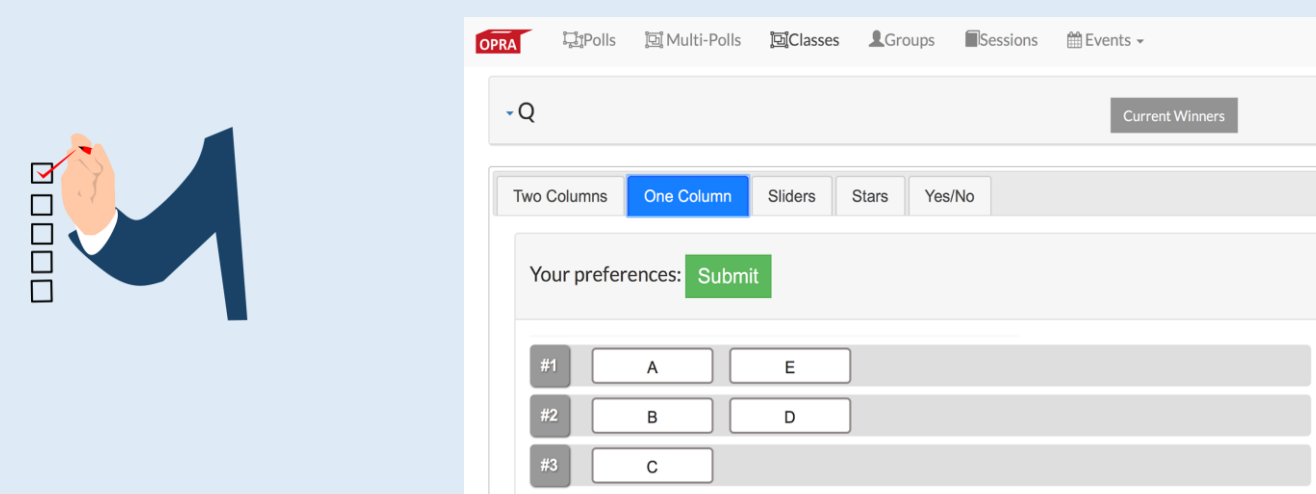


INTRODUCTION

Eliciting preferences

- Traditionally done using ballots or rankings



- How can we learn agent preferences from natural language to make a group decision?
- E.g. Forums, message boards, chat rooms

Harvard is the absolutely best choice for higher education.

Yale University will be a better choice for her than Harvard.

PREFERENCE AGGREGATION

PLACKETT-LUCE (PL) MODEL

Models distribution over preferences

- m alternatives, $\{a_1, \dots, a_m\}$
- Parameter space: $\{\vec{\theta} | \theta_1, \dots, \theta_m\}$

$$\Pr(a_1 > \dots > a_m | \vec{\theta}) = \frac{\theta_1}{\sum_{j=1}^m \theta_j}$$

PREFERENCE AGGREGATION

Voting with m alternatives, n agents, each represented by a distribution

- Probabilistic votes [Hazon et al. AIJ-12]
 - 😊 natural
- Fractional votes [Prasad et al. ICML-15, Noothigattu et al. AAI-18, Zhibing et al. UAI-18]
 - 😊 easy to compute

THEORETICAL RESULTS

Proposition. With PL preferences for agents, Fractional winner computation is polynomial-time for many voting rules

Voting Rule	Runtime
k-Approval	$O(k m^k n)$
Copeland	$O(m^2 n)$
Maximin	$O(m^2 n)$
STV	$O(m^2 n)$

