Story-Driven Summarization for Egocentric Video

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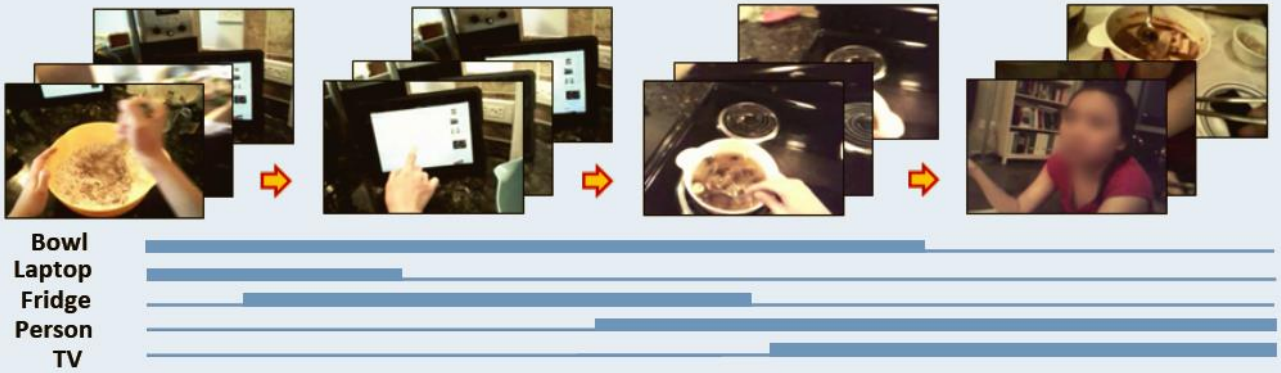
INPUT:
Long video

