

Mining Unstructured Documents for Insights into Organ Transplantation Decision Making

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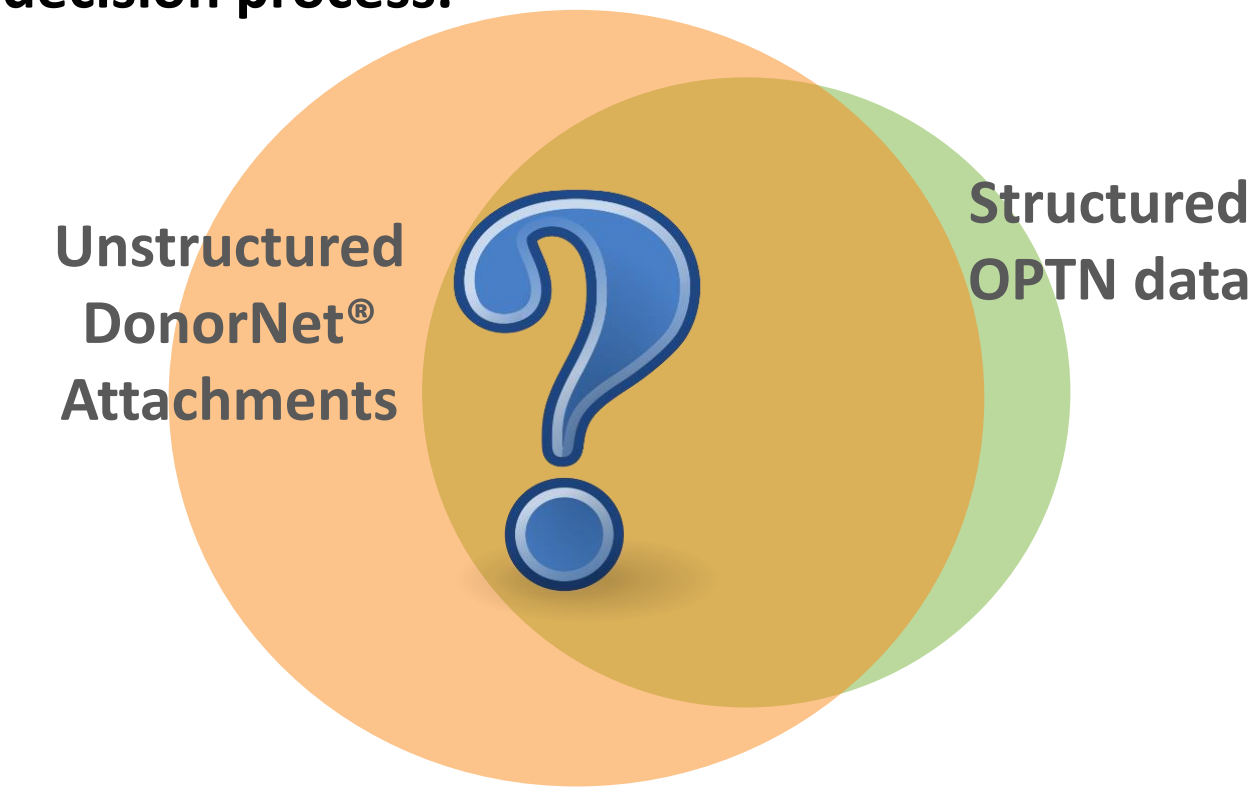
United Network for Organ Sharing, Richmond, VA

Background

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

During **allocation** of a deceased donor organ, organ procurement organizations share both **unstructured** and **structured** data through the DonorNet® platform. These data are used by transplant hospitals to **decide whether or not to accept the organ** for transplant into their patient receiving the offer.

