IRAC: A Domain-Specific Annotated Corpus of Implicit Reasoning in Arguments

Keshav Singh[1] , Naoya Inoue[2,4] , Farjana Sultana Mim[1] , Shoichi Naitoh[1,3,4] , Kentaro Inui[1,4]
[1]Tohoku University , [2]Stony Brook University , [3]RICOH Company, Ltd. , [4]RIKEN

Overview

Implicit Reasoning in arguments

Implicit reasoning explain intermediate link between claim and premise; crucial for comprehending arguments.

- E.g., one may ***understand why/how? premise support claim*** by framing implicit reasoning via background knowledge

Claim: We should *ban surrogacy*.
Premise: Surrogacy often creates *abusive and coercive conditions for women*.
Implicit Reasoning: *Banning surrogacy* causes *decrease in number of women working as surrogates* which suppresses *abusive and coercive conditions for women*.

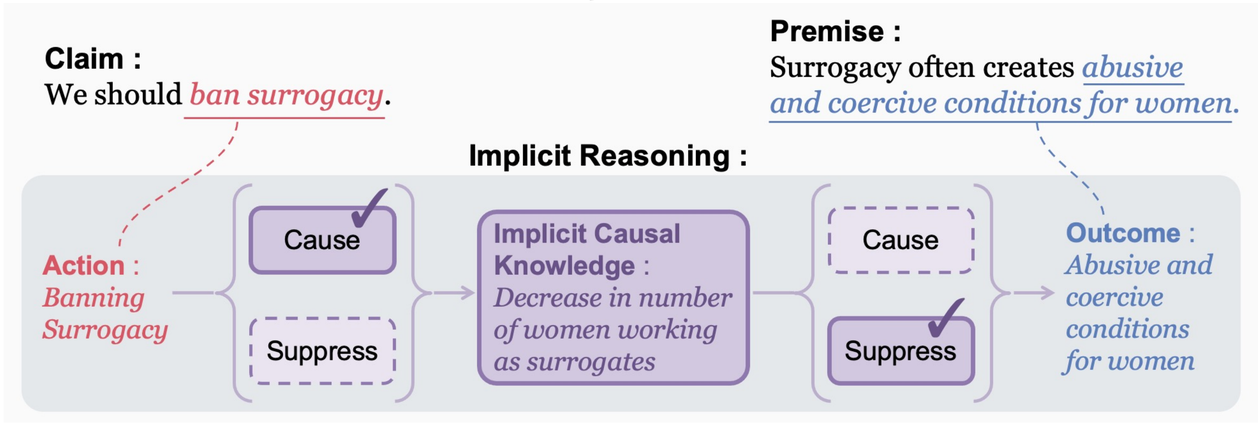
Framing implicit reasoning in semi-structured fomat

Motivation

- Current systems have limited capability in modelling reasoning over knowledge; limitations in explicating implicit reasonings.
- Innate domain-specific knowledge important factor for humans to make reasoning
- Previous works focused only on domain-general resources.