OUTPUT:
Short video summary



Activation pattern of influential objects

Potential Applications

Memory aid

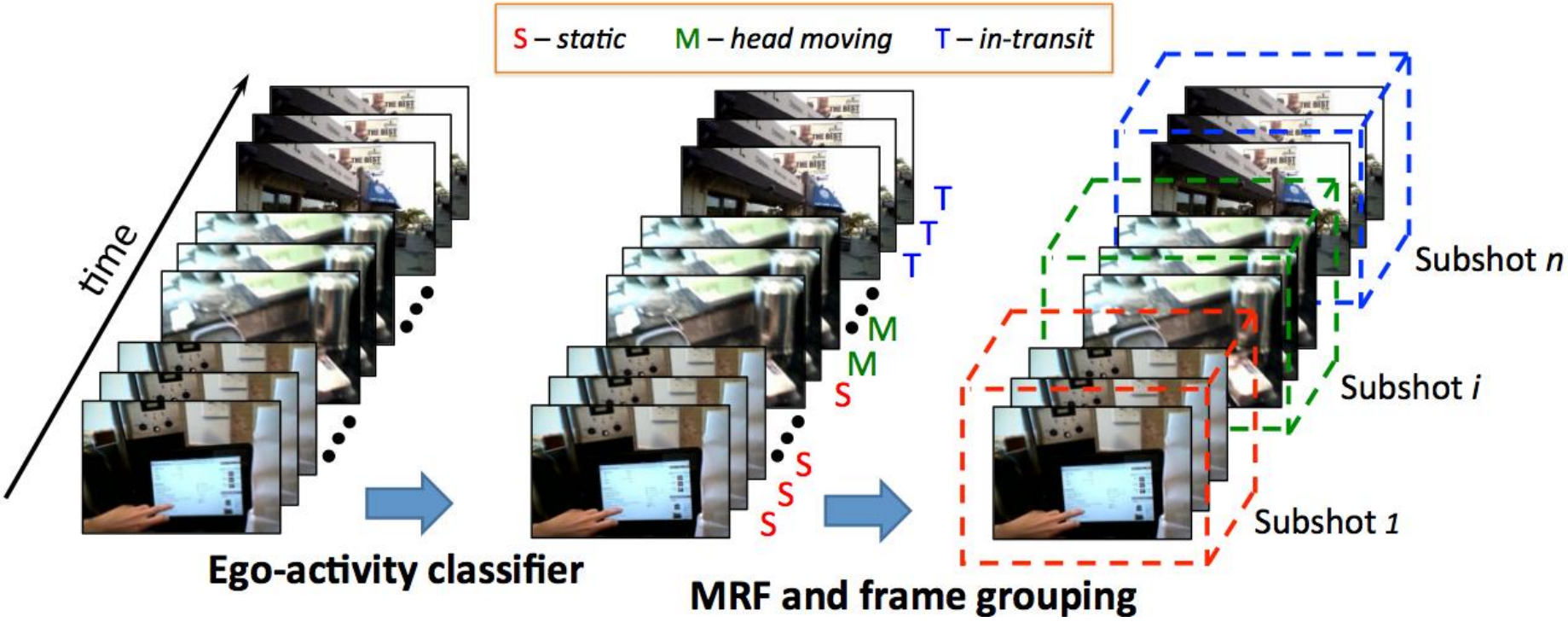
Law enforcement

Mobile robot discovery

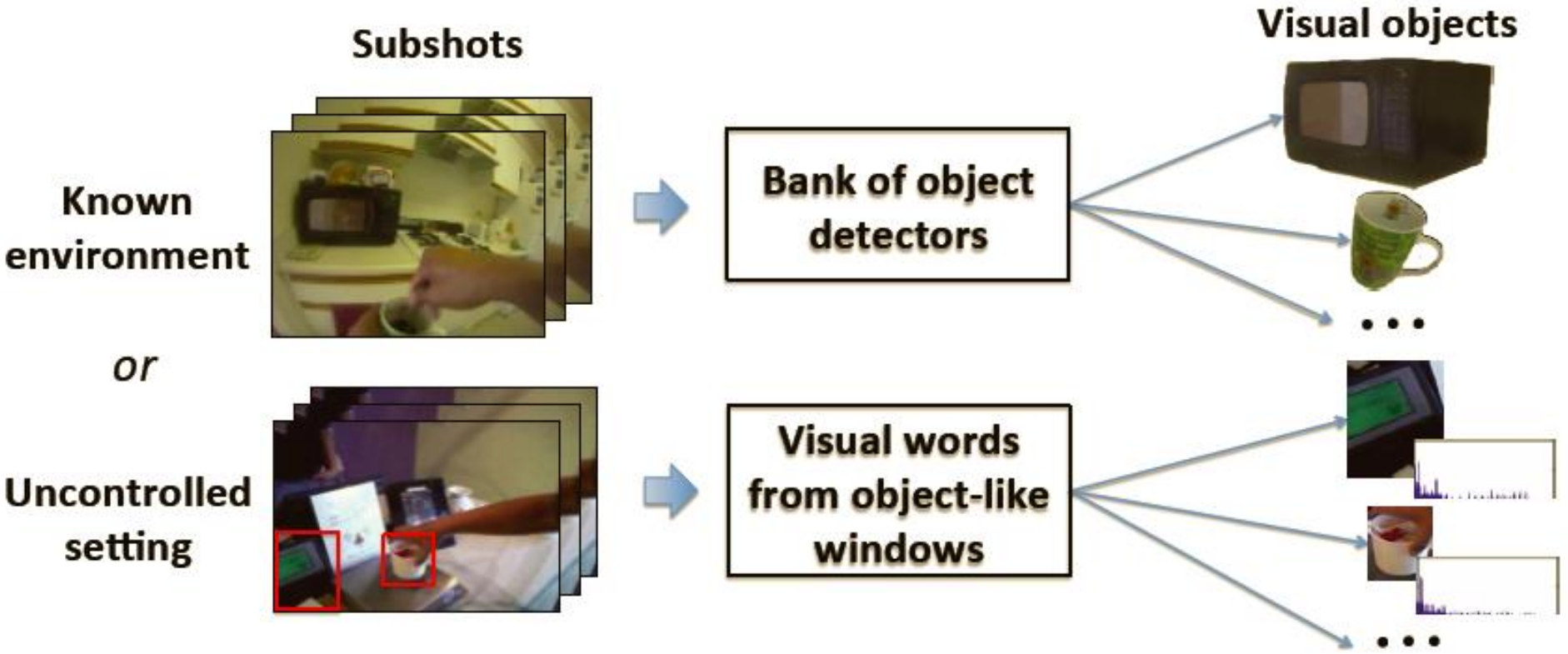
Related Works

- Video summarization
  - Y. J. Lee, J. Ghosh, and K. Grauman. Discovering important people and objects for egocentric video summarization. In CVPR, 2012.
- Egocentric video analysis
- Influence in news articles
  - D. Shahaf and C. Guestrin. Connecting the dots between news articles. In KDD, 2010.

