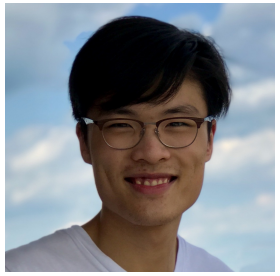
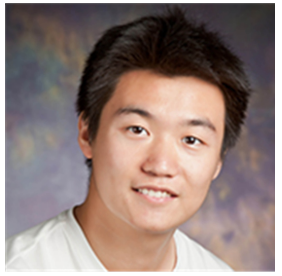
"Going on a vacation" takes longer than *"Going for a walk"*: A Study of Temporal Commonsense Understanding



Ben Zhou

Daniel Khashabi*



Qiang Ning*

Dan Roth

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Temporal Common Sense

- Humans assume information when reading
  - Not explicitly mentioned
  - Related to time
- Happens all the time
  - To better understand the storyline and beyond

Temporal Common Sense

My friend Bill went to Duke University in North Carolina. With a degree in CS, he joined Google MTV as a software engineer. As a huge basketball fan, he has attended all 3 NBA finals since then. He also plans to visit Duke regularly as an alumnus to attend their home games.

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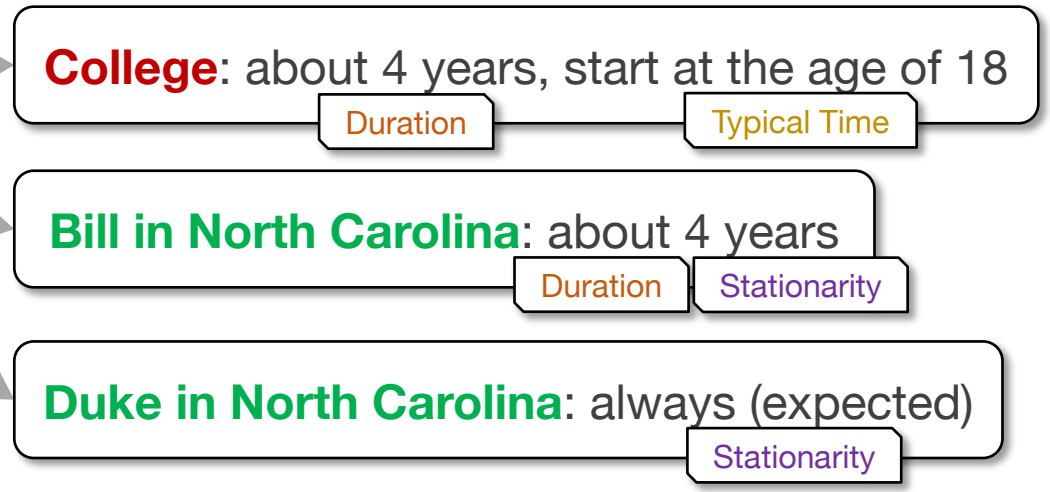

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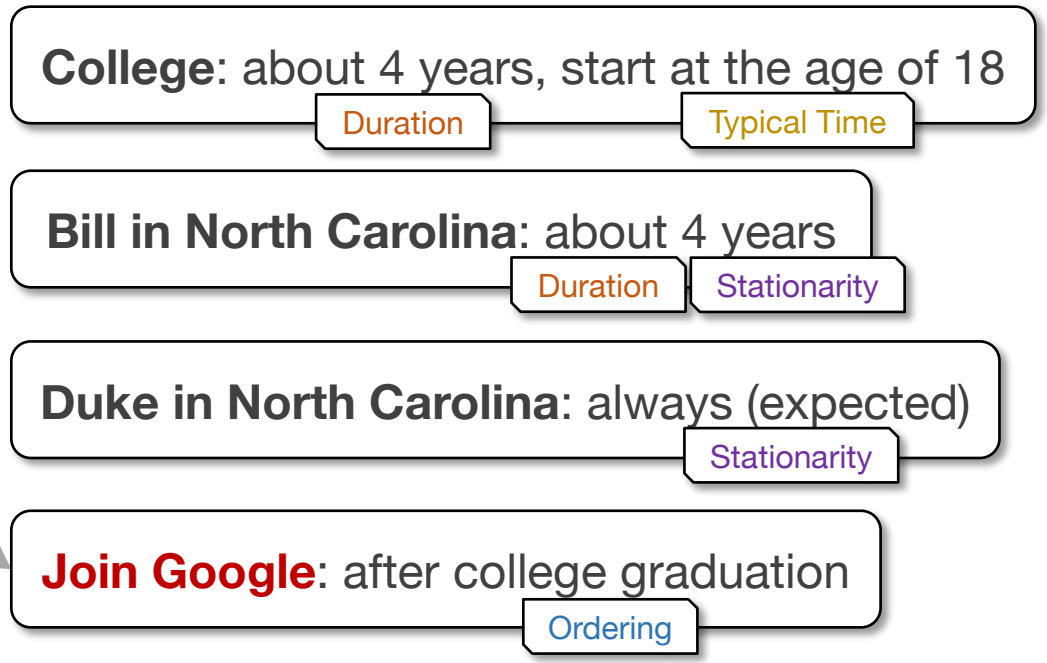

