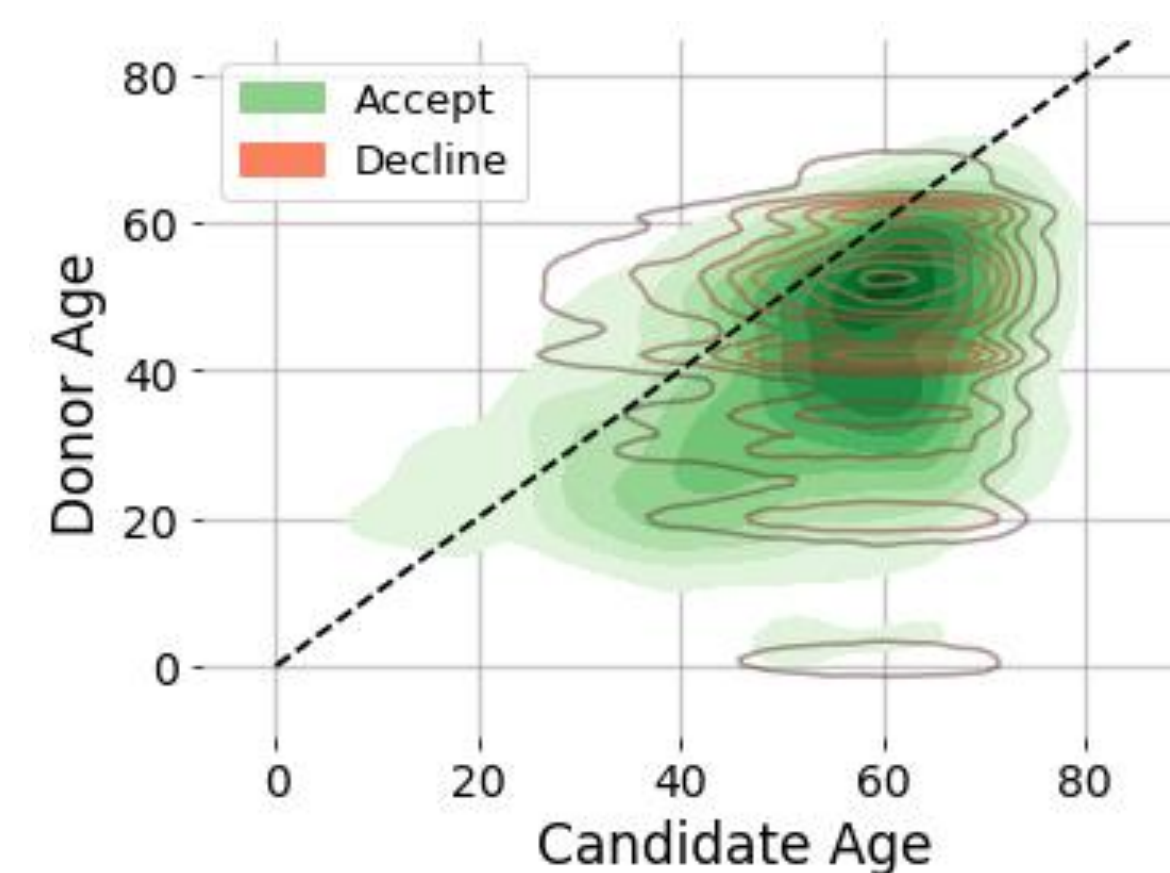
Results

(1) Imbalanced and Changing response

(2) Medical Urgency

(3) Medical Risk Correlated with Latency

(4) Age Preferences

Results

Decision Tree Results

True label	Predicted label	
	Decline	Accept
Decline	463944	38331
Accept	1292	5238

