

Toward Factuality in Information Access: **Event-Centric** Multimodal Knowledge Acquisition

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University of Illinois at Urbana-Champaign

Multimodal info is everywhere (text, images, videos...)

2019



Mar 29, 2020: A person is **taken** on a stretcher into **treatment** after going through testing for the coronavirus in Houston, Texas, March 19, 2020. (AP/David J. Phillip)....

2020



Jan 17, 2021: Of the 28,500 health workers who had been listed to get the **vaccine**, Maharashtra recorded a turnout of 64.3 percent. Of the 18,328 people vaccinated in Maharashtra on Saturday, 10 recipients suffered mild reactions including **nausea**, **vomiting**, and **anxiety**..

2021



Jun 22, 2022: California and Louisiana have **announced** plans to institute **vaccine mandates** for K-12 students statewide (and Washington, D.C. has done the same), though they are waiting until the FDA fully approves the vaccines for schoolchildren of all ages...

2022



Oct 18, 2022: Parents rally at State Capitol in **protest** of upcoming COVID-19 vaccine mandates. Whitney Justo, a parent from Espardo, and **her two children attend the protest** on Oct. 18 at the California State Capitol.

2023



THE TIMES OF ISRAEL



Multimodal info is everywhere (text, images, videos...)

2019

2020

2021

2022

2023



Quiz time!



What happened?



Quiz time!



What happened?

Yes! A protest.

What are they protesting for?



Quiz time!



What happened?

Yes! A protest.

What are they protesting for?



vaccine



Quiz time!



What happened?

Yes! A protest.

What are they protesting for?