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College: about 4 years, start at the age of 18
- Duration
- Typical Time

Bill in North Carolina: about 4 years
- Duration
- Stationarity

Duke in North Carolina: always (expected)
- Stationarity

Join Google: after college graduation
- Ordering

NBA Finals: every year
- Frequency

Visit Alma Mater: 0-2 times per year, 0-2 days each time
- Frequency
- Duration

Attend basketball games: a few hours
- Duration

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** Human infer temporal common sense that helps them to better understand the story.*

- **Q: How old is Bill?**
- A: Around 25.
- R: 3 + 4 + 18

- **Q: How long will take Bill to fly to Duke?**
- A: A few (1-5) hours.
- R: Duke is always in NC, Bill is now in CA

- **Q: How often would he visit Duke in the future?**
- A: A few (<5) times a year.

- Q: **Which one happened first, went or joined?**
- A: Went.

Our Contribution

- MC-TACO 🌮 (**m**ultiple **c**hoice **t**empor**a**l **co**mmon-sense) **:**
  - A dataset that focuses on temporal commonsense
  - Input:

		Gold	Prediction	
He went to Duke University.	How long did it take him to graduate?	4 years		✓
He went to Duke University.	How long did it take him to graduate?	10 days		✓
		3.5 years		X
		16 hours		✓
				✓

  - Task: Decide whether each answer is plausible.
  - Metrics:
    - Exact Ma
    - F1: The F
  - Statistics:
    - 1,893 questions
    - 13,225 question-answer pairs
  - Conclusion: current systems are not enough to solve this.

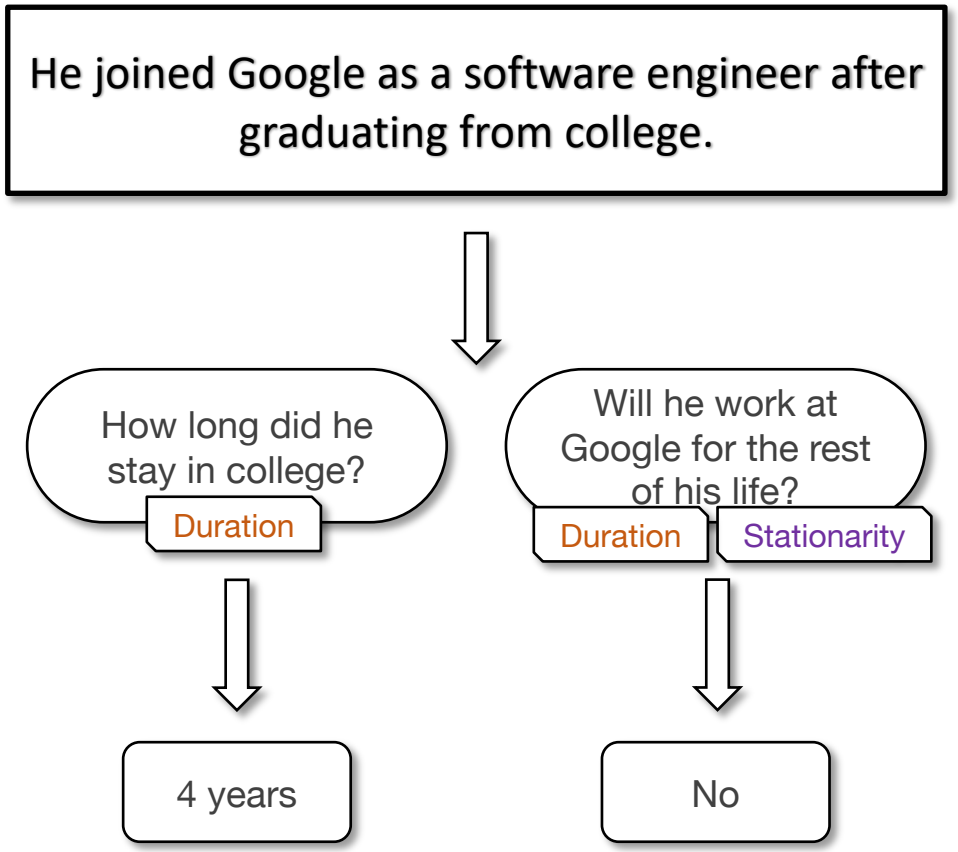
Reading Comprehension: able to answer any questions regarding a piece of text