Top 5 (of 29 utilized) for Decision Tree
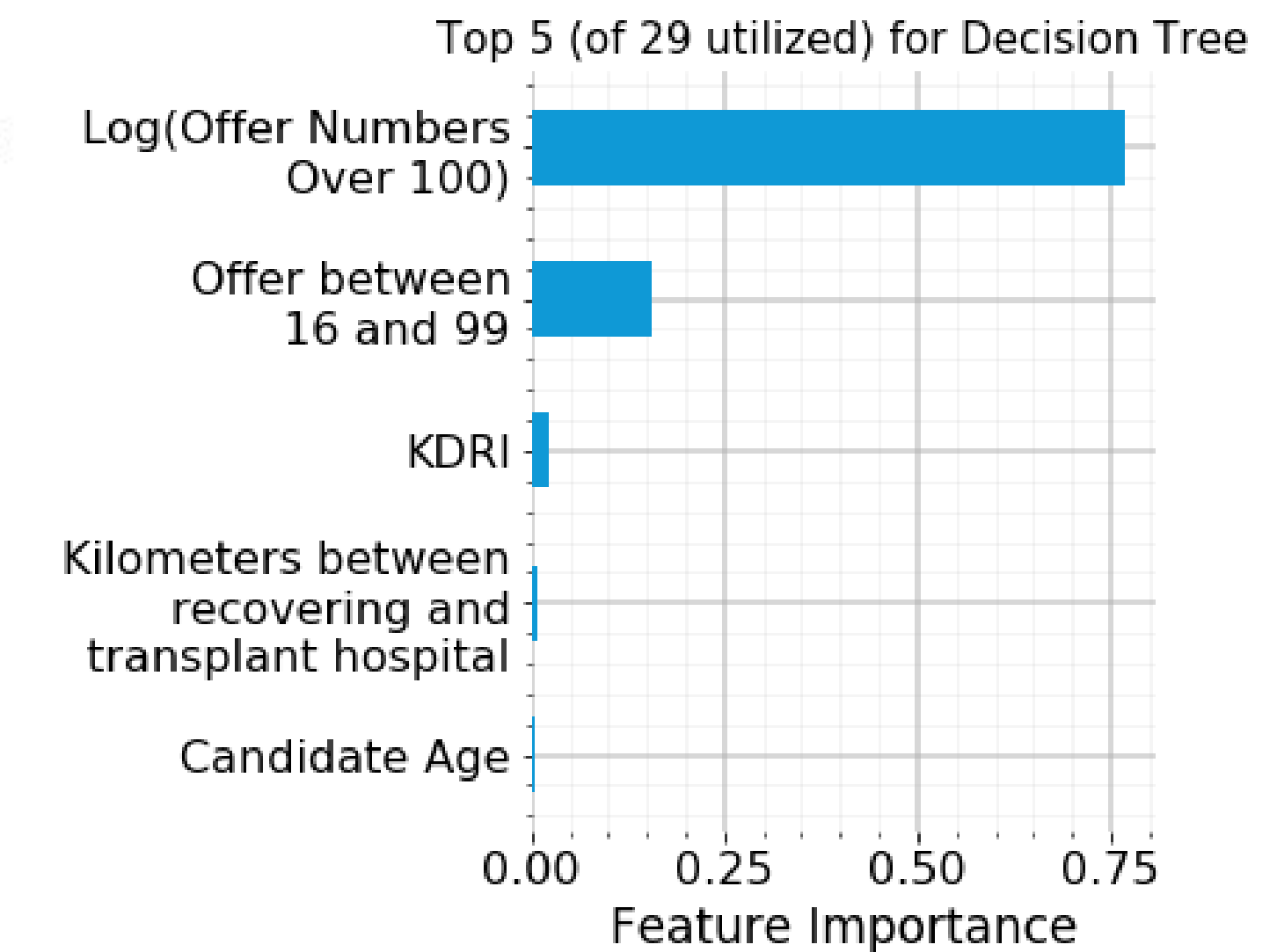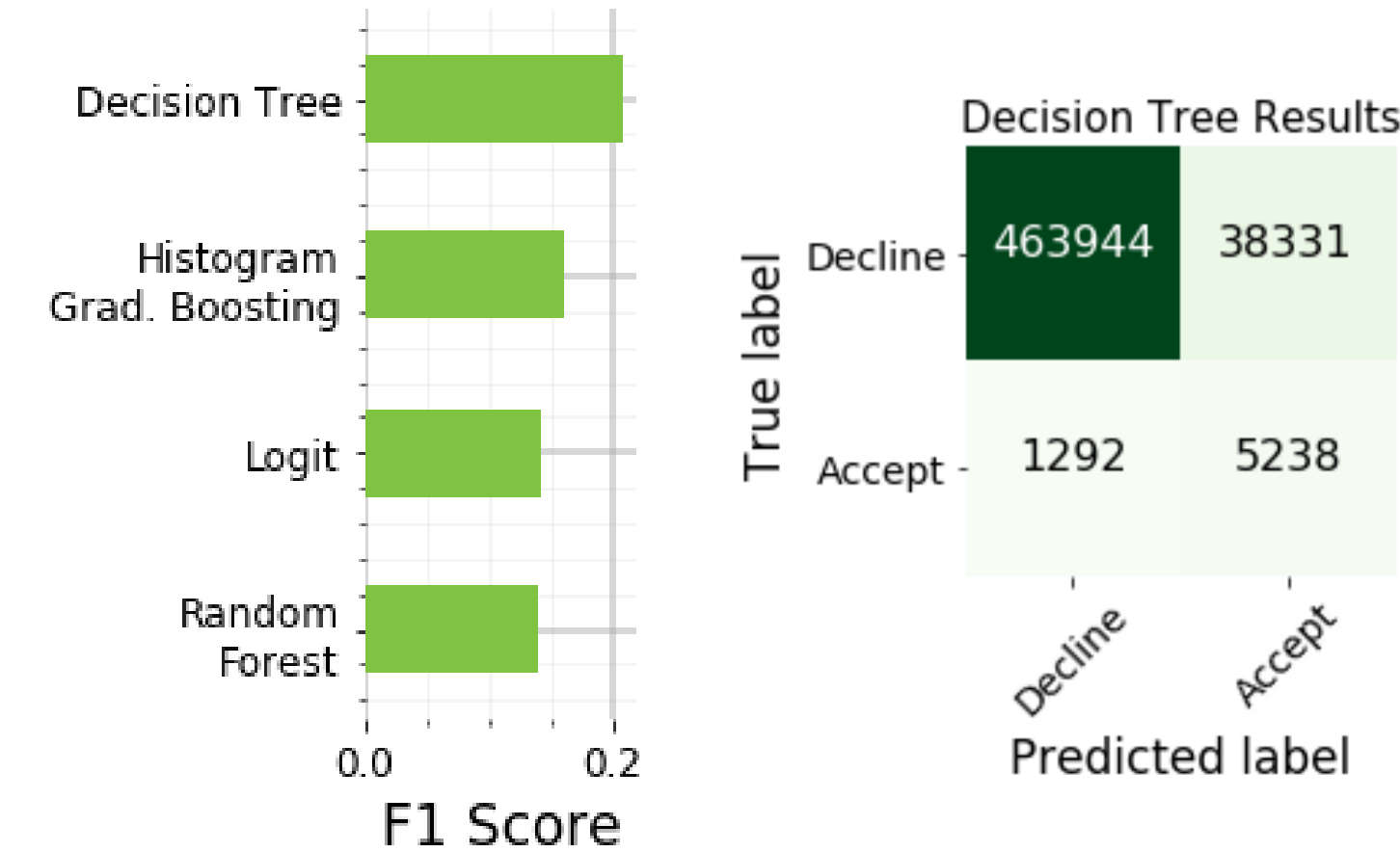
Conclusion

- Order of offer (offer number) is highly predictive
  - Associated with many hidden factors
- Imbalanced target challenges
- Data leakage likely exists at person and region

SciPy 2020

The authors have no conflict of interest related to this abstract.

Notes & Resources

- Visualizations 2 & 4 use a sub-sample of data stratified over time

- About the Organ Procurement and Transplantation Network (OPTN)
  - https://optn.transplant.hrsa.gov/governance/about-the-optn/

- United Network for Organ Sharing (UNOS)
  - https://unos.org/

- Estimated Post Transplant Survival (EPTS, "Post Transplant Survival" in poster)
  - https://optn.transplant.hrsa.gov/media/1511/guide_to_calculating_interpreting_epts.pdf

- Kidney Donor Risk Index (KDRI) and Kidney Donor Profile Index (KDPI)
  - https://optn.transplant.hrsa.gov/media/1512/guide_to_calculating_interpreting_kdpi.pdf

- Existing *Acceptance* model used for performance monitoring by outside contractor
  - https://www.srtr.org/reports-tools/offer-acceptance/

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