vaccine



negation



Existing entity-centric info leads to surface semantics



Image / VideoFrame

Image

Existing entity-centric info leads to surface semantics

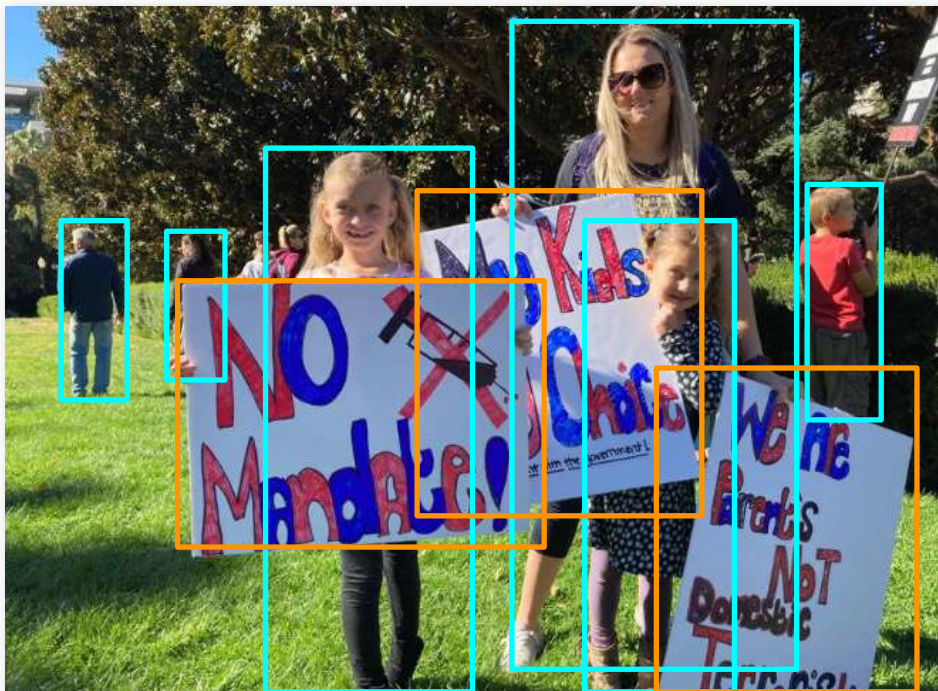


Image / VideoFrame
Image
Object

Existing entity-centric info leads to surface semantics

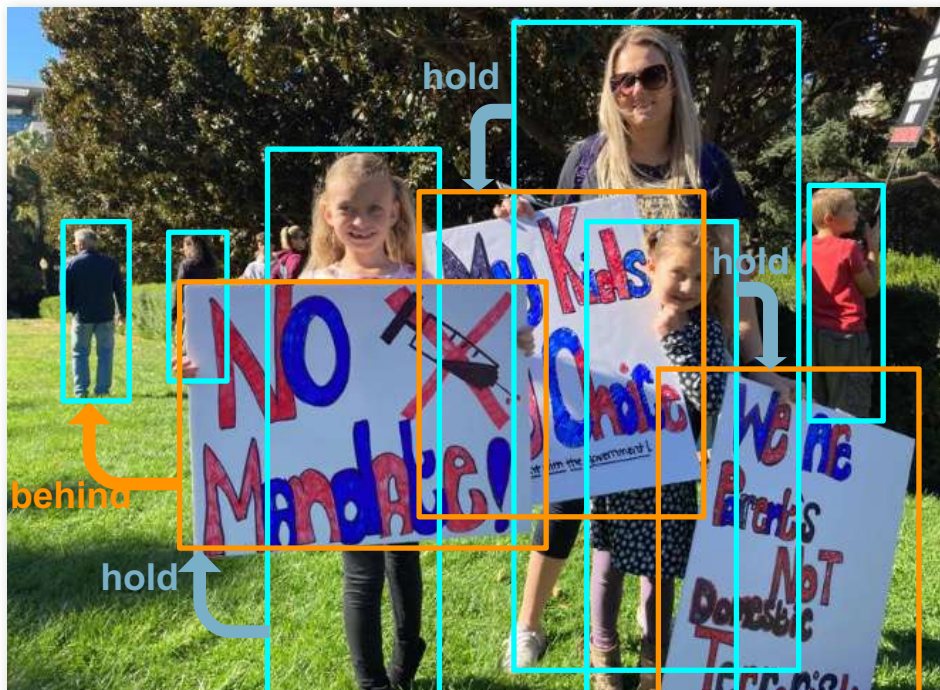


Image / VideoFrame
Image
Object
Relation
Scene Graph

Existing entity-centric info leads to surface semantics

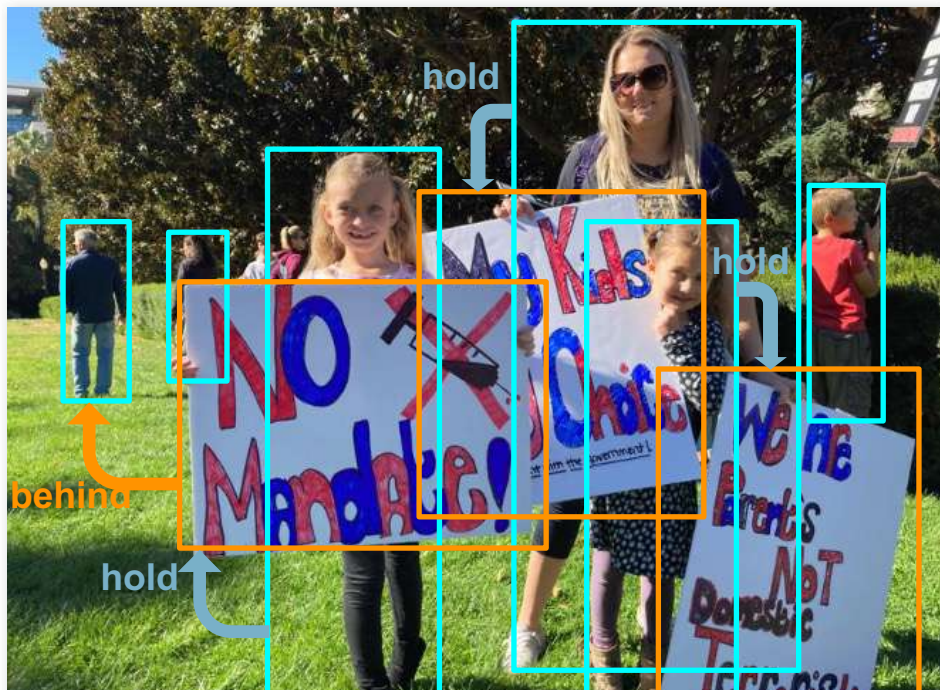


Image / VideoFrame	Text
Image	Sentence
Object	Entity
Relation	Relation
Scene Graph	Entity-Relation Graph

Existing entity-centric info leads to surface semantics



Image / VideoFrame	Text
Image	Sentence
Object	Entity
Relation	Relation
Scene Graph	Entity-Relation Graph

Entity-centric

State-of-the-art Captioner (Kamath et al., 2022)

Answer ▾

a woman holding a sign in front of a group of people.

a woman holding a sign while standing in a park.

a woman holding a sign in front of a crowd.

My Research Vision: Surface → Deep

Deep Semantic Understanding:

Discover **knowledge** (important information) that humans are actively seeking.

My PhD Research: Entity-Centric → Event-Centric



Event

Protest

What happened?