Exact Match: able to label all candidate answers of a question

.7
Exact Match: 0.0

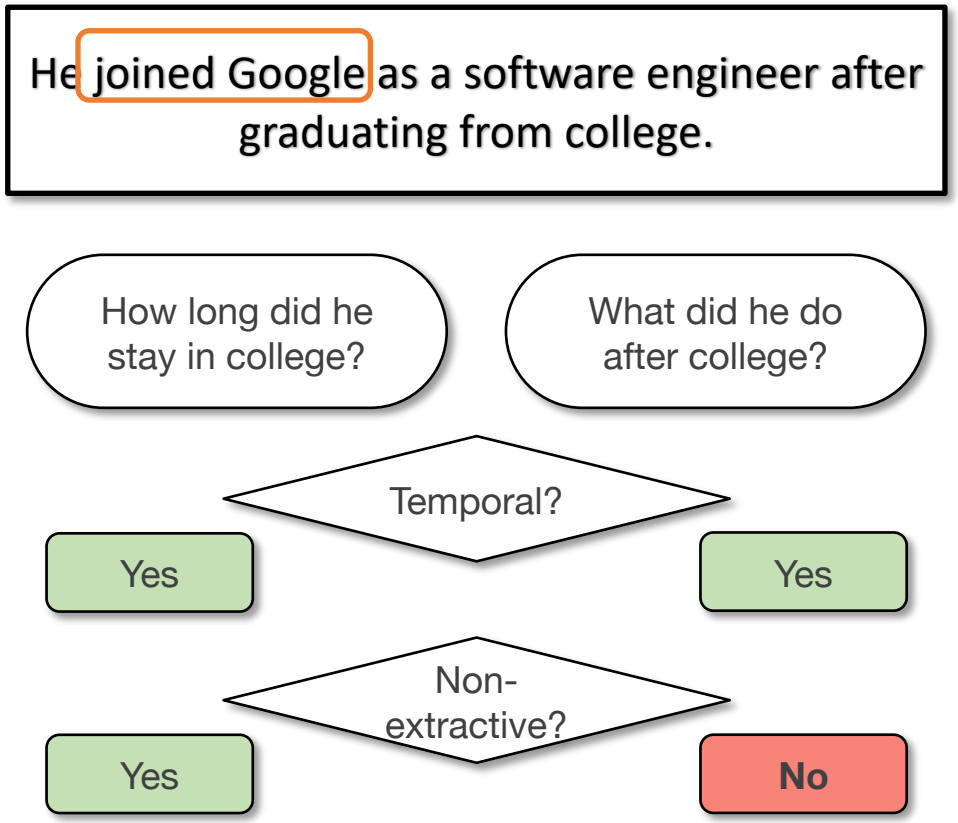
MC-TACO: Construction

- Step 0: Source Sentence Generation
  - Randomly samples sentences
- Step 1: Question Generation
  - Ask people to write questions
    - A) **temporal**
    - B) **non-extractive**
      - To require commonsense
  - Ask for one “plausible” answer