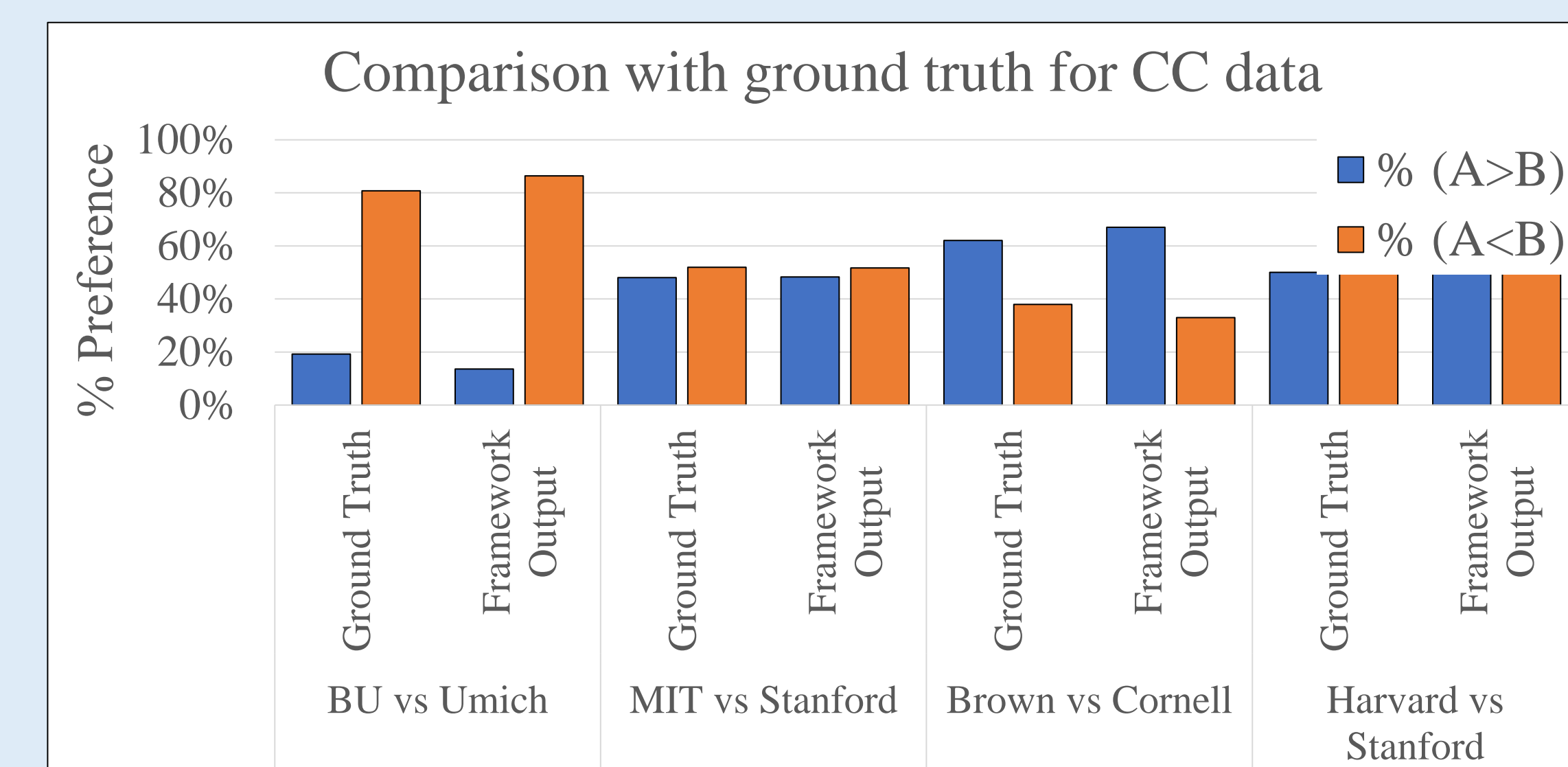
Theorem. For all anonymous rules and any profile of distributions

$$\Pr(\text{Prob winner} = \text{Fractional winner}) \geq 1 - m! \exp(-\Omega(\text{Margin of Victory}))$$