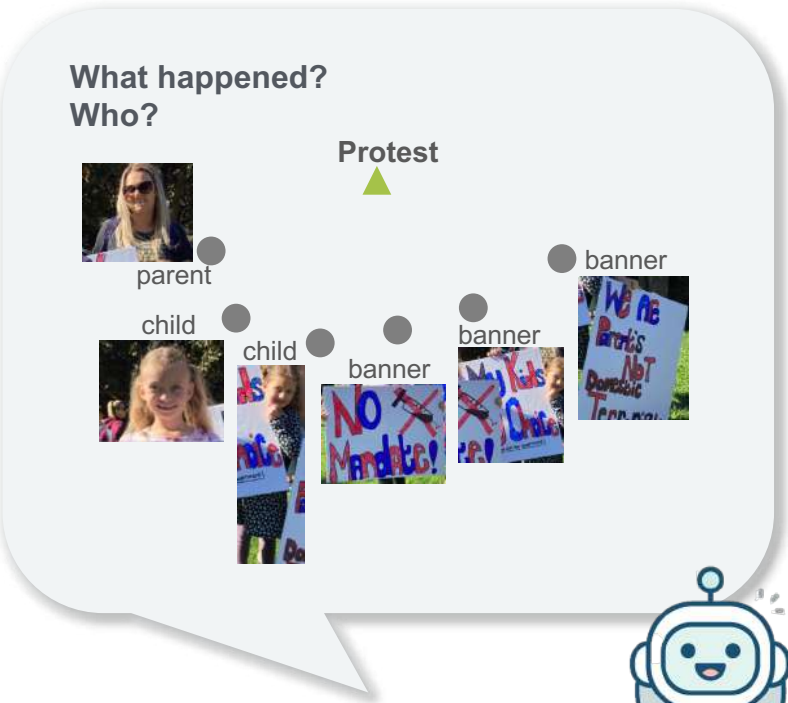
Protest



My PhD Research: Entity-Centric → Event-Centric



Event	Protest
	parent
	child
	banner
	No vaccine mandate for kids



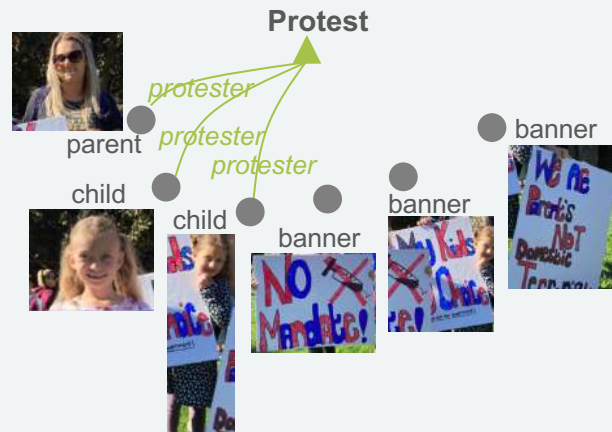
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Event	Protest
Protester	parent
Protester	child
	banner
	No vaccine mandate for kids

What happened?

Who?

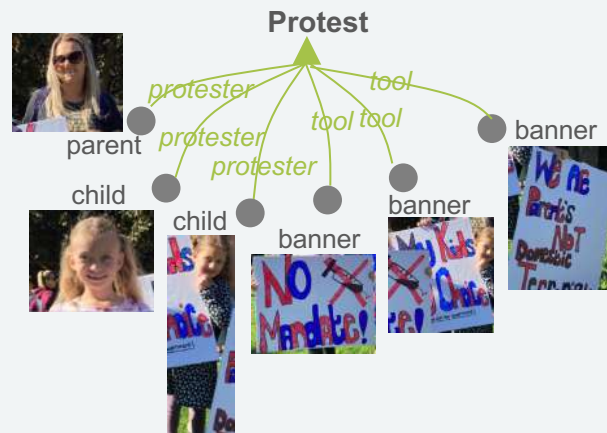


My PhD Research: Entity-Centric → Event-Centric



Event	Protest
Protester	parent
Protester	child
Tool	banner
Topic	No vaccine mandate for kids

What happened?
Who?



What is Multimodal Event Extraction?

Multimodal Event Extraction [ACL'20]

Input: text, image, video, speech, ...

Output: structured knowledge

- 1. Event Type:** *identify the **occurrence** of certain event*
- 2. Argument:** *Identify the **participants** and their **semantic roles***

My PhD Research: Entity-Centric → Event-Centric



	Text	Image / VideoFrame
	Sentence	Image
Entity-centric	Entity	Object
	Relation	Relation
	Entity-Relation Graph	Scene Graph

My PhD Research: Entity-Centric → Event-Centric



	Text	Image / VideoFrame
	Sentence	Image
Entity-centric	Entity	Object
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	Entity-Relation Graph	Scene Graph
Event-centric	Event Trigger	Activity
	Event Structure	Image Event Graph

