

Argument Mining and Its Applications

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The Problem



Amazon Customer

☆☆☆☆☆ **Sucks**

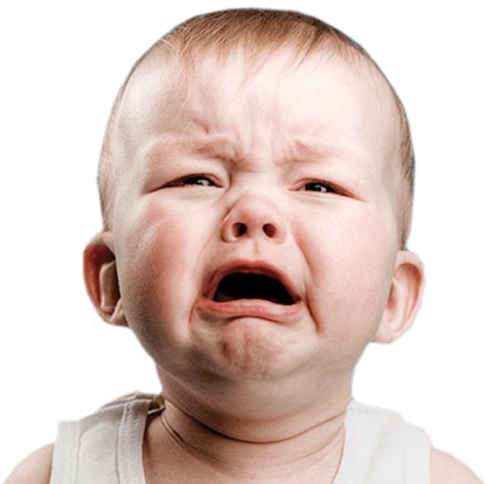
Reviewed in the United States on October 31, 2018

Verified Purchase

It sucks

Helpful

Report abuse



A Proposed Solution



✓ Posted publicly as

| Clear

Insert product link

What's this? ▾

It sucks. The battery only lasts 4 hours!!

Could you provide evidence?

Sucks

⌵ View tips and guidelines

Preview

📷 Add photos/video

Submit

A Proposed Solution



Amazon Customer

★☆☆☆☆ **Sucks**

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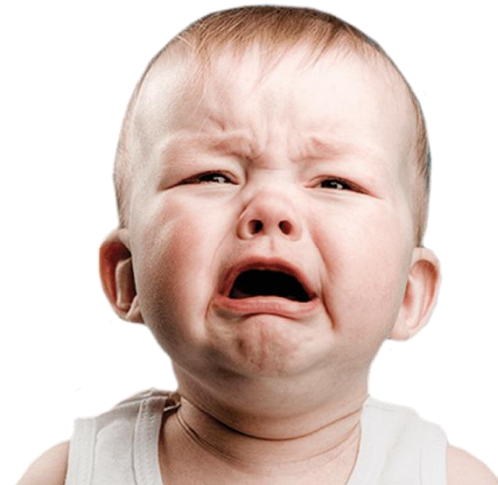
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“The battery only lasts 4 hours!!”

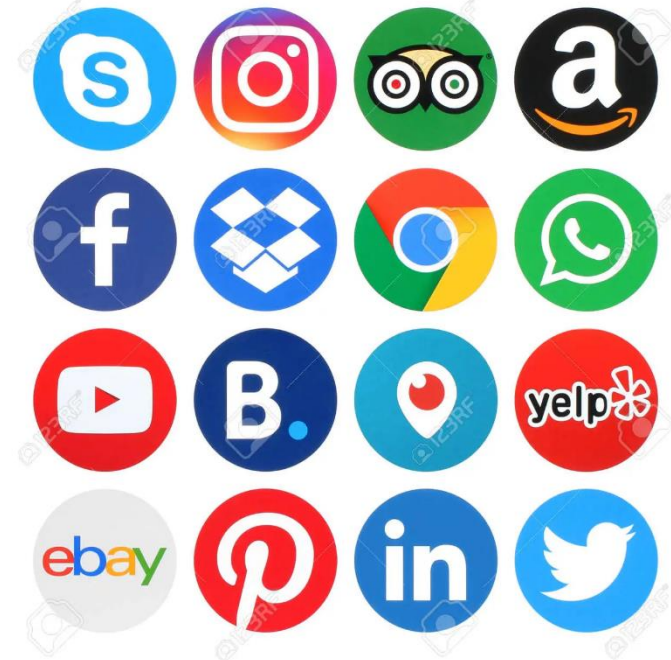


Argument as a unit of communication

Past



Present



Home Mortgage Consumer Protection

ISSUES	AGENCY DOCUMENTS	DRAFT SUMMARY	FINAL SUMMARY	FINAL RULE
<ul style="list-style-type: none"> For All Borrowers: Who is Servicing Your Loan? (42 comments) 	<ul style="list-style-type: none"> For All Borrowers: Periodic Statements (65 comments) 	<ul style="list-style-type: none"> For All Borrowers: Asking For, and Getting, Information (59 comments) 	<ul style="list-style-type: none"> For All Borrowers: Getting Errors Fixed (15 comments) 	<ul style="list-style-type: none"> For All Borrowers: Adjustable Rate Mortgages (18 comments)
<ul style="list-style-type: none"> For Borrowers in Trouble: "Early Intervention" Help (20 comments) 	<ul style="list-style-type: none"> For Borrowers in Trouble: Reliable Contact with People Who Can Help (31 comments) 	<ul style="list-style-type: none"> For Borrowers in Trouble: Options for Avoiding Foreclosure (42 comments) 	<ul style="list-style-type: none"> For Borrowers in Trouble: Partial Payments (13 comments) 	<ul style="list-style-type: none"> For Borrowers in Trouble: "Force-Placed" Insurance (42 comments)

Agency Proposal

By the Regulation Room team based on the NPRM

For All Borrowers: Who's Servicing Your Loan?

[§1. Updating borrowers](#)
[§2. Getting info to the new servicer](#)

[Like](#) 425

§1. Updating borrowers 30

During the mortgage crisis, some consumers had trouble finding the right person to contact about problems with their home mortgage. The mortgage industry is complicated. A home buyer borrows money from a lender who "owns" the mortgage, and has the right to collect the payments. But, many lenders don't keep these mortgage loans. They sell them to a new owner, who may resell them to yet another company. Other times, the original lender keeps the mortgage but sells the right to collect the payments to a company known as a "servicer" who actually deals with the borrower to collect payments, etc. Servicers get a fee for doing this and it can be profitable — \$25-\$50 per thousand dollars of remaining principal, per year — so servicing rights are often resold to still other companies. So, Company 1 might have made the mortgage loan, Company 2 might buy it and become the new owner; Company 3 might get the right to collect the payments, but then resell those "servicing rights" to Company 4. And sometimes the companies are related to one another. No wonder borrowers sometimes couldn't figure out who to talk to.

CFPB wants borrowers to get better information about when the servicing rights on their mortgage are sold to a different company. Its proposal would also make servicers responsible for good recordkeeping and communication when a loan is being transferred.

People's Comments (42)

[SECTIONS](#)
[ALL](#)
[RECOMMENDED](#)

mpick76 August 15, 2012 10:11 am

All of the new proposals appear to be good and are what small banks have been doing for years. My small bank has over half of their loans in home mortgages and have not foreclosed on one in over 10 years. Rules like this one could make it harder on small banks to work with customers and more expensive to make mortgage loans.

Moderator August 15, 2012 1:10 pm

Hi mpick76, and welcome to Regulation Room. Rules like this one are made by trying to minimize costs and maximize benefits. Could you provide more details about the costs of the new rules to your business, and how you might make them better?

mpick76 August 15, 2012 3:39 pm

A college professor of mine many, many years ago always said think of the word "KISS" – Keep It

Example Rule

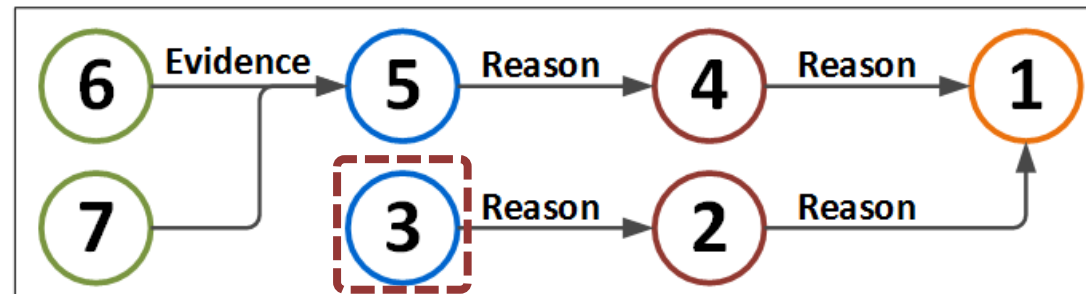
- **Agency:** U.S. Department of Transportation (DoT)
- **Rule:** Airline Passenger Rights
- **Issue:** Peanut Allergy
- **DOT's Proposed Solutions:**
 - Ban on all flights
 - Ban on selected flights
 - Ban within a buffer zone

Example Comments

- “A simple warning peanuts may be present on a flight should suffice!”
 - Is there a **reason**?
- “Peanuts should be banned from all airlines. Peanuts are already banned in all kindergartens in New Jersey, as well.”
 - Is there any **evidence** (of peanut-banning)?