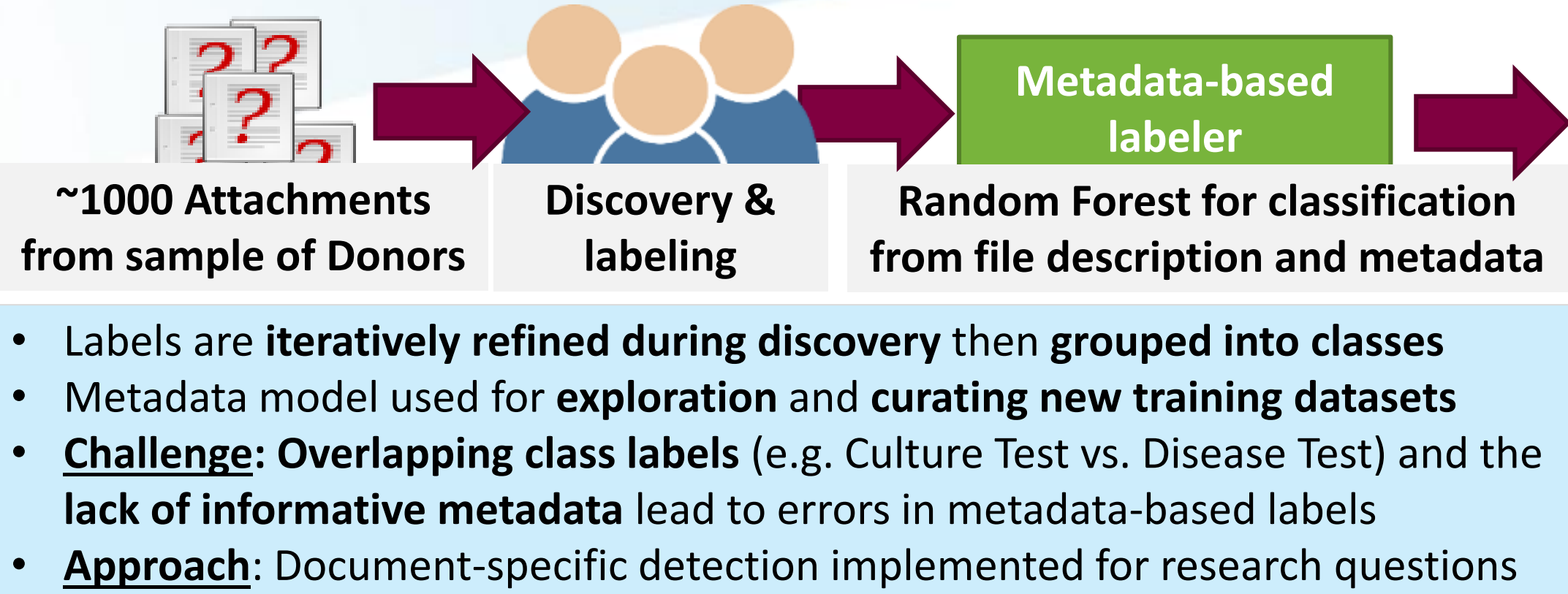
While the OPTN maintains databases and registries of well-structured historical data, **it is unclear what role unstructured data plays in the decision process**.