My PhD Research: Entity-Centric → Event-Centric



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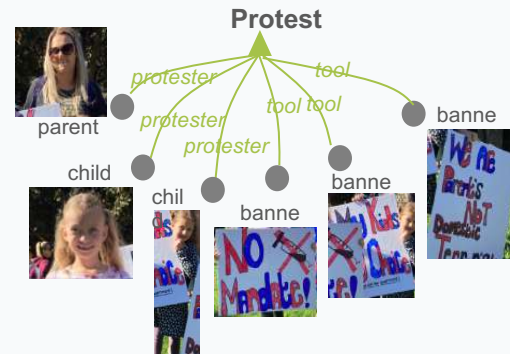
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Entity-centric

Event-centric



Entity-centric

Event-centric

Surface

Deep

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Deep Semantic Understanding:

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Surface

Concrete

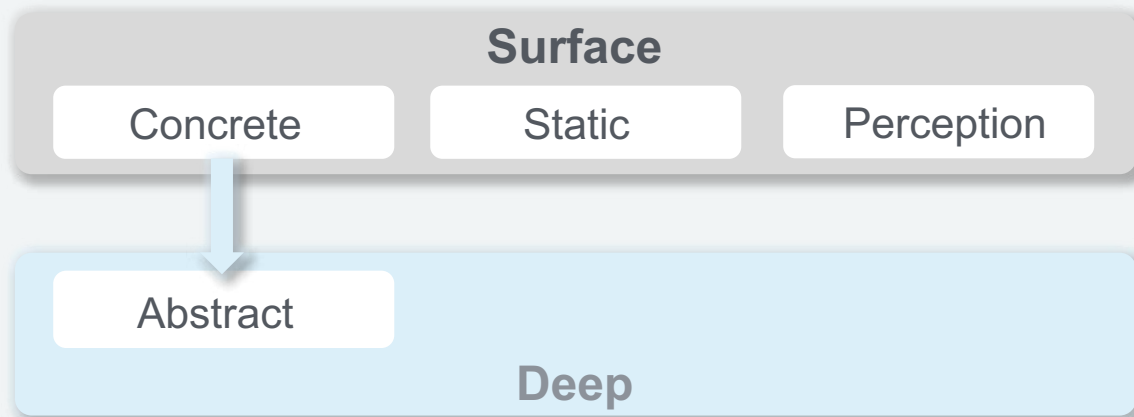
Static

Perception

My Research Vision: Surface → Deep Knowledge

Deep Semantic Understanding:

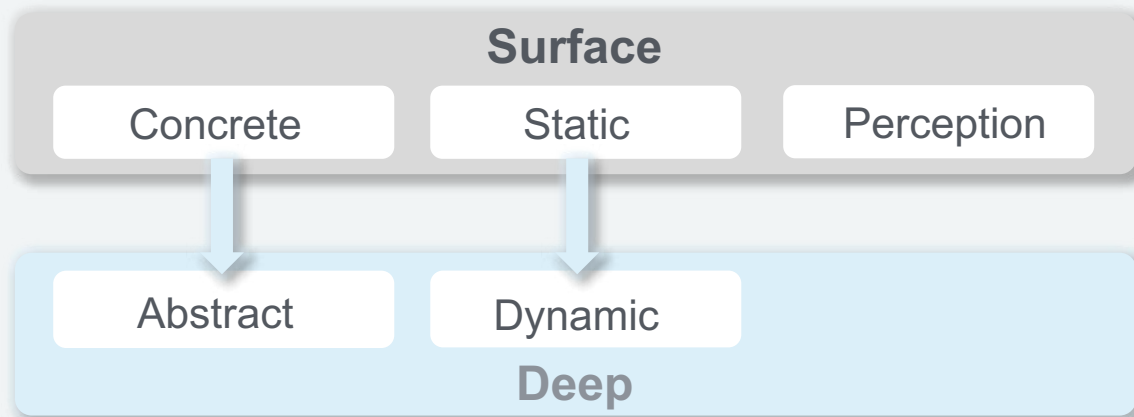
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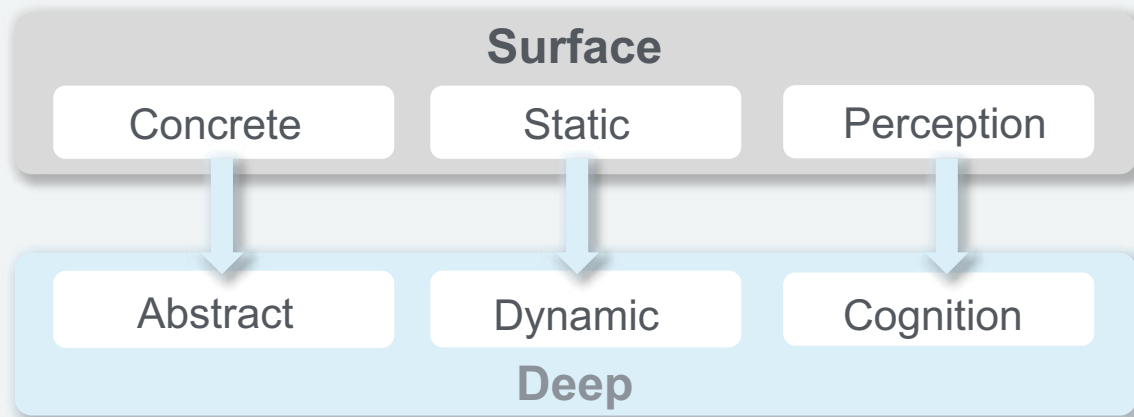
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My Research Vision: Surface → Deep Knowledge