Overview

¹ There should be a full ban of peanut products on all airlines,² because peanut allergy could have terrible effects.³ Peanut reactions can be life threatening.⁴ Restricting to certain flights is not enough,⁵ as residue from previous flights can remain on the seats.⁶ Recently we flew across the country⁷ and I find left over peanuts in our seats!



Potential Applications

- Commenting Assistance
 - Providing real-time feedback for commenters
- Writing Education
 - Improving automated grading systems & more useful feedback to the students
- Summarization
 - Generating interactive/hierarchical summaries
- Review Recommendation
 - Improving extractive summarization approaches

Outline

- Background & Motivation
- ⦿ Argumentation Model
- Argument Mining
- Application: Review Helpfulness Prediction
- Conclusions

Argumentation Models

- Purpose
 - Capture specific aspects of argument
 - Abstract away from the rest
- Components
 - Elementary units
 - Relations among the units
- Examples
 - Premise-Conclusion Model [Aristotle 384–322 BC?]
 - Argumentation Schemes [Walton 1996, Reed & Walton 2003, Walton et al. 2008]

What We Want to Model

- Support relations prevalent in user comments
 - ➔ Support relations like **reason** and **evidence**.
- Appropriate types of support for different types of claims
 - ➔ Elementary units capturing *multiple* **claim** types, each associated with appropriate support type

Existing Models Are Inadequate

- Premise-Conclusion Model [Aristotle 384–322 BC?]
 - Only a *single relation* (“support”)
 - **elementary unit types** not specifying appropriate type of support (“premise” and “conclusion”)
 - ➔ Does not capture the details we need
- Argumentation Schemes [Walton 1996, Reed & Walton 2003, Walton et al. 2008]
 - Only a *single relation* (“support”)
 - *too many elementary unit types*
 - ➔ Inappropriate for data acquisition/machine learning
- Thus, we need to develop a new model!

Defining Elementary Units

Proposition in Example Comment	Appropriate Support?	Verifiable?*
“Peanuts are banned in all kindergartens in New Jersey”	Evidence	Yes
“A simple warning peanuts may be present on a flight should suffice!”	Reason	No

* with objective evidence,
without subjective judgment/interpretation

Proposition Type	Appropriate Support
Verifiable	Evidence
UnVerifiable	Reason

Proposition Type	Appropriate Support
Verifiable	Evidence
UnVerifiable & Policy	Reason
UnVerifiable & Non-Policy	Reason

“Peanut products should be banned.” (Policy)

VS

“Peanut products are dangerous.”(Non-policy)

Proposition Type	Appropriate Support
Verifiable (Fact)	Evidence
UnVerifiable & Policy (Policy)	Reason
UnVerifiable & Non-Policy (Value)	Reason

Cf. Fact, value, policy claim [Hollihan & Baaske 2005]

Proposition Type	Appropriate Support
Verifiable (Fact)	Evidence
UnVerifiable & Policy (Policy)	Reason
UnVerifiable & Non-Policy (Value)	Reason

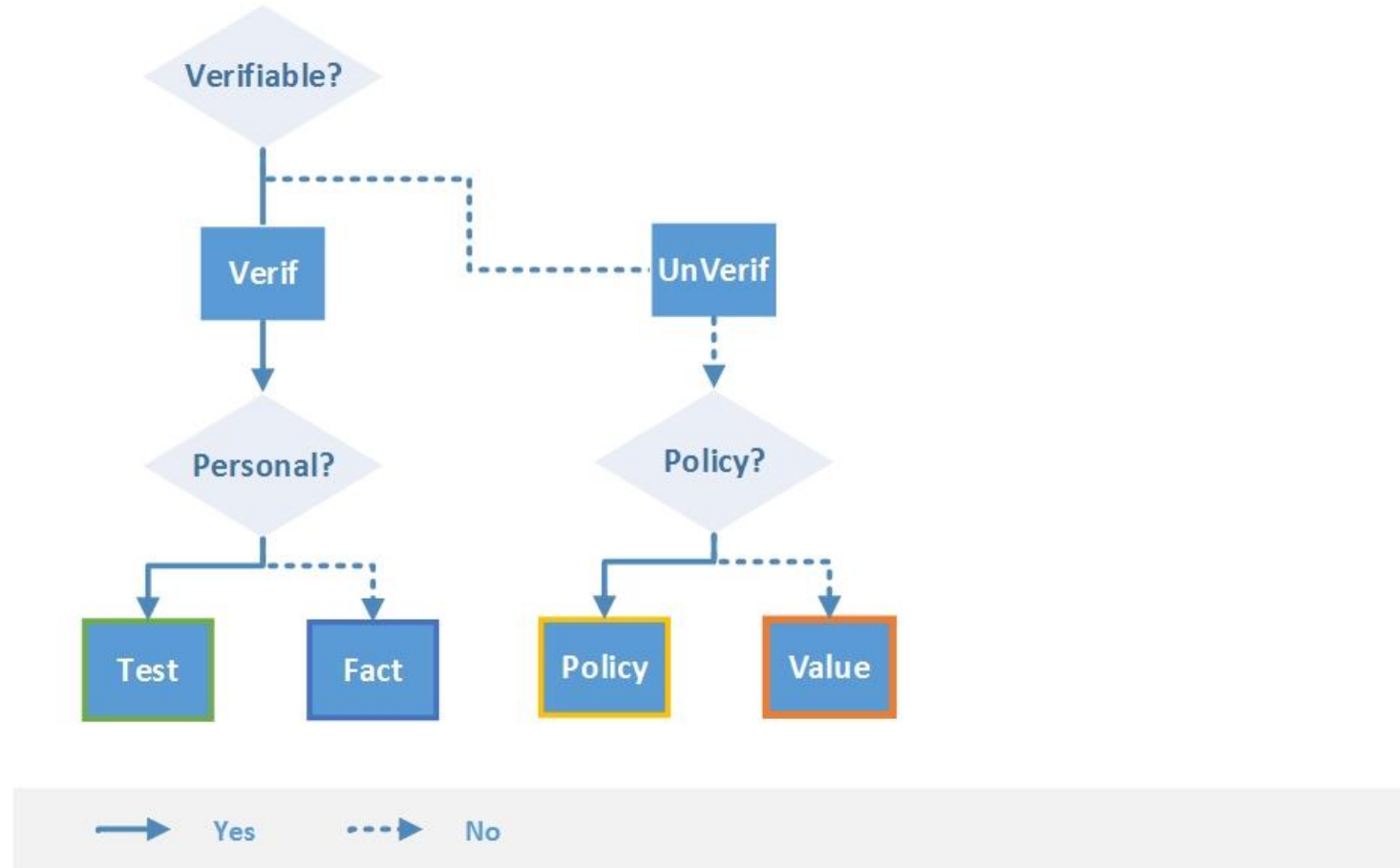
Proposition Type	Appropriate Support
Verifiable & Non-Experiential (Fact)	Evidence
Verifiable & Experiential (Testimony)	(optional) Evidence
UnVerifiable & Policy (Policy)	Reason
UnVerifiable & Non-Policy (Value)	Reason

“I flew from LA to NY last year.” (Experiential)