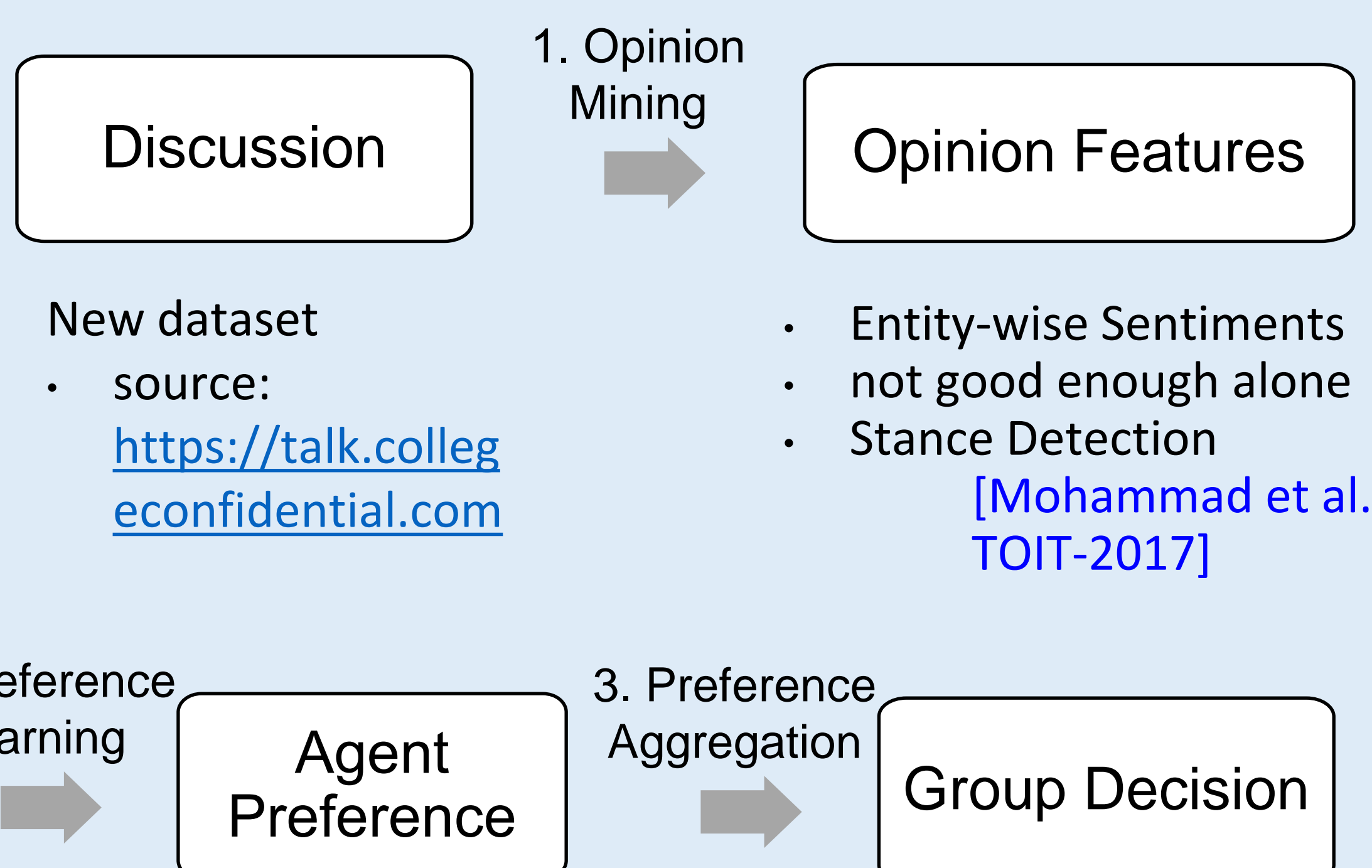
Results also extend to mixtures of PL models

COLLEGE CONFIDENTIAL DATASET

- Created new dataset to test framework
 - Scenario: Which college will be best for this student?
 - 😊 tailored for group-decision/opinion aggregation
 - 😞 small, hard to train
- Our framework gets ~67% accuracy in predicting group decision for 2/3 alternatives



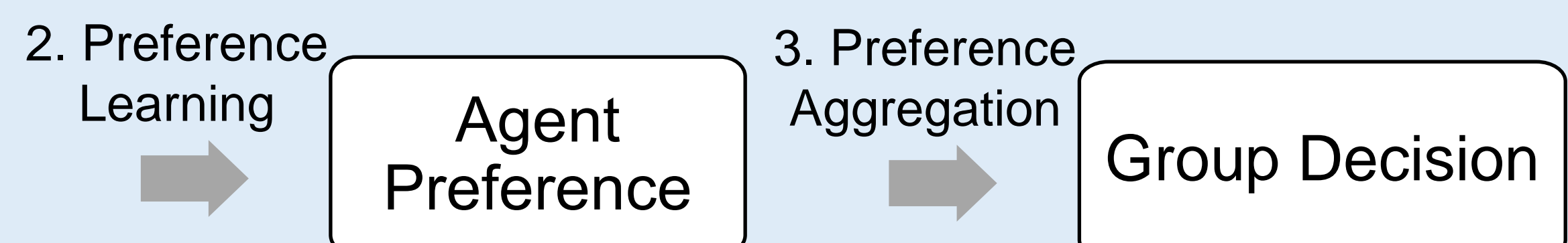
PROPOSED FRAMEWORK



New dataset

- source: <https://talk.collegconfidential.com>

- Entity-wise Sentiments
- not good enough alone
- Stance Detection [Mohammad et al. TOIT-2017]



- Plackett-Luce model with features
 - Opinion + agent + alternative features
- Compared to basic ML methods
 - sentiment+SVM or LogReg or NB
 - ngram+SVM
 - pre-trained word vectors+NN
- Similar accuracy
- Apply voting rule on predicted agent preferences

FUTURE WORK

- More data from more scenarios
- Active learning
- Better models and algorithms
- Multi-modal preference learning
- Practical systems

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