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My Research Vision: Surface → Deep Knowledge

Text generation paradigm (e.g., ChatGPT) is taking over the NLP world.

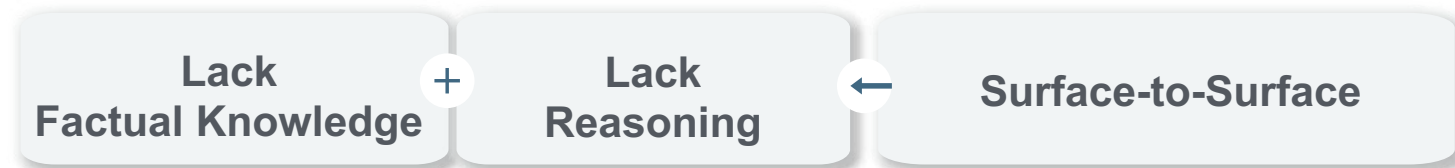
But it is flat and surface-to-surface.

Surface-to-Surface

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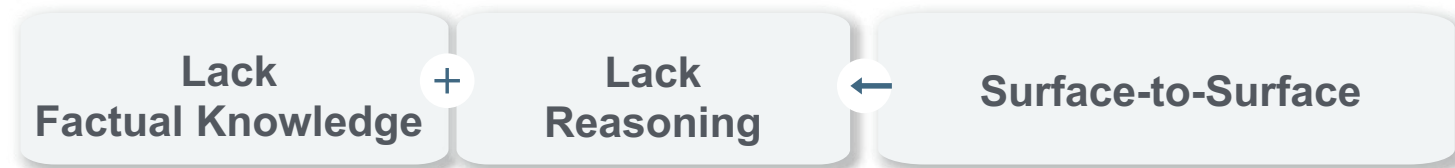
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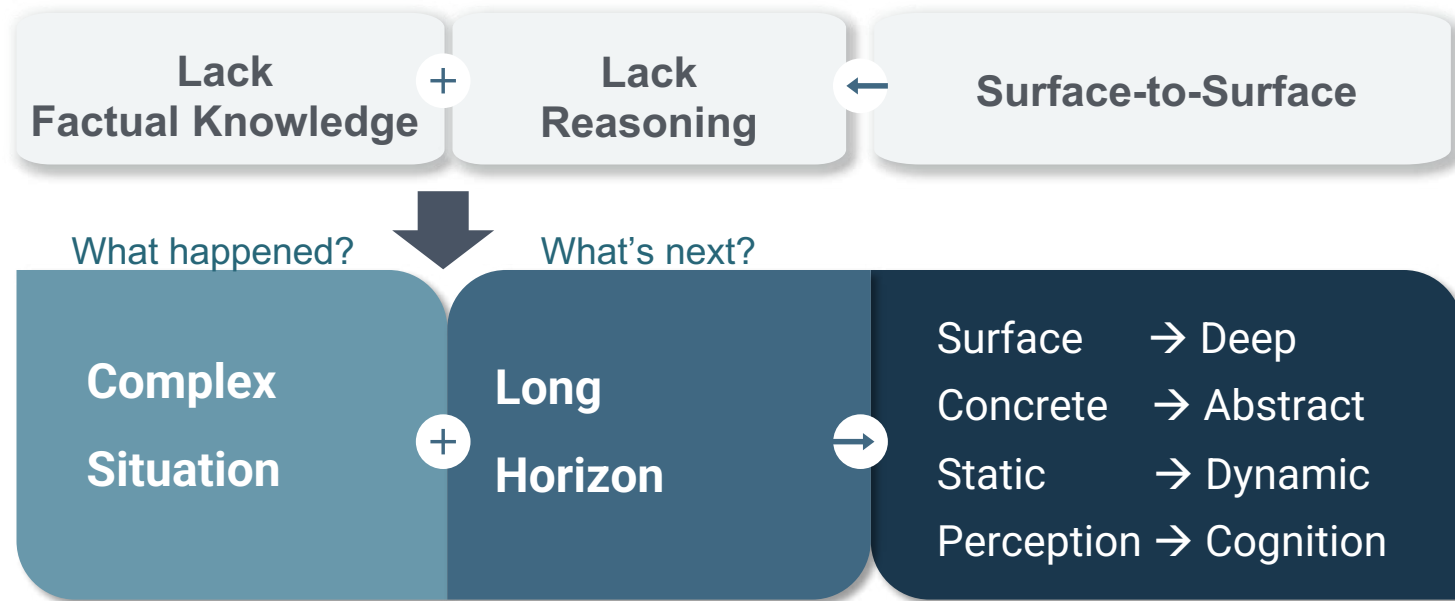