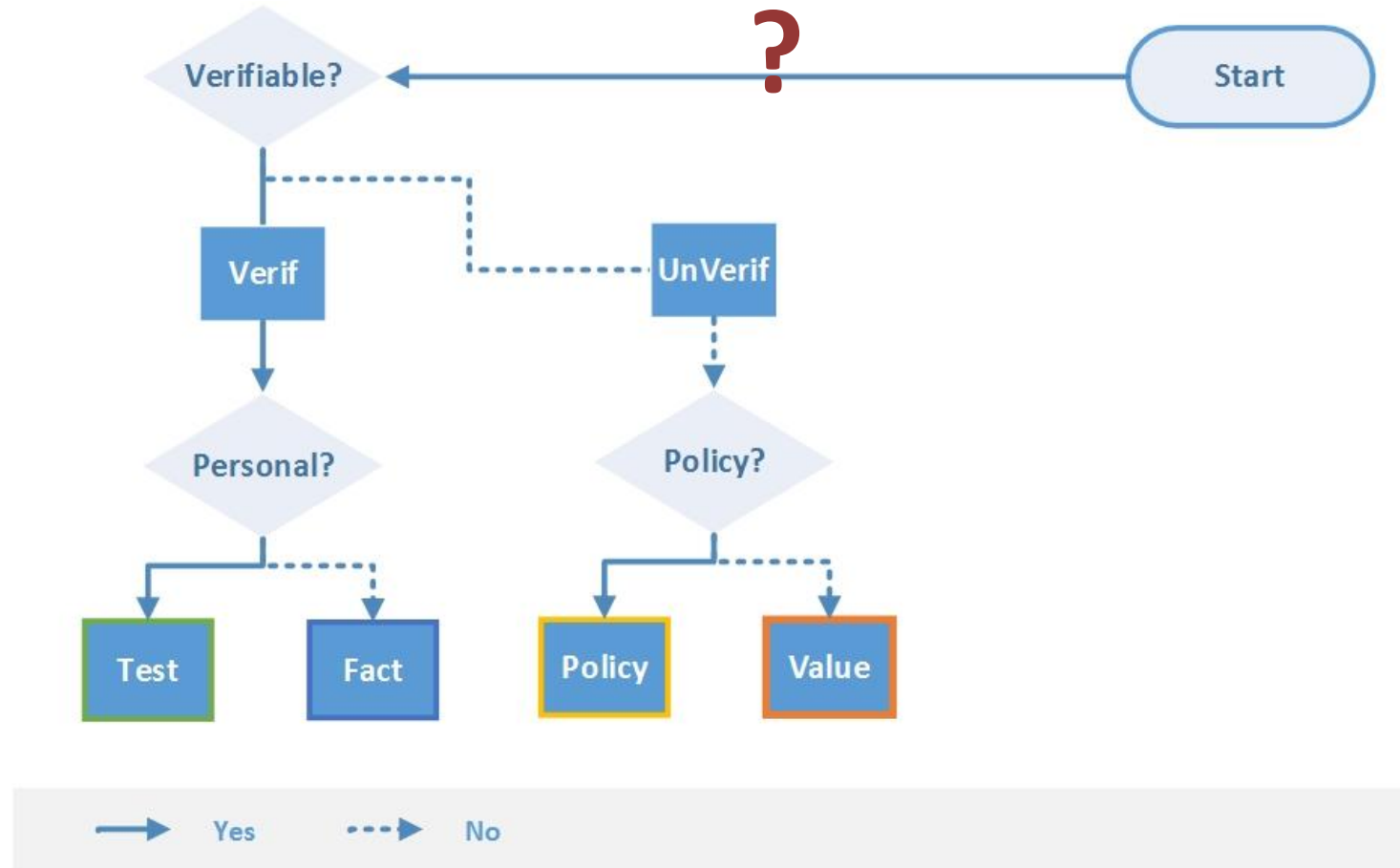
VS

“There are flights from LA to NY.” (Non-Experiential)