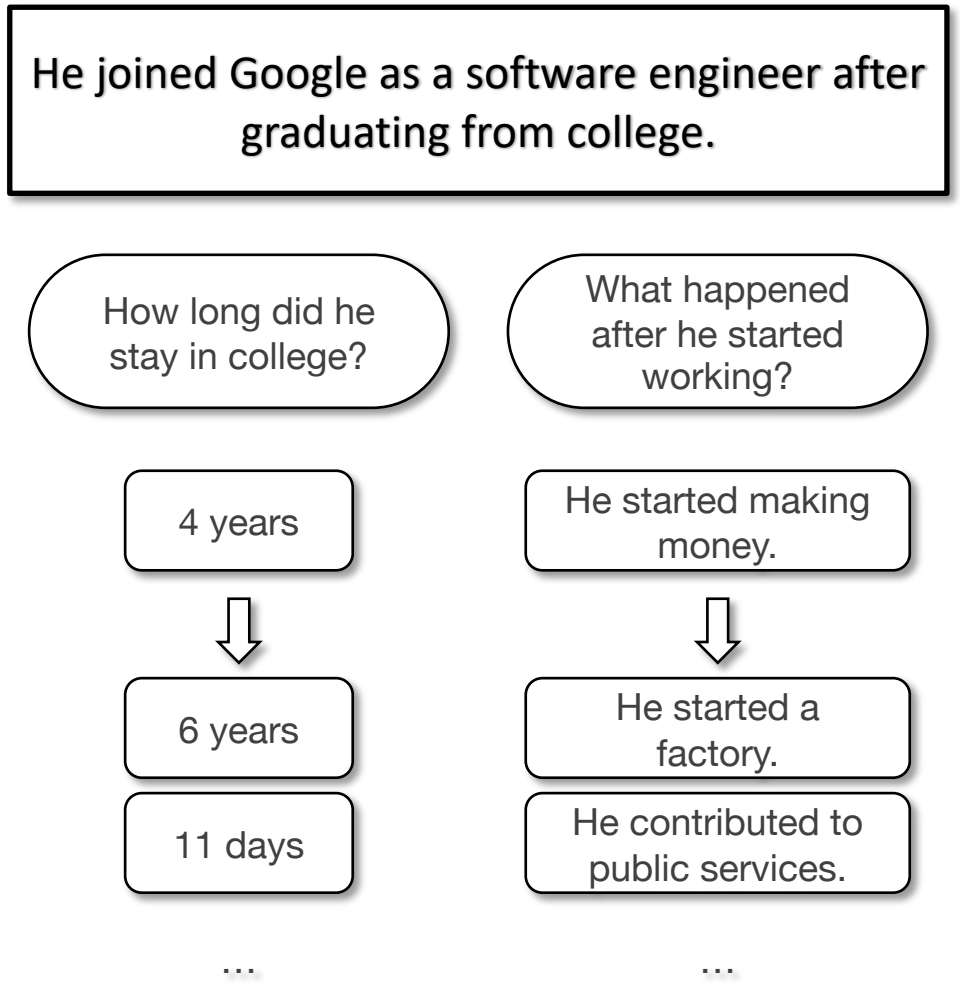
MC-TACO: Construction

- Step 2: Question Verification
  - 2 additional verifications on each question
  - 100% agreement
  - We also ask for
    - 1 “plausible” answer
    - 1 “implausible” answer