Surface → Deep
Concrete → Abstract
Static → Dynamic
Perception → Cognition

My Research Vision: Surface → Deep Knowledge

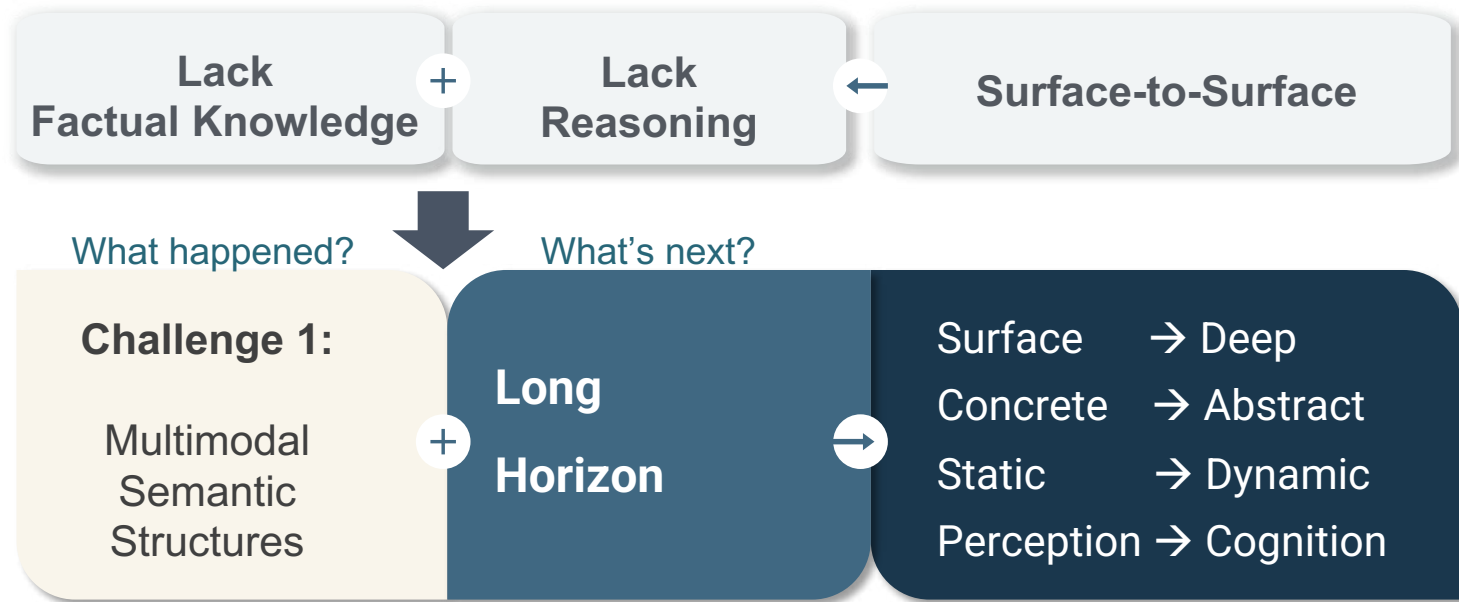
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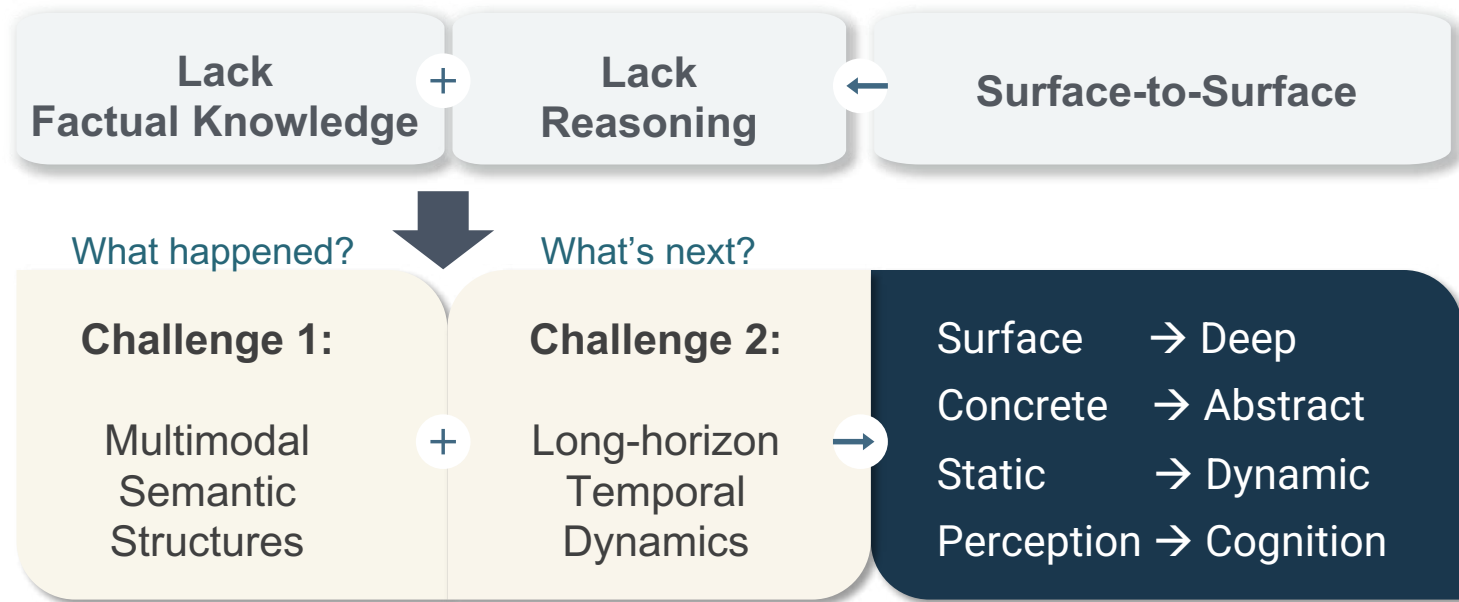