Temporal Subshot Segmentation



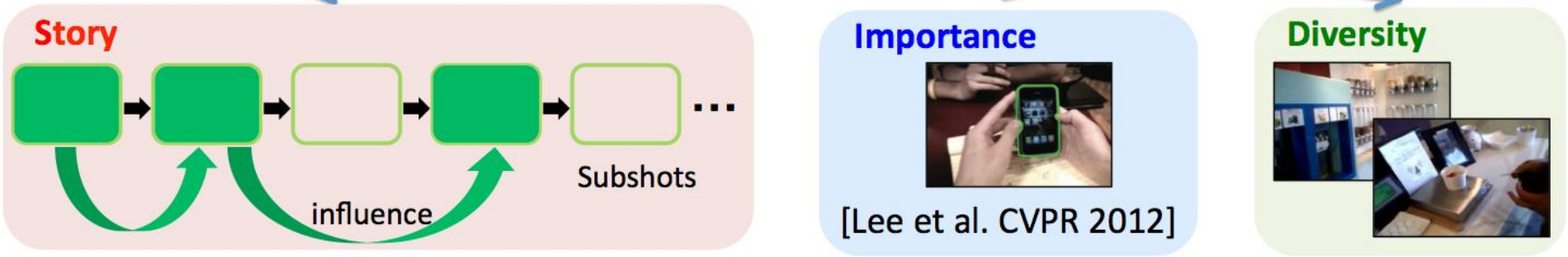
Subshot and Object Representation



Subshot Selection Objective

$$S^* = \arg\max_{S \subset \mathcal{V}} \; Q(S)$$

$$Q(S) = \lambda_s \mathcal{S}(S) + \lambda_i \mathcal{I}(S) + \lambda_d \mathcal{D}(S)$$



Story Progress Between Subshots

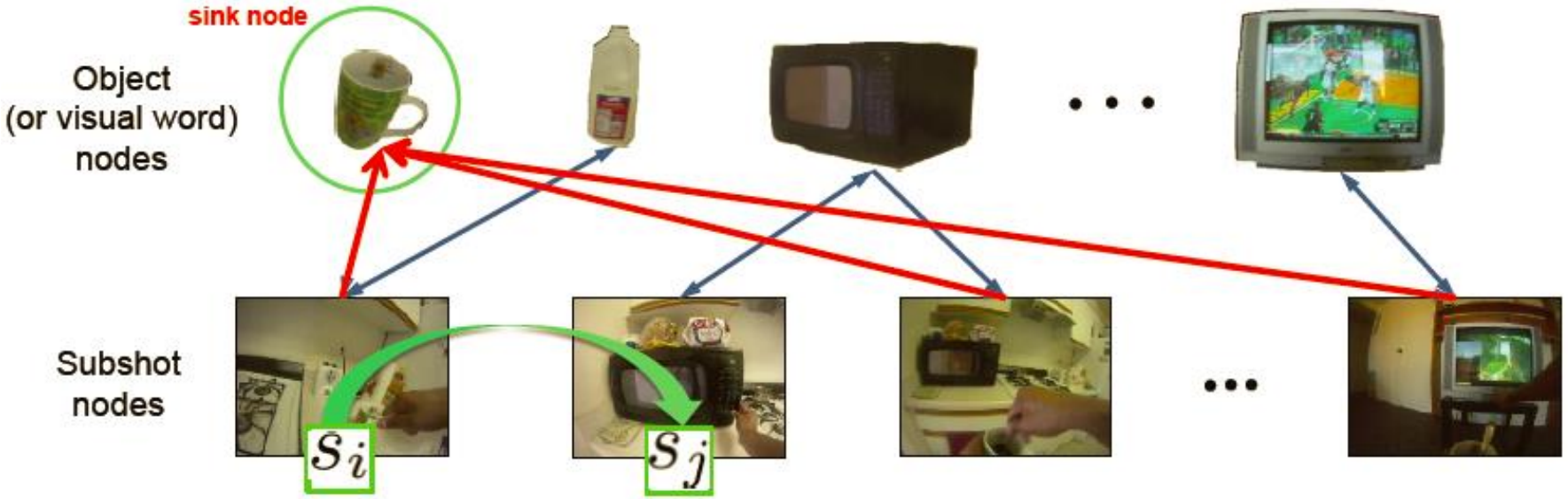
$$\mathcal{S}(S) = \max_{a} \min_{j=1,\ldots,K-1} \sum_{o_i \in O} a_{i,j} \textsc{Influence}(s_j, s_{j+1} | o_i)$$