MC-TACO: Construction

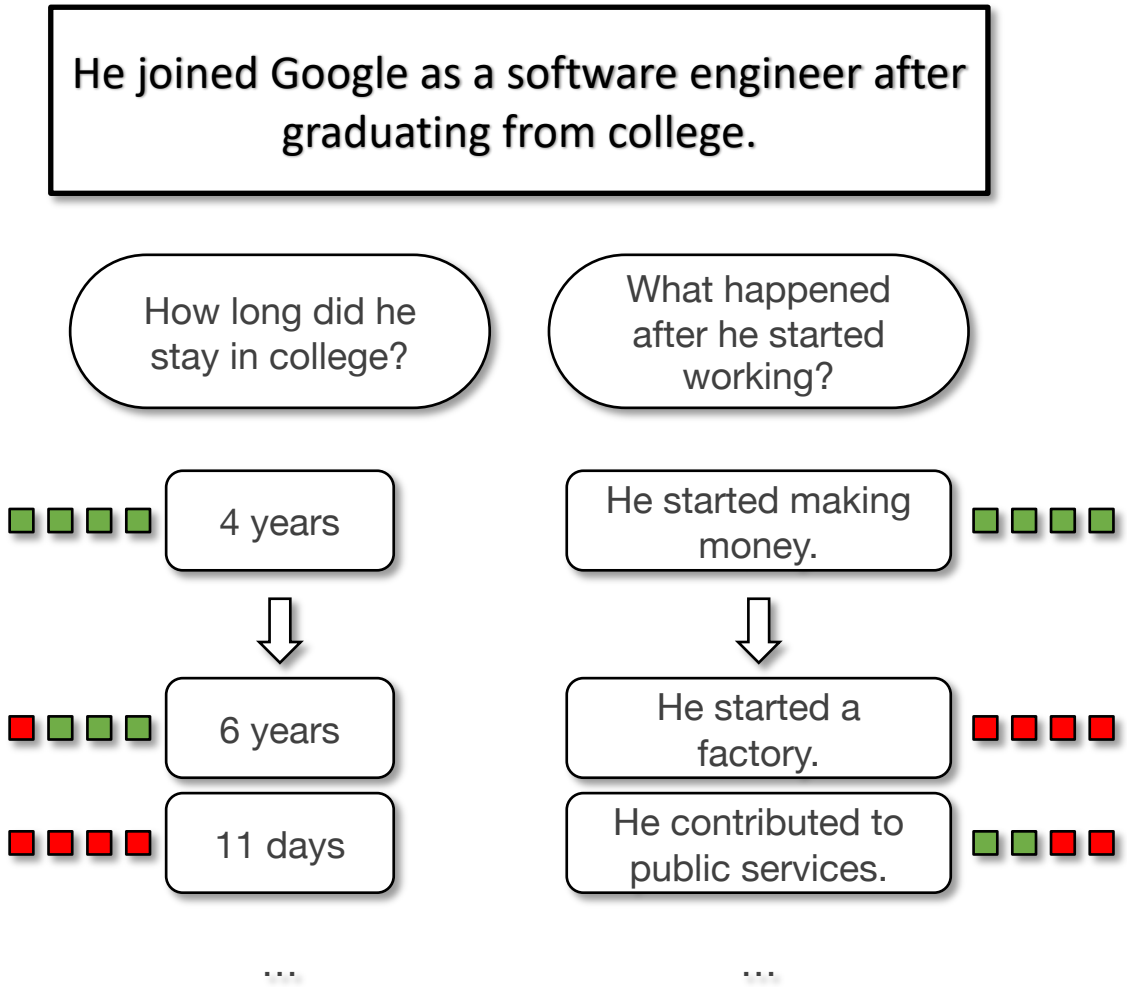
- Step 3: Candidate Answer Expansion
  - ☐ Seed answers from step 1+2
  - ☐ Expand candidates automatically
    - Perturbations
    - Information Retrieval