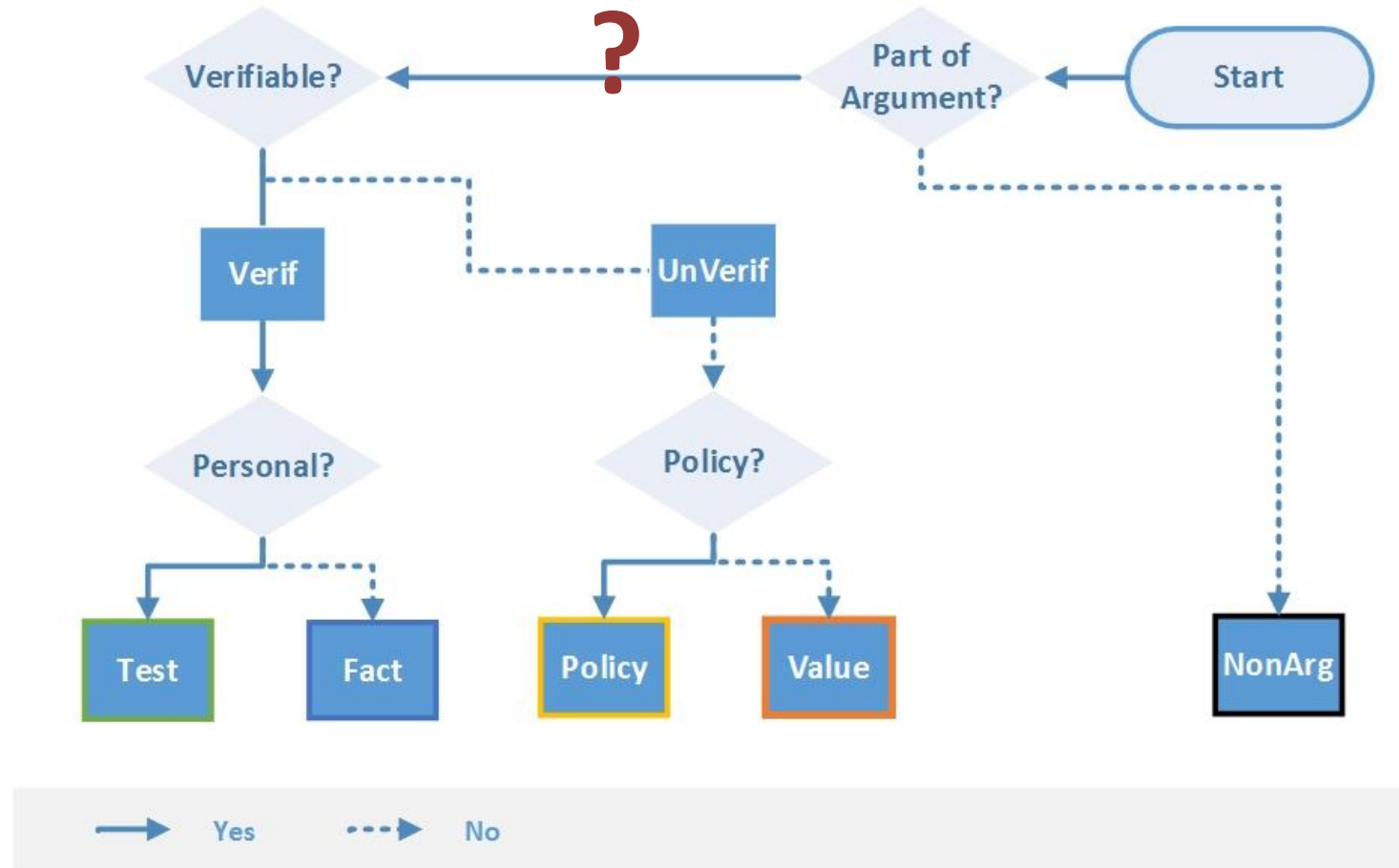
Elementary Units



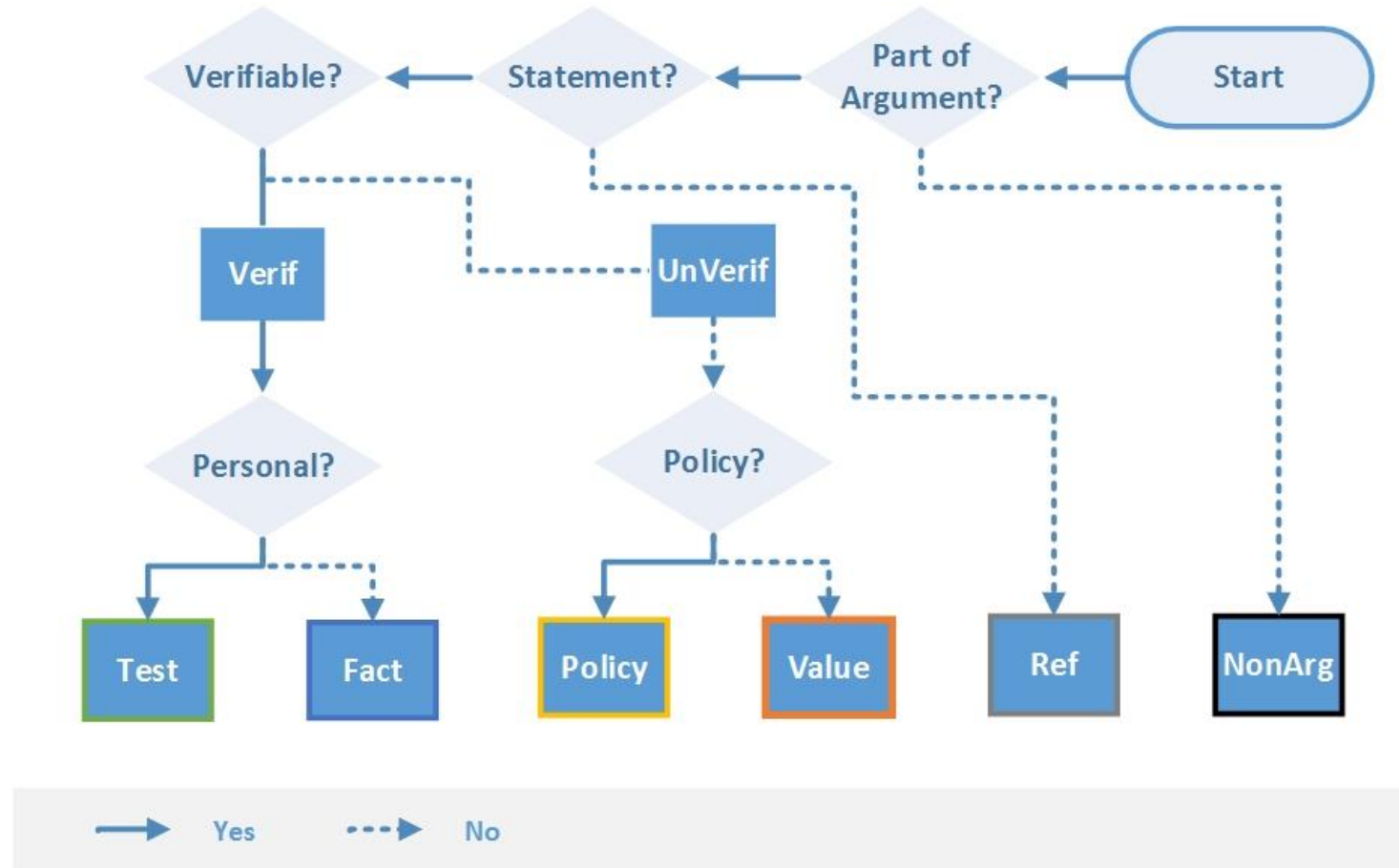
Elementary Units



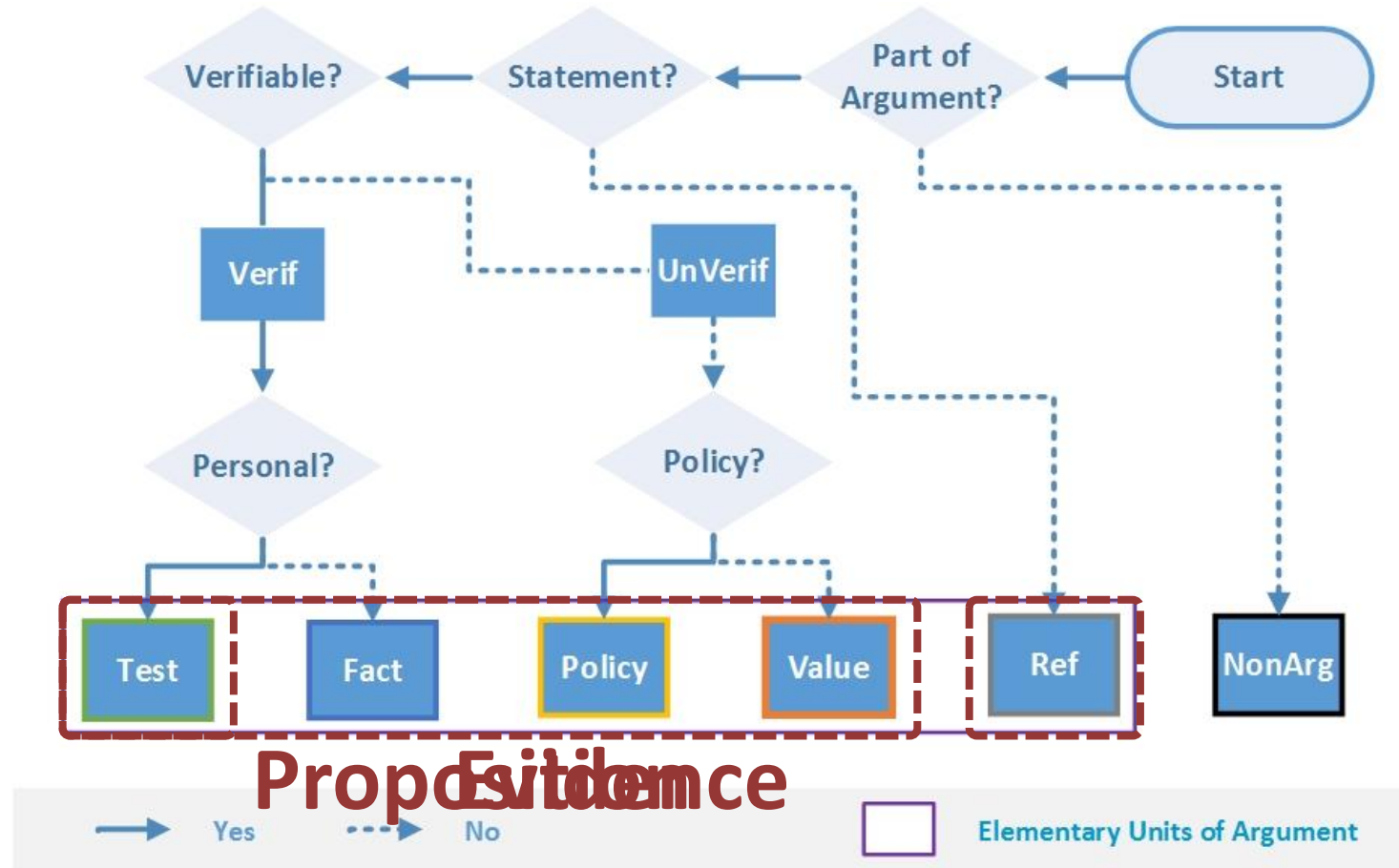
Elementary Units



Elementary Units



Elementary Units



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Fact

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Testimony

¹ There should be a full ban of peanut products on all airlines, ² because peanut allergy could have terrible effects. ³ Peanut reactions can be life threatening. ⁴ Restricting to certain flights is not enough, ⁵ as residue from previous flights can remain on the seats. ⁶ Recently we flew across the country ⁷ and I find left over peanuts in our seats!

Value

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Policy

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Reason : Value → Policy

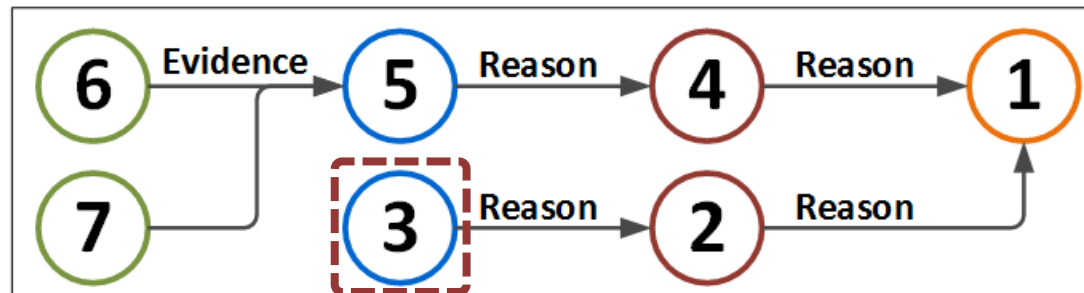
¹ There should be a full ban of peanut products on all airlines,² because peanut allergy could have terrible effects.³ Peanut reactions can be life threatening.⁴ Restricting to certain flights is not enough,⁵ as residue from previous flights can remain on the seats.⁶ Recently we flew across the country⁷ and I find left over peanuts in our seats!