Maximize influence of weakest link

Object activation variables

Influence between two subshots conditioned on an object

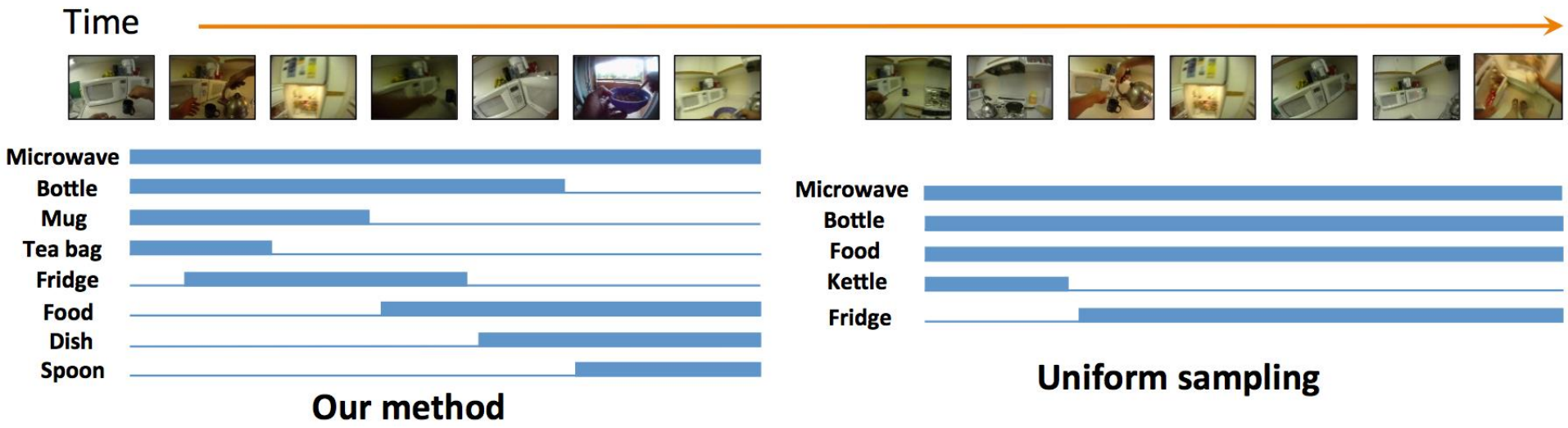
Predicting Influence Between Subshots



$$\text{INFLUENCE}(s_i, s_j | o) = \prod\nolimits_i (s_j) - \prod\nolimits_i^o (s_j)$$

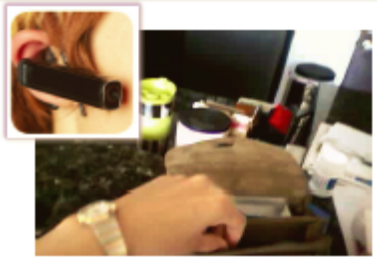
[Shahaf & Guestrin, KDD 2010]

Coherent Object Activation Patterns



Datasets

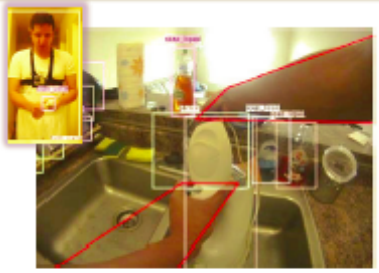
UT Egocentric (UTE)
[Lee et al. CVPR 2012]



4 videos, each 3-5 hours long, uncontrolled environment.

We use visual words and subshots.

Activities of Daily Living (ADL)
[Pirsiavash & Ramanan CVPR 2012]



20 videos, each 20-60 minutes, daily activities in house.

We use object bounding boxes with keyframes.

Baselines

- Uniform sampling
- Shortest-path
- Object-driven

Evaluating Summary Quality

- Large-scale user study
  - UTE: 5 hours and 11 events.
  - ADL: 7 hours and 37 events.
- 34 subjects, from 18 – 60 years old.
- 5 users per comparison. Total 535 tasks, 45 hours of user time.

Blind taste test:

- Show speed up original video.
- Show our summary and one of baselines'.
- Which better shows the progress of the story?