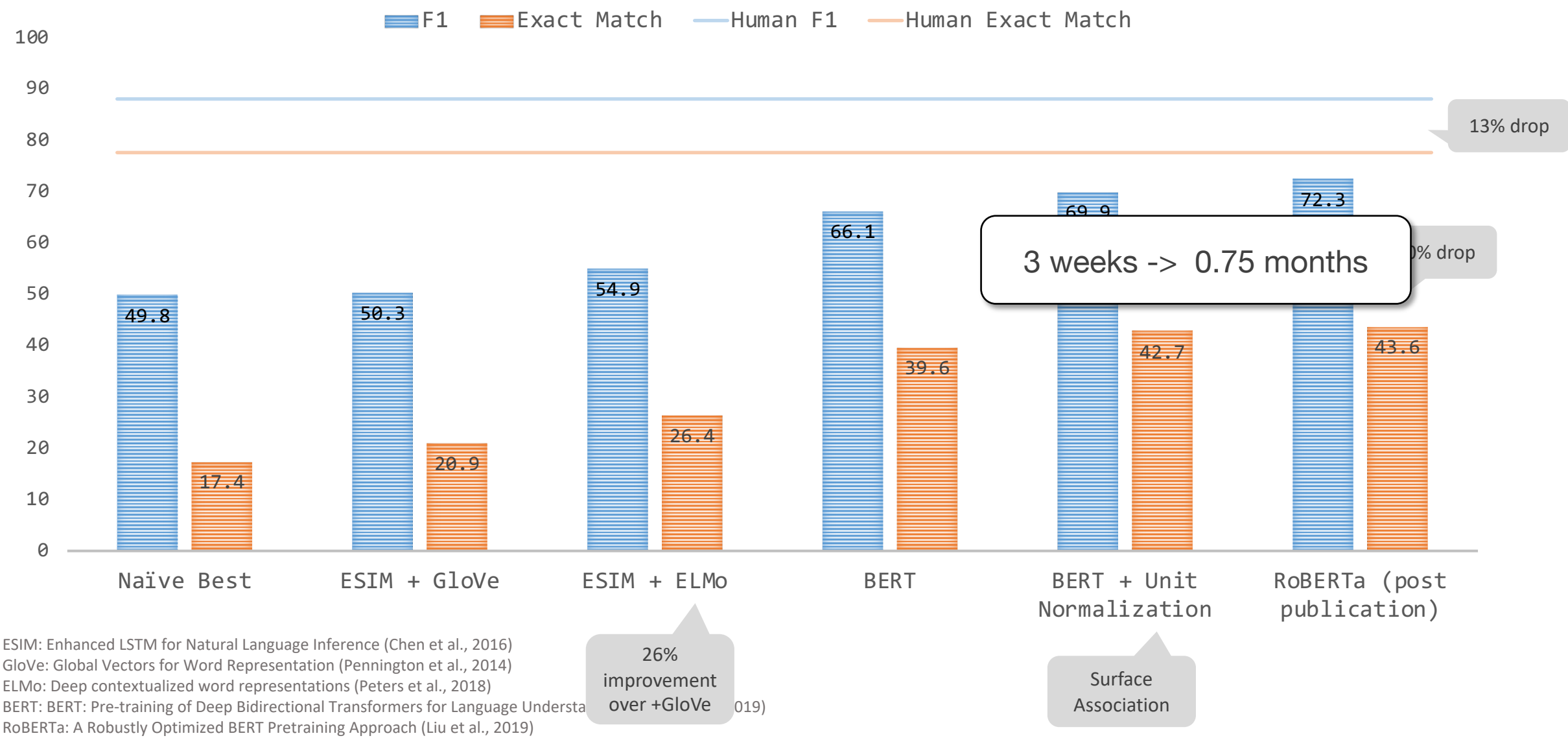
MC-TACO: Construction

- Step 4: Answer Labeling
  - Each answer is labeled by **4** different annotators
  - Either "likely" ■ or "unlikely" ■
  - Enforce 100% agreement

    ■■■■ or ■■■■
    - Eliminate marginal answers with "intermediate" probability



Results



ESIM: Enhanced LSTM for Natural Language Inference (Chen et al., 2016)
GloVe: Global Vectors for Word Representation (Pennington et al., 2014)
ELMo: Deep contextualized word representations (Peters et al., 2018)
BERT: BERT: Pre-training of Deep Bidirectional Transformers for Language Understa 019)
RoBERTa: A Robustly Optimized BERT Pretraining Approach (Liu et al., 2019)

Summary

- Define 5 temporal commonsense phenomena
- Present MC-TACO, a QA dataset focused on temporal commonsense
- Show that existing systems are not enough to solve it
- Encourage further research
- Thanks!

Leaderboard
https://leaderboard.allenai.org/mctaco/

GitHub (data, baseline, evaluator)
https://github.com/CogComp/MCTACO