Reason : Fact → Value

¹ There should be a full ban of peanut products on all airlines,² because peanut allergy could have terrible effects.³ Peanut reactions can be life threatening.⁴ Restricting to certain flights is not enough,⁵ as residue from previous flights can remain on the seats.⁶ Recently we flew across the country⁷ and I find left over peanuts in our seats!

Evidence : Testimony → Fact

1 There should be a full ban of peanut products on all airlines,^{**2**} because peanut allergy could have terrible effects.^{**3**} Peanut reactions can be life threatening.^{**4**} Restricting to certain flights is not enough,^{**5**} as residue from previous flights can remain on the seats.^{**6**} Recently we flew across the country^{**7**} and I find left over peanuts in our seats!



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(<http://www.peanuts.com/reactions>)

Evidence : Reference → Fact

Definition #1

An **argument** is a set $\{R, E, c\}$ where:

- c is the **conclusion**,
s.t. $\text{Type}(c) \in \text{Proposition}$
- R is a **set of reasons** explaining that c is true,
s.t. $\forall r \in R, \text{Type}(r) \in \text{Proposition}$
- E is a **set of evidence** proving that c is true,
s.t. $\forall e \in E, \text{Type}(e) \in \text{Evidence}$

Definition #2

An **evaluable argument** Z is an argument (i.e., a set $\{R, E, c\}$), s.t. at least one of the following is satisfied for Z and all its *sub-arguments*:

- $\text{Type}(c) = \text{Testimony}$
- $\text{Type}(c) \in \{\text{Policy}, \text{Value}\}$
s.t. $R \neq \emptyset$ and $\forall r \in R, \text{Type}(r) \in \text{Proposition}$
- $\text{Type}(c) = \text{Fact}$
s.t. $R \neq \emptyset$ and $\forall r \in R, \text{Type}(r) = \text{Fact}$
- $\text{Type}(c) = \text{Fact}$
s.t. $E \neq \emptyset$ and $\forall e \in E, \text{Type}(e) \in \text{Evidence}$



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Goal of Argument Mining

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Subtasks of Argument Mining

1There should be a full ban of peanut products on all airlines,
2because peanut allergy could have terrible effects.3Peanut reactions can be life threatening.4Restricting to certain flights is not enough,5as residue from previous flights can remain on the seats.6Recently we flew across the country7and I find left over peanuts in our seats!

