

Optimization & Learning Approaches to Resource Allocation for Social Good

Sanmay Das

Washington University in
St. Louis

John Dickerson

University of Maryland,
College Park

Bryan Wilder

University of Southern
California

Allocation and Social Good



- Social problems: disease, poverty, homelessness...
- Intervention: services, outreach, education
- Limited resources

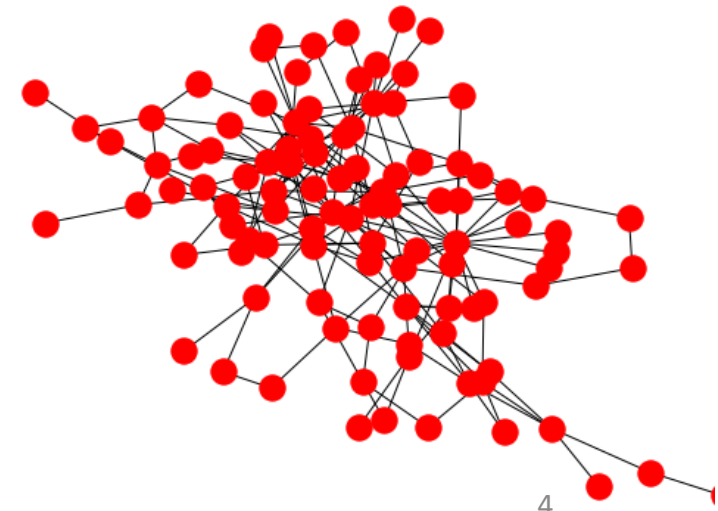


Motivating question

How can AI be used to improve socially impactful decisions?

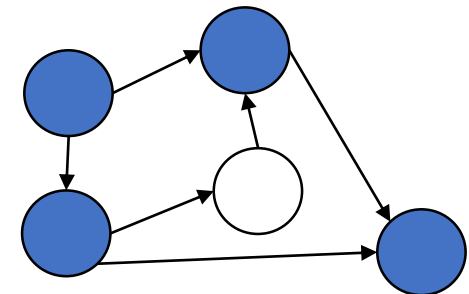
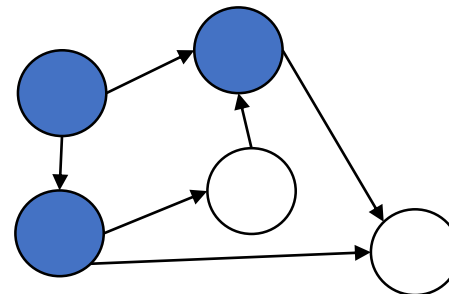
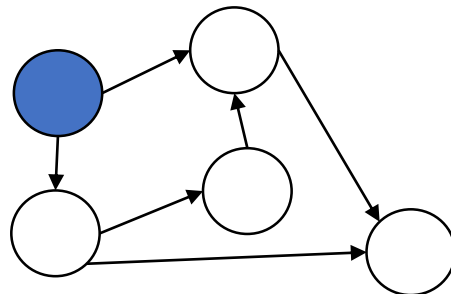
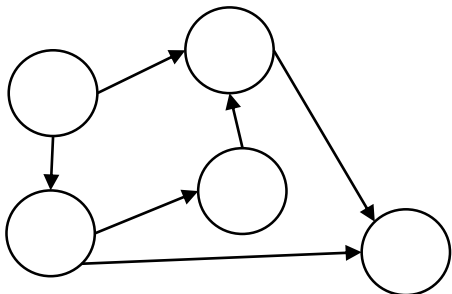
Example: HIV prevention

- Shelters for homeless youth conduct educational interventions
- Resource constraints: work with 4-6 youth at a time
- *Peer leaders*: spread message through social network



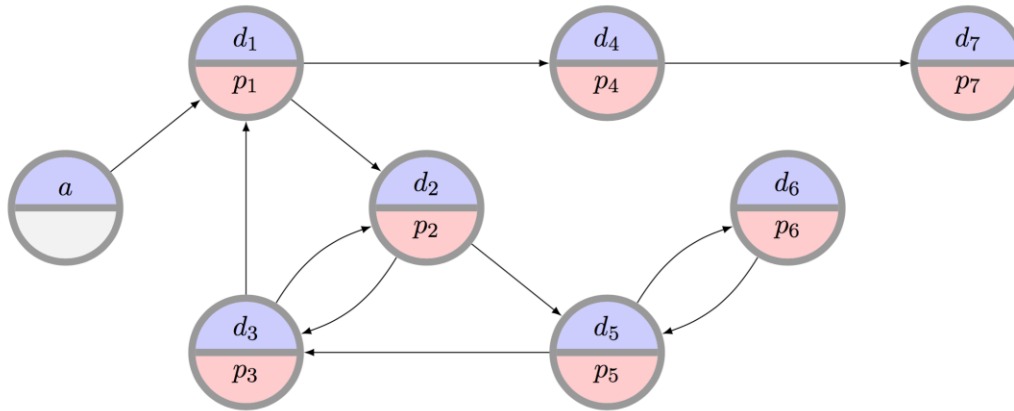
Example: HIV prevention

- Limited budget for total peer leaders trained
- Which nodes lead to greatest influence spread?
- Influence maximization problem