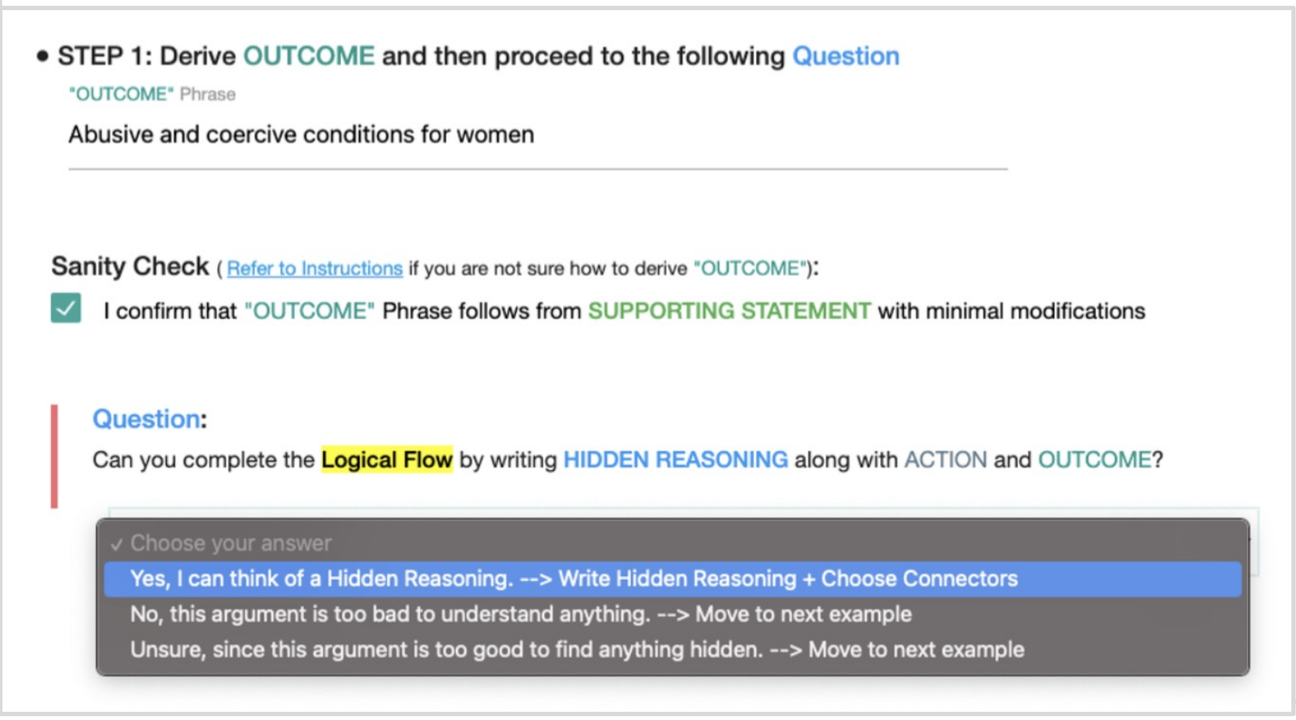
Proposal

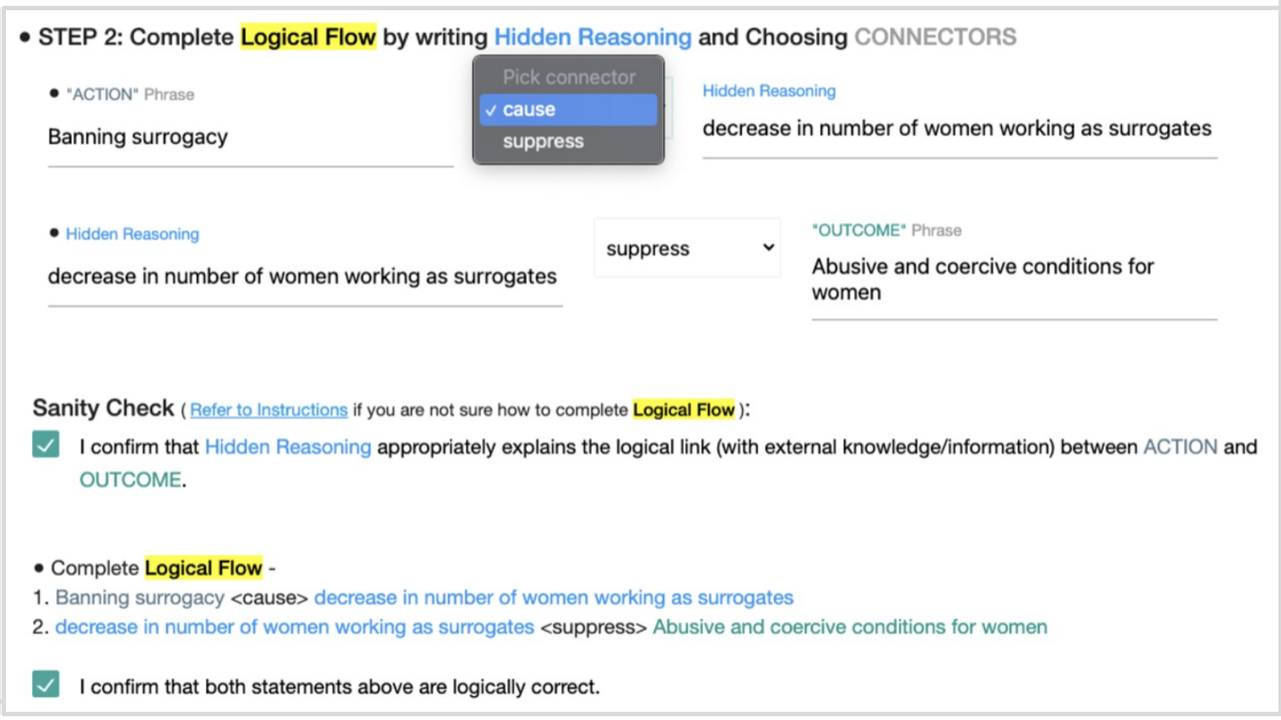
- Create large implicit reasoning corpus with wide coverage of domain-specific knowledge.
- Design novel ***semi-structured annotation method*** that utilizes background knowledge to frame implicit reasoning.