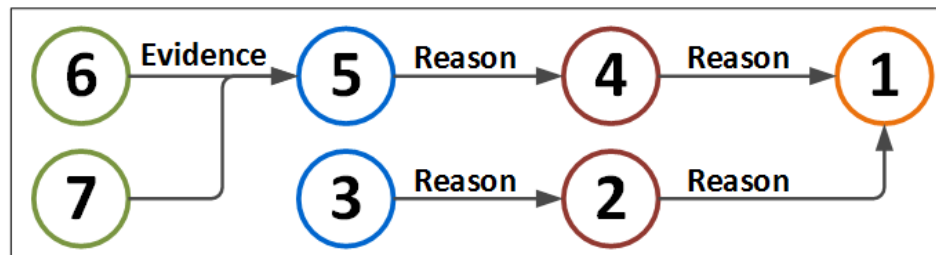


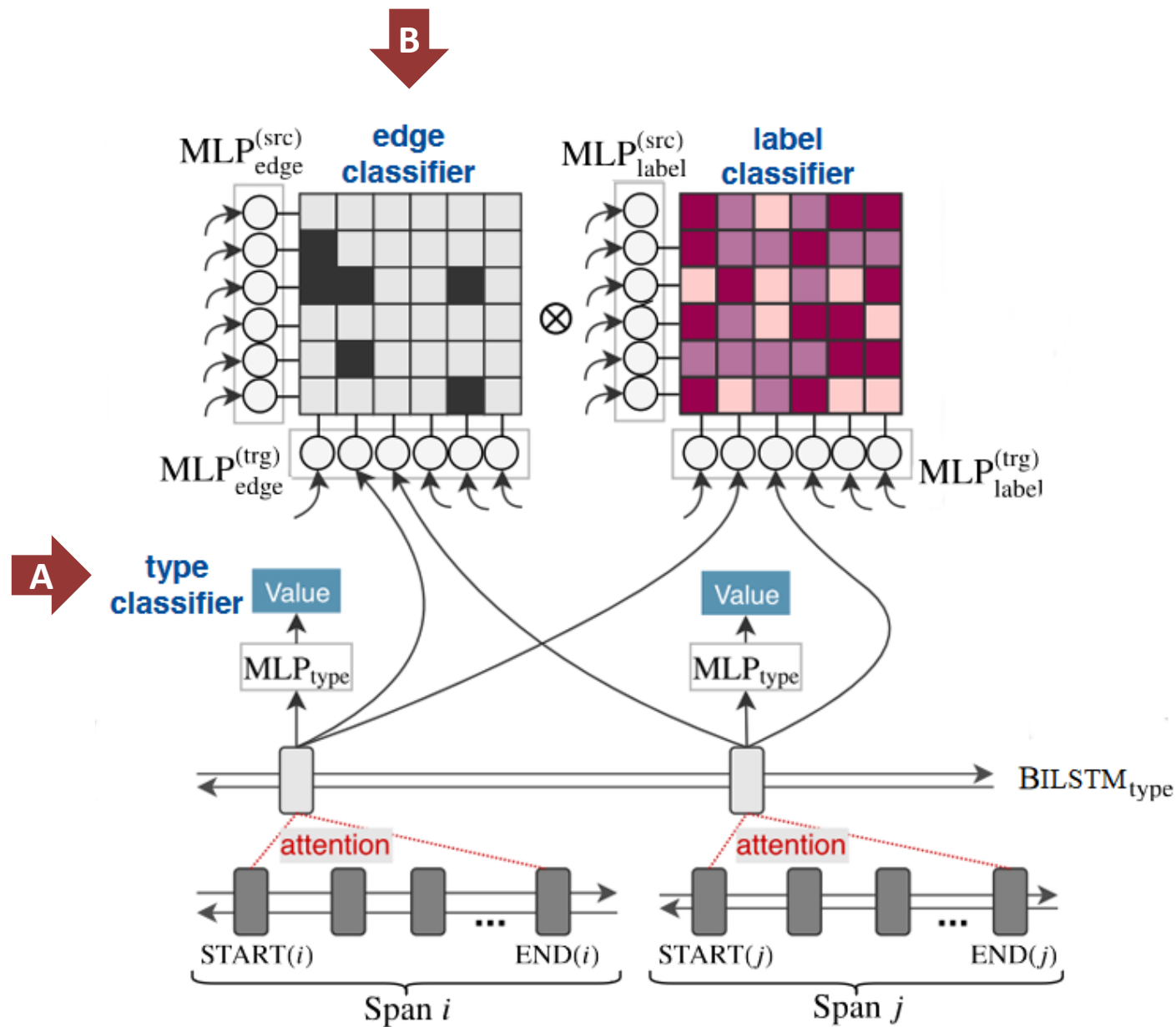
Elementary Unit Classification

1There should be a full ban of peanut products on all airlines,
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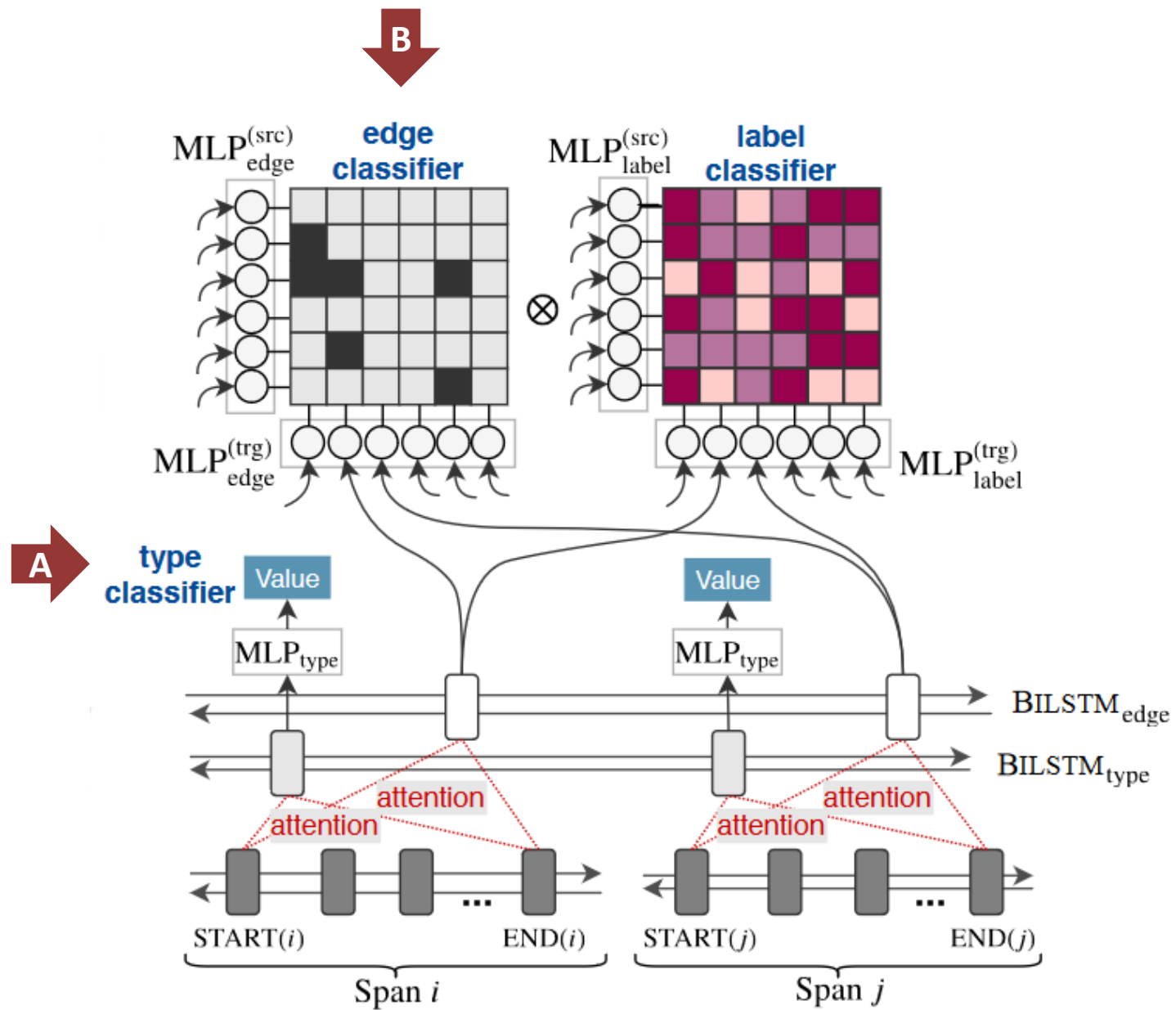


Relation Detection





Towards Better Non-Tree Argument Mining: Proposition-Level Biaffine Parsing with Task-Specific Parameterization (Morio et al., ACL 2020)



Towards Better Non-Tree Argument Mining: Proposition-Level Biaffine Parsing with Task-Specific Parameterization (Morio et al., ACL 2020)

Experiment Results (eRulemaking comments)

Argument Mining With
Structured SVMs and RNNs
(Niculae, Park, Cardie ACL 2017)

model	edge	type avg.
deep basic: LG	22.56	43.79
RNN: full	14.6	52.4
RNN: strict	10.5	65.9
deep basic: PG	22.45	63.31
RNN: basic	14.4	72.7
deep residual: PG	20.76	71.99
deep residual: LG	29.29	65.28
SVM: basic	24.7	71.6
SVM: full	25.1	73.5
SVM: strict	26.7	73.2
ours	34.04	78.91

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Which review did people find more helpful?

Review A

[Good item for the price.]_a [Easy to charge.]_b [Only one headband to deal with.]_c [A "marriage saver"]_d [because I don't have to listen to my wife's shows, especially when I go to bed before her.]_e [My wife says "I like them".]_f

Review B

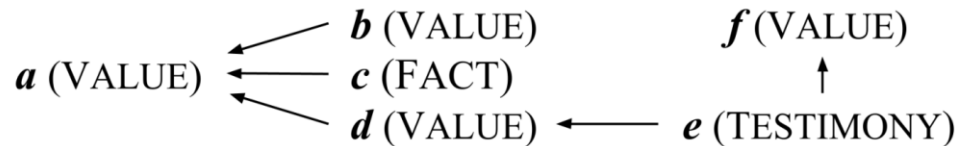
[Skull Candy's are the best earbuds in their price range that you could buy... until they break.]_a [They include a one year warranty,]_b [but often times, for such a low-priced product, its easier to just purchase a new one.]_c [So definitely, purchase these earbuds,]_d [but don't expect more than a few months out of them until one side burns out.]_e



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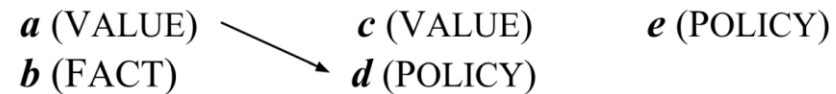
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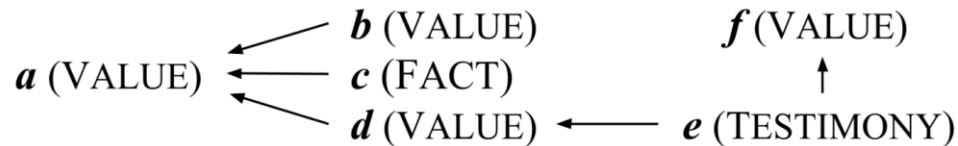
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Which review did people find more helpful?

Review A

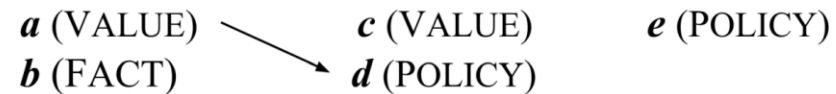
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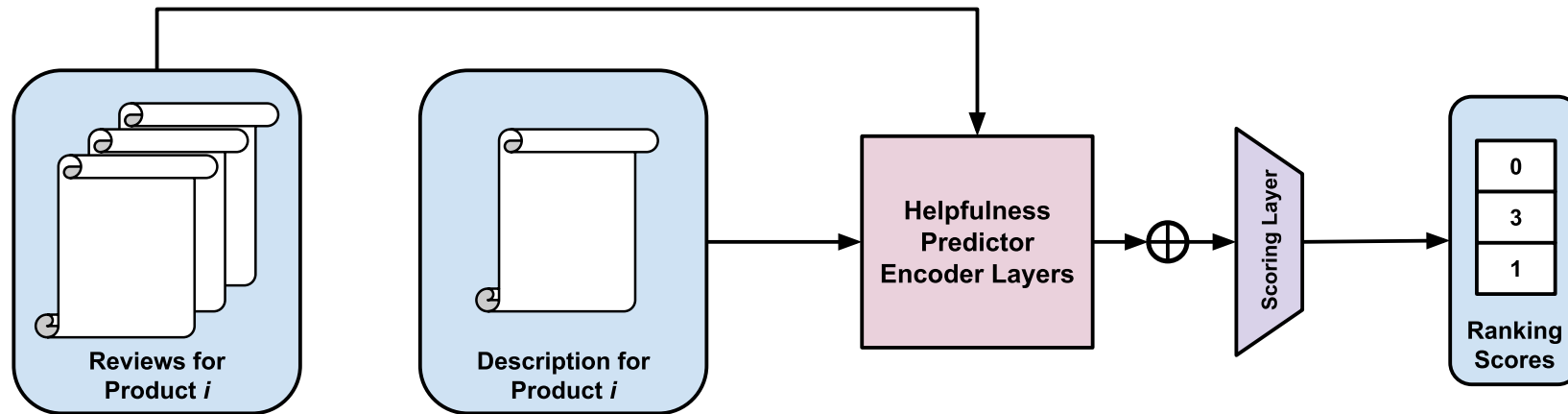
More Helpful!