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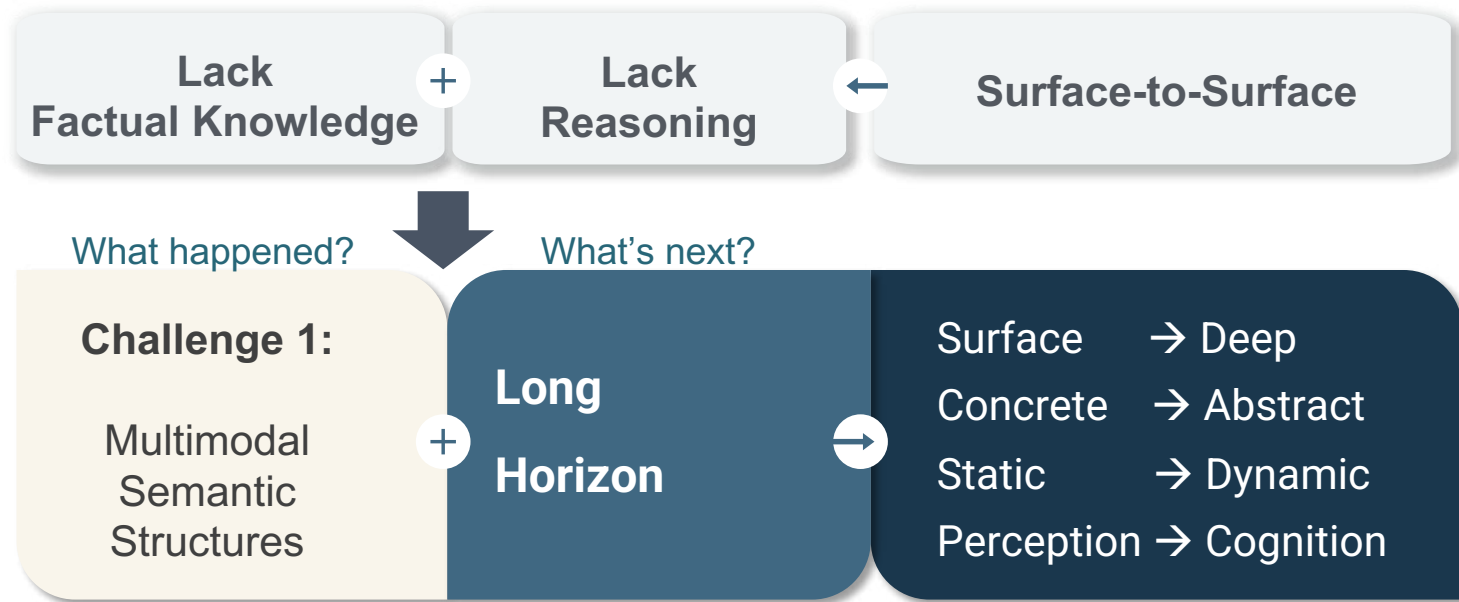
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Challenge 1: Multimodal Semantic Structures

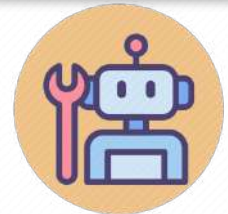


What happened?