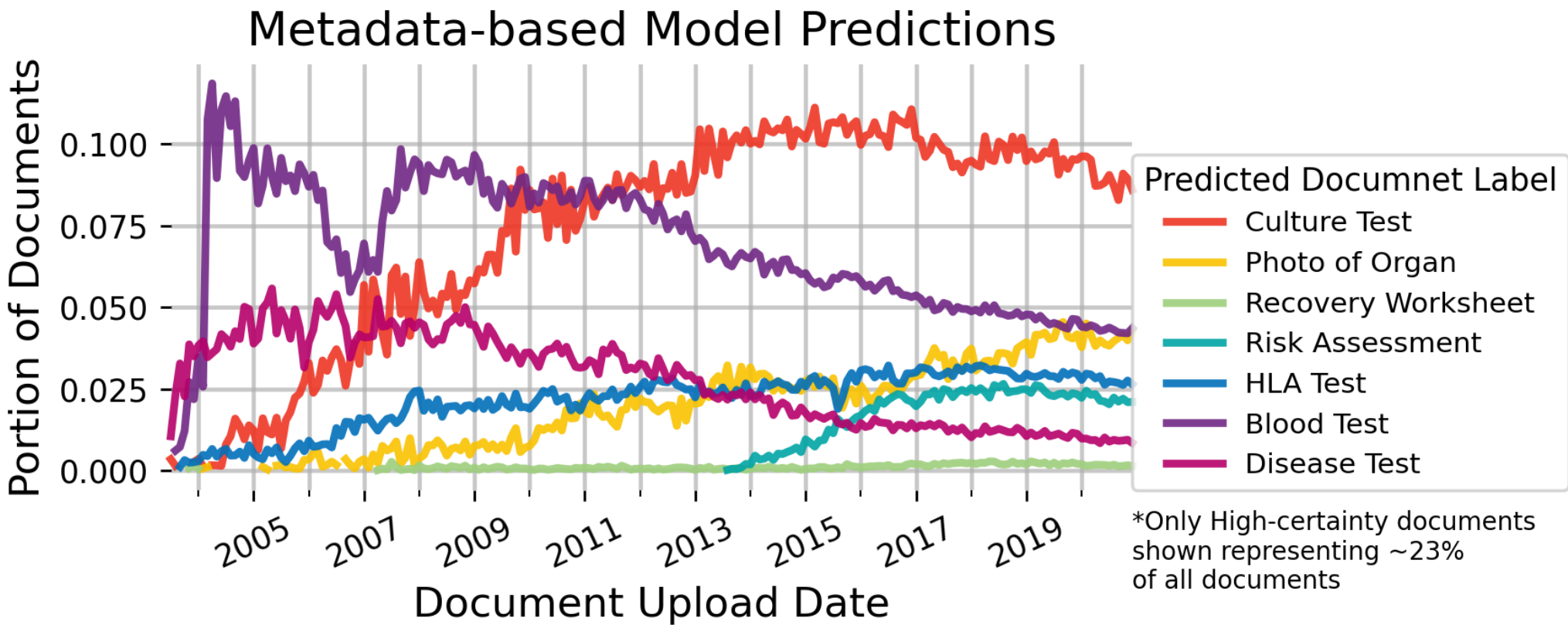
Goals

1. **Perform initial discovery** of attachments data
2. **Detect and extract** data elements of interest
3. **Analyze correlation with organ utilization** using multivariate regression

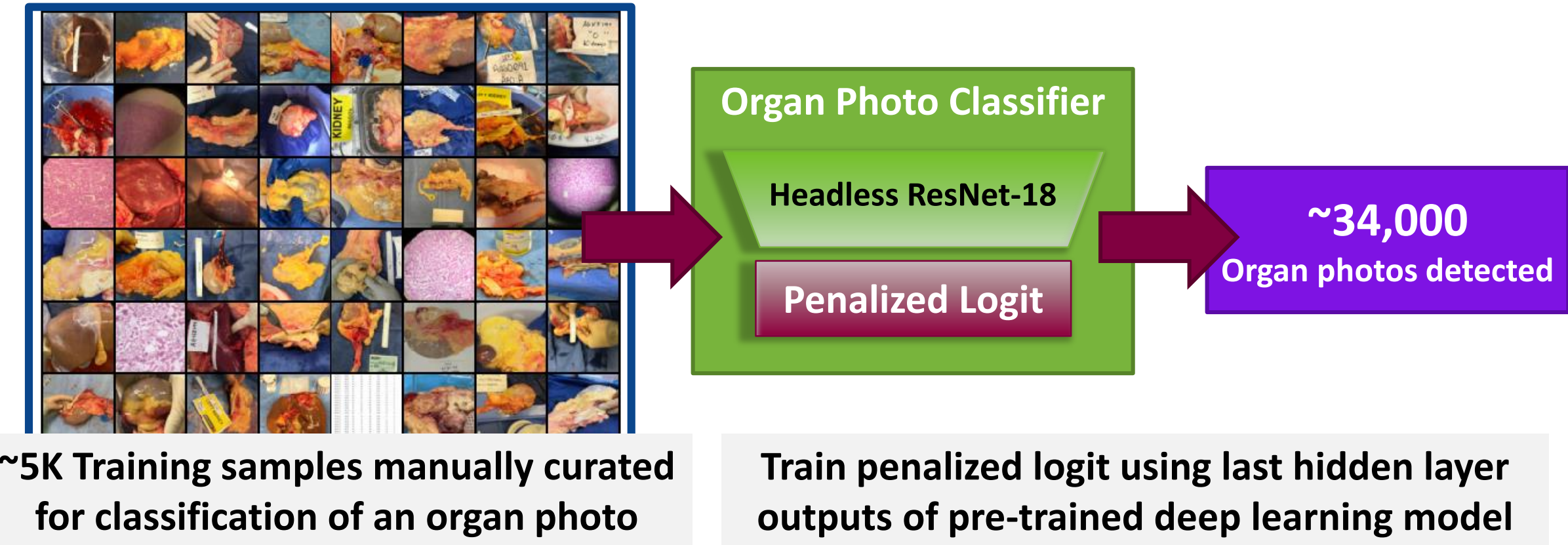
Initial Discovery



- Labels are **iteratively refined during discovery** then **grouped into classes**
- Metadata model used for **exploration** and **curating new training datasets**
- **Challenge:** **Overlapping class labels** (e.g. Culture Test vs. Disease Test) and the **lack of informative metadata** lead to errors in metadata-based labels
- **Approach:** Document-specific detection implemented for research questions



Research Question [1]: Are Organ Photos Related to Kidney Utilization?



Organ Photos are Correlated with...