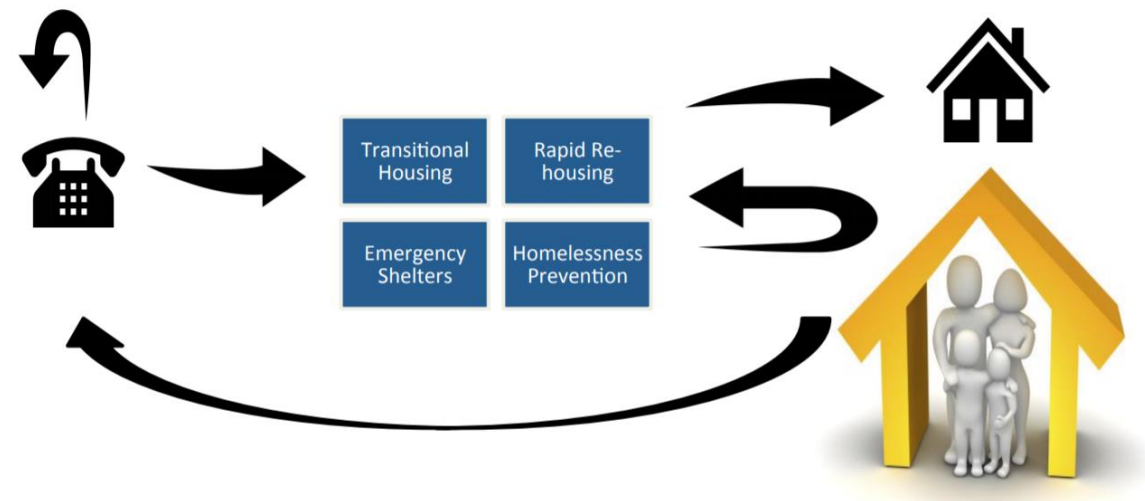
Example: organ allocation

- Patients require organ donation (e.g., kidney)
- Donors can supply an organ to compatible patients
 - Potentially contingent on their own patient receiving one
- How to match as many compatible pairs as possible?



Example: homelessness services

- Cities provide services for homeless or at-risk people
- Preventative interventions, transitional housing, permanent housing...
- How to allocate scarce resources to recipients who benefit most?

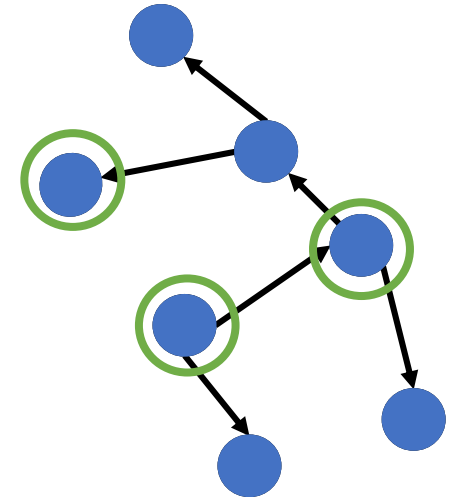


Technical focus

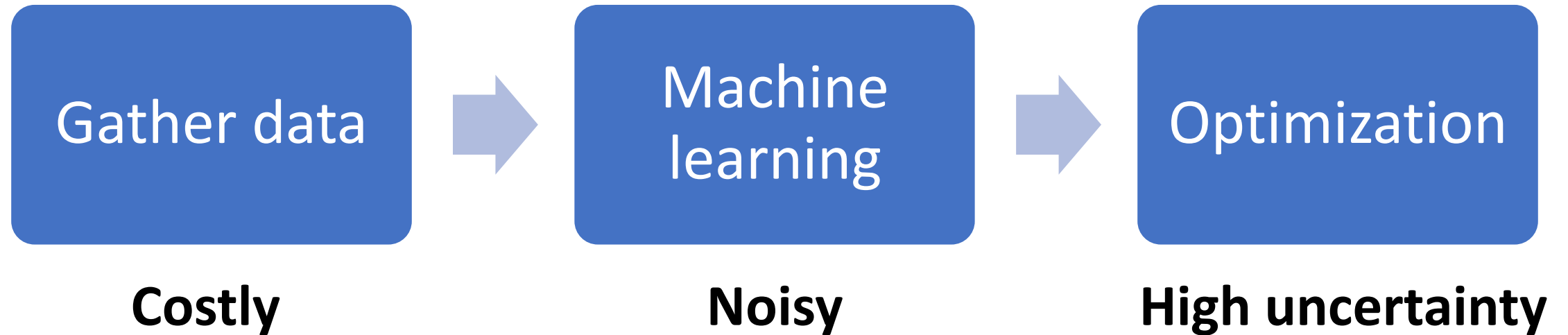
- Improving interventions is often an *optimization* problem

$$\max_{S \in X} f(S) \quad X \subseteq \{0,1\}^n$$

- Select from a set of options
 - Peer leaders from a social network
 - Assign housing to applicants
 - Donor-recipient organ matches
- Resources are limited: intervention is subject to constraints
- Uncertainty about outcomes



Technical focus



Outline

- ~~Intro & motivation~~
- Preliminaries & basic techniques
- Formulating objective functions: value judgement aggregation
- Decision making under uncertainty
- Offline allocation techniques & applications
- Online allocation techniques & applications
- Conclusion