Review B

[Skull Candy's are the best earbuds in their price range that you could buy... until they break.]_a [They include a one year warranty,]_b [but often times, for such a low-priced product, its easier to just purchase a new one.]_c [So definitely, purchase these earbuds,]_d [but don't expect more than a few months out of them until one side burns out.]_e



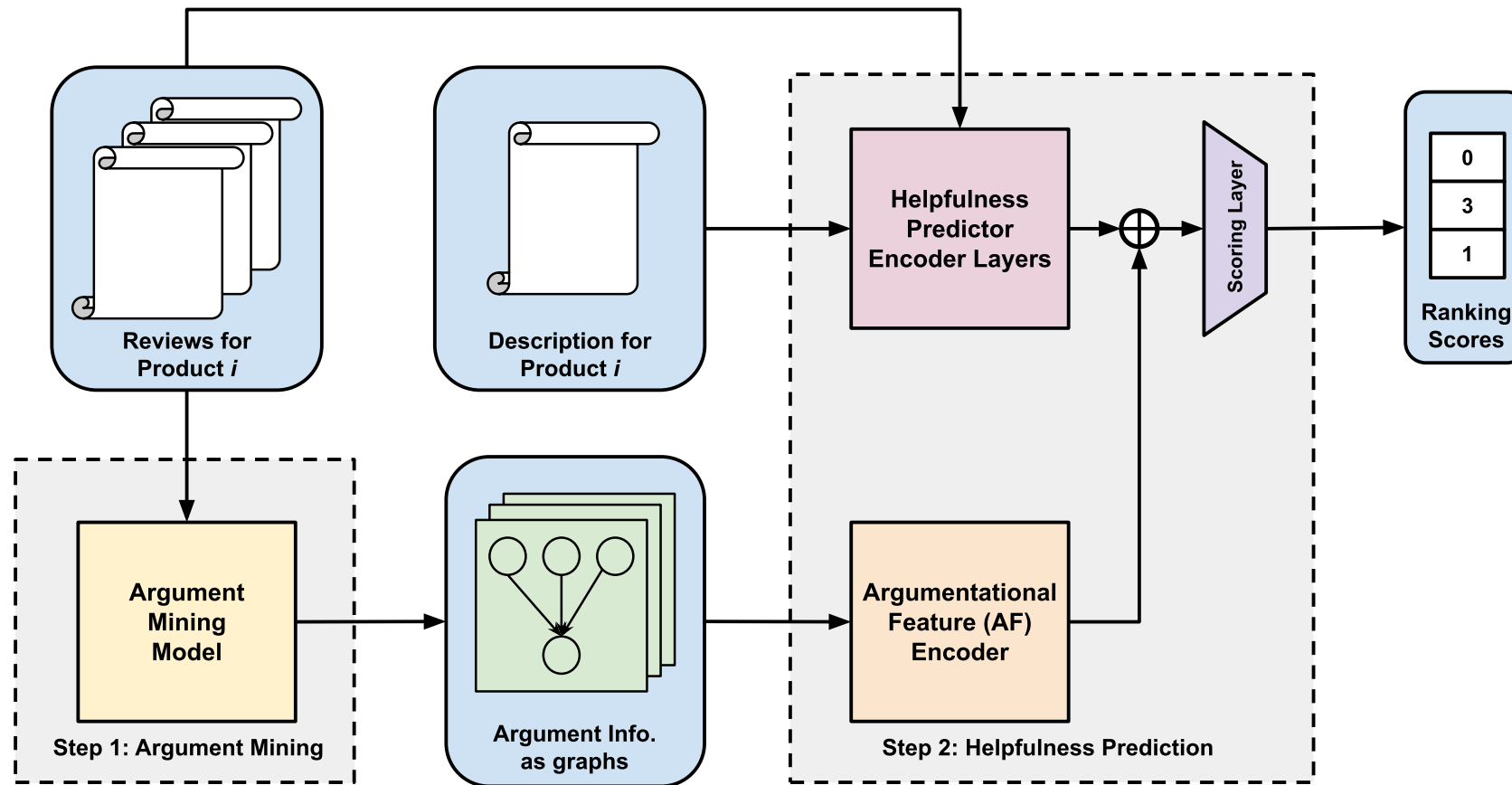
Review Helpfulness Prediction



Convolutional neural networks for soft-matching n-grams in ad-hoc search. (Dai et al., WSDM 2018)

Multi-perspective coherent reasoning for helpfulness prediction of multimodal reviews (Liu et al., ACL 2021)

Review Helpfulness Prediction with AM



Experiment Results (Amazon reviews)

	Model	mAP	N@3	N@5
Text-only	Conv-KNRM	52.6	40.5	44.2
	Conv-KNRM + AFs (MLP)	53.4	42.7	46.0
	Conv-KNRM + AFs (GCN)	52.9	41.4	45.0
Text & Image	MCR	56.0	46.5	49.7
	MCR + AFs (MLP)	56.1	47.4	50.3
	MCR + AFs (GCN)	56.6	48.1	51.0

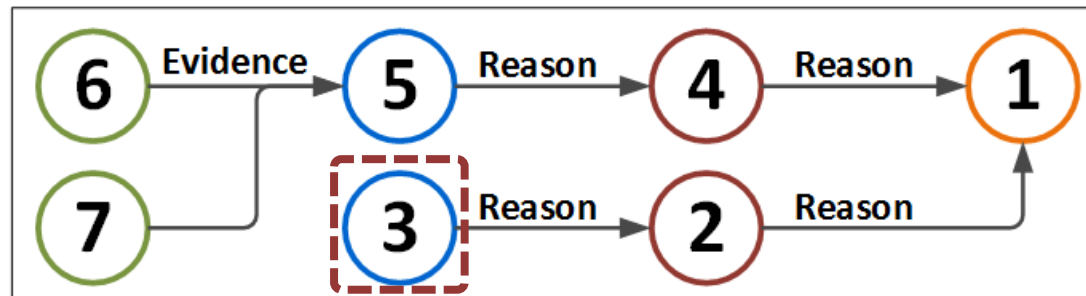
- MLP:
 - A sparse numeric vector storing the counts of each elementary unit by type, as well as the number of support relations in the review
 - → a dense vector using a multilayer perceptron (MLP)
- GCN:
 - Elementary units, their types, and the support relations represented as a graph
 - → a dense vector by a Graph Convolutional Network (GCN)

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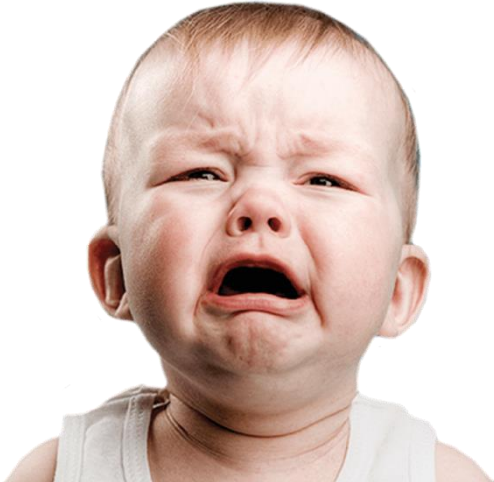
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A Proposed Solution



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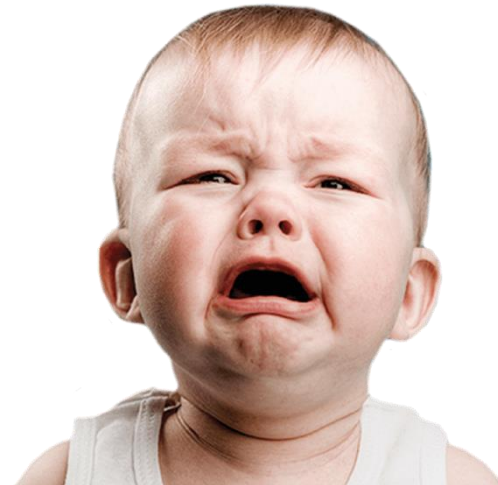
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“The battery only lasts 4 hours!!”