Increased Utilization for high-KDPI (>0.85) organs

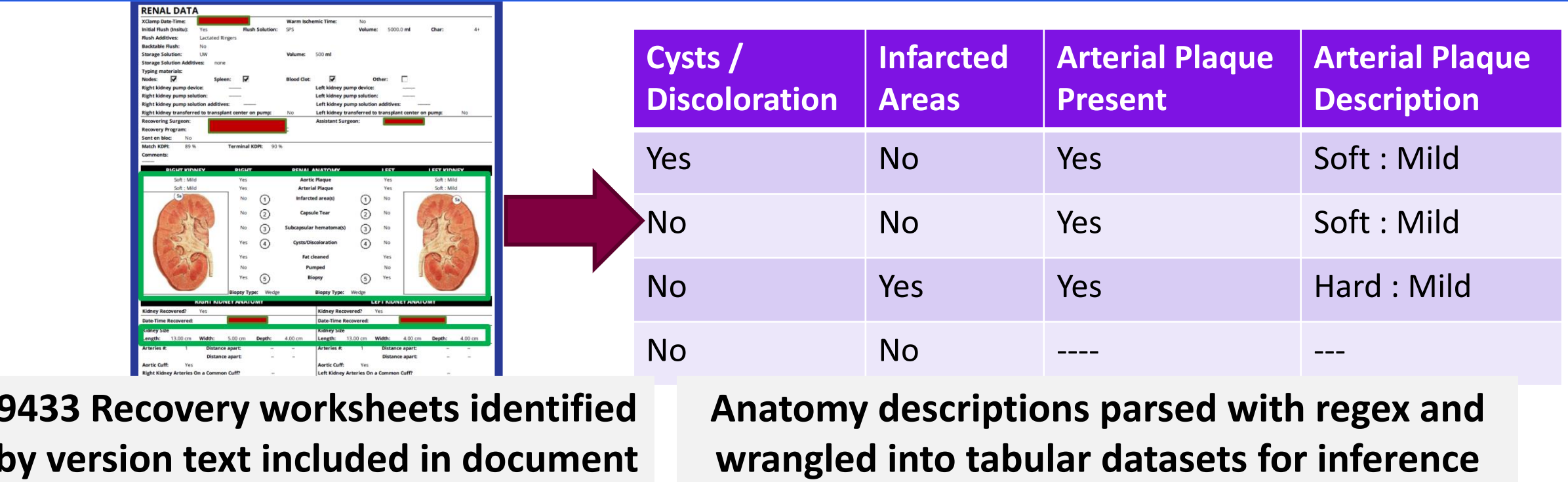
- Hypothesized that the photos **reduce uncertainties** related to accepting high-KDPI organs

Decreased Utilization for low-KDPI (<=0.35) organs

- Hypothesized that low-KDPI images are used to capture **injury** or **abnormalities** in younger organ donors

More research needed to understand the role and use-cases of organ photos

Research Question [2]: Are Recovery Worksheets Related to Kidney Utilization?



Cysts / Discoloration	Infarcted Areas	Arterial Plaque Present	Arterial Plaque Description
Yes	No	Yes	Soft : Mild
No	No	Yes	Soft : Mild
No	Yes	Yes	Hard : Mild
No	No	----	---

Significant Anatomical Utilization Indicators:

Increased Utilization

- "Fat Cleaned"
- Kidney Size (larger)

Decreased Utilization

- Cyst/Discoloration
- Hard Plaque
- Subcapsular Hematoma
- Severe Arterial Plaque

Standardizing collection may be warranted

References & Resources

- [1] Stuart M, Placona AM, Martinez C, Andreoni K. **DonorNet Procurement Photos and Their Association with Kidney Utilization** [abstract]. *Am J Transplant*. 2022; 22 (suppl 3).
<https://atcmeetingabstracts.com/abstract/donornet-procurement-photos-and-their-association-with-kidney-utilization/>
- [2] Placona AM, Martinez C, McCharen K, Shean B, Stuart M. **The Association Between Renal Anatomy Data and Kidney Utilization** [abstract]. *Am J Transplant*. 2022; 22 (suppl 3).
<https://atcmeetingabstracts.com/abstract/the-association-between-renal-anatomy-data-and-kidney-utilization/>
- 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/>
- Kidney Donor Risk Index (**KDRI**) and Kidney Donor Profile Index (**KDPI**)
 - https://optn.transplant.hrsa.gov/media/1512/guide_to_calculating_interpreting_kdpi.pdf
- Python Packages important to enabling this work
 - PySpark, pdfreader, statsmodels, Scikit-Learn, PyTorch and torchvision, pandas, numpy