Annotating Semi-structured Implicit Reasoning

Crowdsourcing via Amazon Mechanical Turk (5 annotators/claim-premise)





Corpus and Experiment details

IRAC Statistics

- Source data of claim-premise : **IBM-rank30k**
- # of topics and arguments: **6 topics w/ 952 claim-premise**
- # of annotated implicit reasonings : **2636**
- % of claim-premise with at least 1 implicit reasoning (i.e., IRs ≥ 1) : **95%**
- Average # of implicit reasonings annotated per claim-premise : **2.9**

Quality Analysis

Two experts analyze 50 random implicit reasonings

- Judge correct/incorrect based on three criteria:
  1. *Keyword correctness*
  2. *Implicit causal knowledge correctness*
  3. *Logical correctness*

- 34 and 38 implicit reasonings labelled correct respectively
- Krippendorff's **α : 0.64**

Experiment

- **Baseline Model**: Out-of-domain setting
  - train and test instances w/o topic overlap
- **Our Model**: In-domain setting
  - train and test instances belong to same topic
- Generation model : BART
  - *Input (encoder) : <claim, premise>*
  - *Output : <implicit reasoning>*
- Metrics : B1-BLEU1, B2-BLEU2 and BS-BertScore

Results

Topic	Baseline			Our Model		
	B1	B2	BS	B1	B2	BS
	Out-of-Domain			In-Domain		
Zoos	0.21	0.04	0.16	0.44	0.28	0.37
Whaling	0.16	0.03	0.20	0.40	0.24	0.37
Cannabis	0.33	0.10	0.19	0.45	0.21	0.48
Voting	0.19	0.07	0.23	0.38	0.21	0.36
School uniform	0.23	0.04	0.27	0.36	0.17	0.41
Capital punish-ment	0.16	0.02	0.18	0.17	0.03	0.16

Generation Examples

Claim	We should legalize cannabis.
Premise	Legalizing cannabis can help people with certain health problems be relieved of their symptoms.
Implicit Reasoning	
Gold	*Legalizing cannabis causes **easy access to the drug for the needy** causes helping people with certain health problems be relieved of their symptoms.*
In-domain	*Legalizing cannabis causes **extensive medicinal research on cannabis** causes relief in health problems.*
Out-of-domain	*Legalizing cannabis causes **good medicinal use** causes relieve of patients symptoms.*

Acknowledgements: This work was partly supported by JSPS KAKENHI Grant Number 22H00524 and NEDO JP1234567.
Contact: Keshav Singh (keshav.singh29@gmail.com)