Argumentation-related Publications

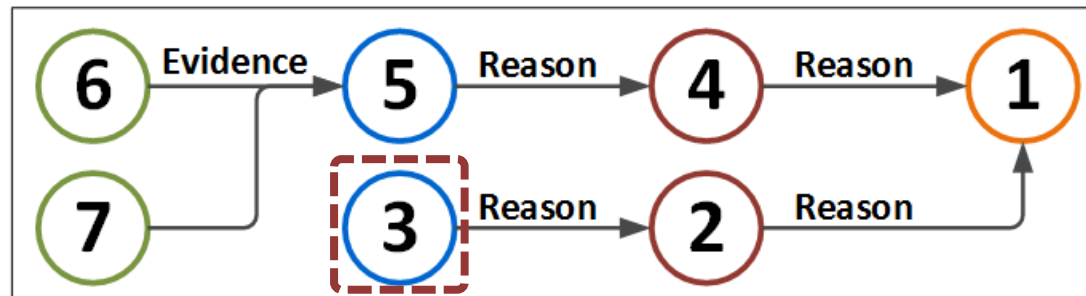
- **Argumentation Theory**
 - **Toward Machine-assisted Participation in eRulemaking: An Argumentation Model of Evaluability (Park et al., ICAIL 2015)**
- **Argument Mining**
 - Argument Mining on Twitter: A Case Study on the Planned Parenthood Debate (Bhatti et al., ArgMining 2021)
 - **A Corpus of eRulemaking User Comments for Measuring Evaluability of Arguments (Park & Cardie, LREC 2018)**
 - **Argument Mining with Structured SVMs and RNNs (Niculae et al., ACL 2017)**
 - A Corpus of Argument Networks: Using Graph Properties to Analyse Divisive Issues (Konat et al., LREC 2016)
 - Automatic Identification of Rhetorical Questions (Bhattachali et al., ACL 2015)
 - Conditional Random Fields for Identifying Appropriate Types of Support for Propositions in Online User Comments (Park et al., ArgMining 2015)
 - AsseSS: A Tool for Assessing the Support Structures of Arguments in User Comments (Park & Cardie, COMMA 2014)
 - Identifying Appropriate Support for Propositions in Online User Comments (Park & Cardie, ArgMining 2014)
- **Argument Mining Applications**
 - **Argument Mining for Review Helpfulness Prediction (Chen et al., EMNLP 2022)**
 - Analyzing Cultural Assimilation through the Lens of Yelp Restaurant Reviews (Chen et al., DSAA 2021)
 - Using Argumentative Structure to Interpret Debates in Online Deliberative Democracy and eRulemaking (Lawrence et al., ACM TOIT 2017)
- **Factuality**
 - Plug-and-Play Adaptation for Continuously-updated QA (Lee et al., ACL-Findings 2022)
 - Masked Summarization to Generate Factually Inconsistent Summaries for Improved Factual Consistency Checking (Lee et al., NAACL-Findings 2022)
 - Automatic Fact-Checking with Document-level Annotations using BERT and Multiple Instance Learning (Sathe et al., FEVER 2021)
 - Automated Fact-checking of Claims from Wikipedia (Sathe et al., LREC 2020)

Acknowledgements

- Collaborators
 - *Computer Science* : Claire Cardie, Lu Wang, Bishan Yang, Arzoo Katiyar, Parvaz Mahdabi, Jeremy Cytryn, Aalok Sathe, Salar Ather, Tuan Mahn Le, Nathan Perry, Zaiqian Chen, Muhammad Mahad Afzal Bhatti, Ahsan Suheer Ahmad, Kyungjae Lee, Wookje Han, Seung-won Hwang, Hwaran Lee, Sang-Woo Lee, Hwanhee Lee, Kang Min Yoo, Kyomin Jung, Daniel Verdi do Amarante, Jenna Donaldson, Yohan Jo
 - *Argumentation* : Chris Reed, John Lawrence
 - *Philosophy/Logic* : Katarzyna Budzinska, Barbara Konat
 - *Linguistics* : Shohini Bhattasali, Elana Feldman
 - *Law* : Cynthia Farina, Mary Newhart, Cheryl Blake
 - *Industrial Labor Relations* : Sally Klingel
 - *Political Science* : Joan-Josep Vallbe

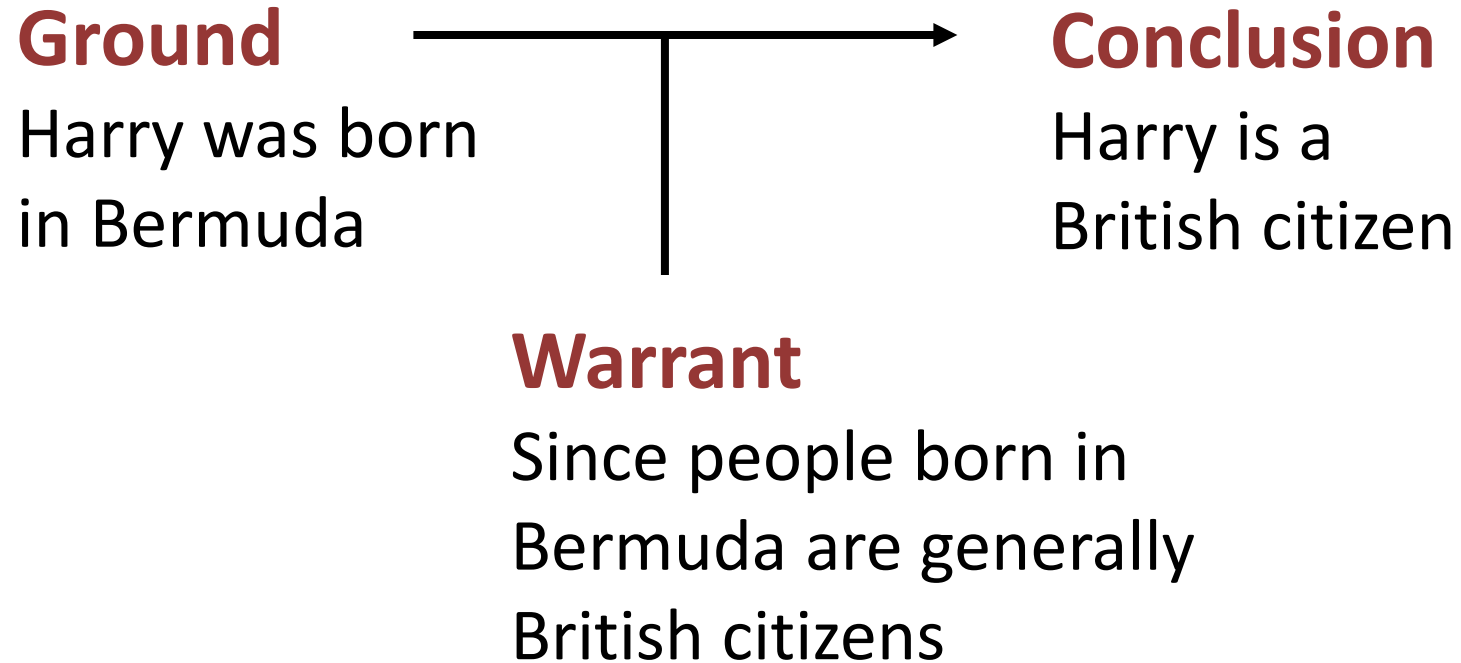
Thanks! Questions?

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Extra Slides

The Toulmin Model (main comp.)



Argumentation Schemes

- E.g. “Argument by Expert Opinion”
 - Scheme
 - Premise : E is an expert in D.
 - Premise : E asserts that A is known to be true.
 - Premise : A is within D.
 - Conclusion** : Therefore, A may plausibly be taken as true
 - Critical Questions
 - Field: Is E an expert in the field that A is in?
 - ...
 - Consistency: Is A consistent with what other experts assert?