Results

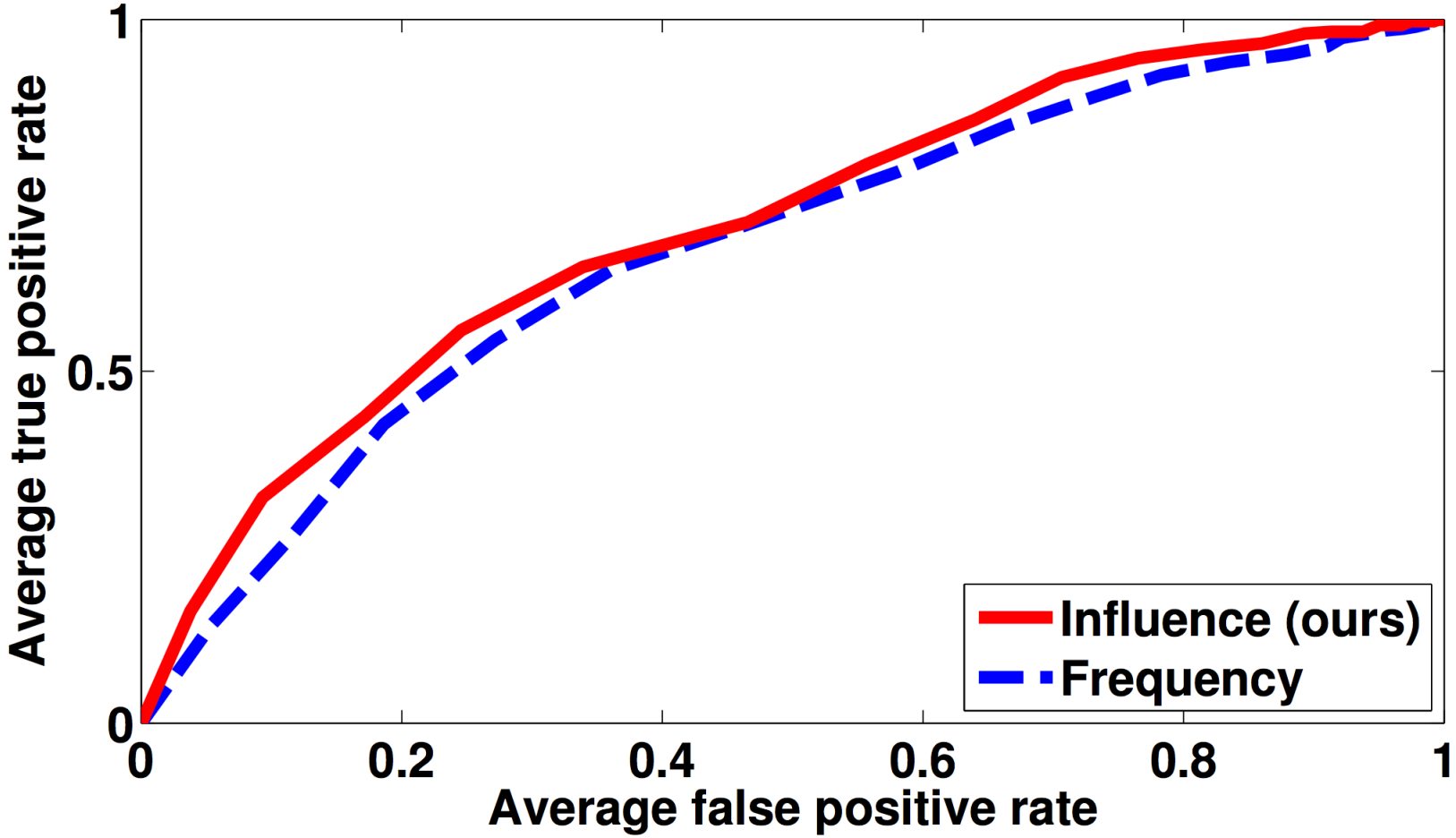
Data	Uniform sampling	Shortest-path	Lee et al. CVPR 2012
UTE	90.0%	90.9%	81.8%
ADL	75.7%	94.6%	N/A

% of subjects who prefer this method's summary to the baseline

Results

Results

Results


Average true positive rate
1
0.5
0
0
0.2
0.4
0.6
0.8
1
Average false positive rate
Influence (ours)
Frequency

THANK YOU