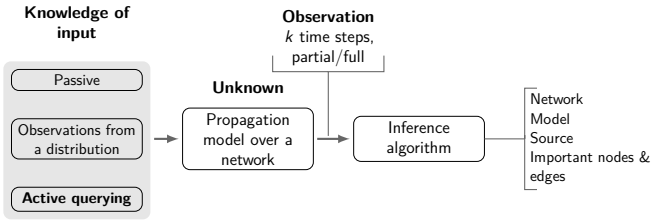
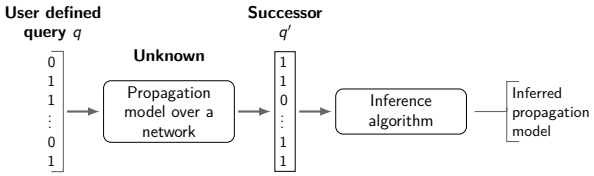
Outline

- Inferring propagation models over networks



- Accuracy of inference: exact or approximate
- Knowledge: partial or full

Problem: Inferring propagation models by active querying



- User knows:
  - Network (undirected, unweighted)
  - Concept class
    - ⋆ threshold functions
    - ⋆ symmetric local functions
- Exact inference

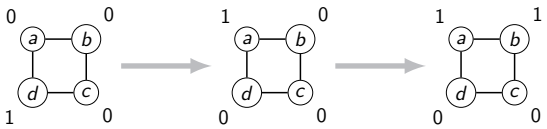
Sample complexity: How many queries are sufficient to infer the dynamical system?

Threshold propagation model

... and symmetric vertex functions

- Closed neighborhood of a vertex v: $N[v]$
- Every node is associated with a threshold: $t(v)$

$$q_{i+1}(v) = \begin{cases} 1, & \sum_{v' \in N[v]} q_i(v') \geq t(v) \\ 0, & \text{otherwise} \end{cases}$$

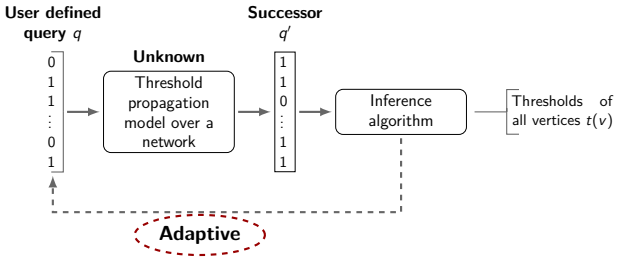


$$t(a) = 1,\ t(b) = 1,\ t(c) = 2,\ t(d) = 2$$

- Symmetric vertex functions: State depends only on number of neighbors in state 1.

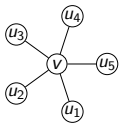
Query models

Batch and adaptive modes



- Batch: queries must be submitted at once.
- Adaptive: a query can be submitted after observing answers to previous queries ("Twenty questions" game).

Inferring the threshold of a single vertex



Threshold $t(v) = 5$
Degree $d(v) = 5$

Batch mode

	q_1	q_2	q_3	$\cdots$	$q_{d(v)}$	$q_{d(v)+1}$
u_1	0	1	1		1	1
u_2	0	0	1		1	1
u_3	0	0	0	$\cdots$	1	1
u_4	0	0	0		1	1
u_5	0	0	0		1	1
v	0	0	0		0	1

Adaptive mode

	q_1	q_2	q_3
u_1	1	1	1
u_2	1	1	1
u_3	1	1	1
u_4	0	1	1
u_5	0	1	0
v	0	0	0