Who?

Where?

When?



Challenge 1: Multimodal Semantic Structures

- My Solution: We propose the first Multimodal Event Extraction model



Event	Protest
Protester	parent
Protester	child
Tool	banner
Topic	No vaccine mandate for kids
Location	California State Capitol
Time	Oct 18

Caption: Whitney Jiusti, a parent from Espardo, and her two children attend the protest on **Oct. 18** at the **California State Capitol**.

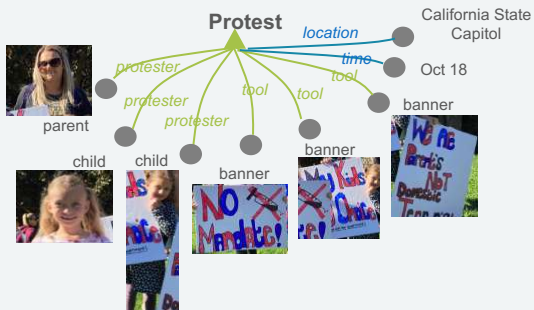
From Entity-centric to Event-centric Multimodal Knowledge Acquisition

Read: Complex Situation

Challenge 1:

Multimodal
Semantic
Structures

My Solution: Structural Transfer from Text to Vision → Factual Knowledge



CLIP-Event

[CVPR'22], [NeurIPS'22]

M²E²: Multimodal Event

[ACL'20], [EMNLP'21], [AAAI'23]

GAIA: Multimodal IE

[ACL'20 Best Demo Paper] 🏆

COVID-KG

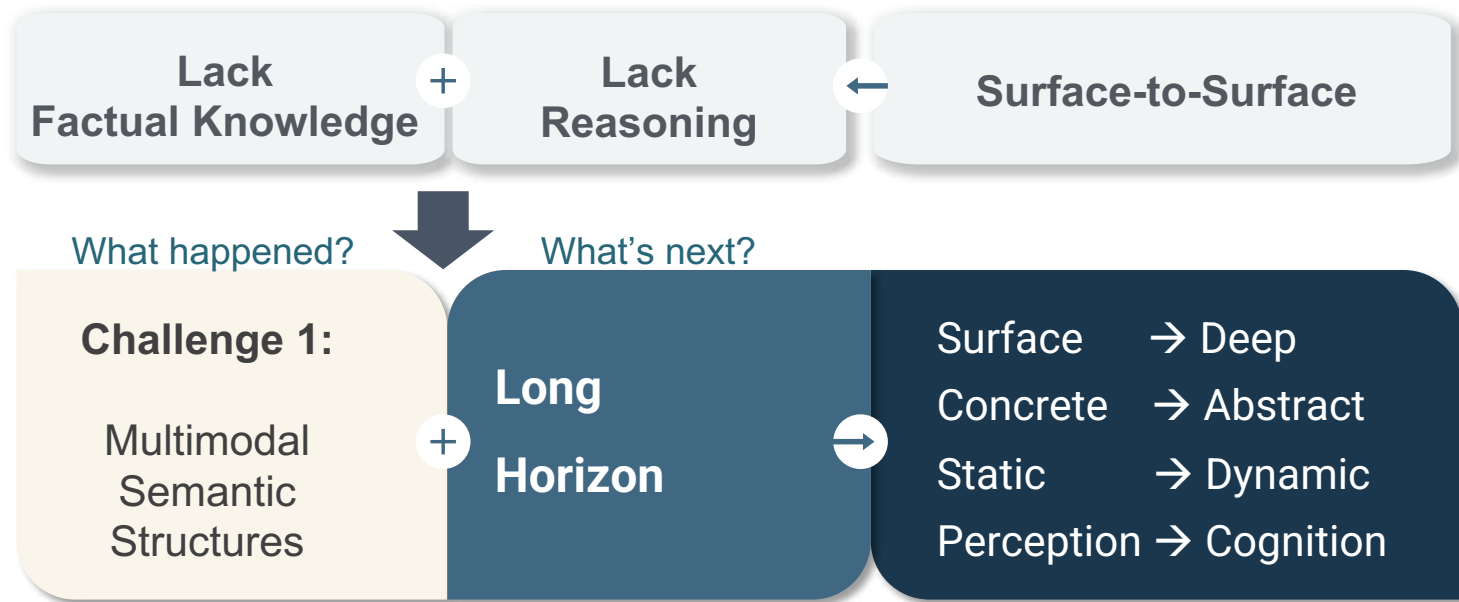
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Challenge 2:

Long-horizon
Temporal
Dynamics

My Research Vision: Surface → Deep Knowledge

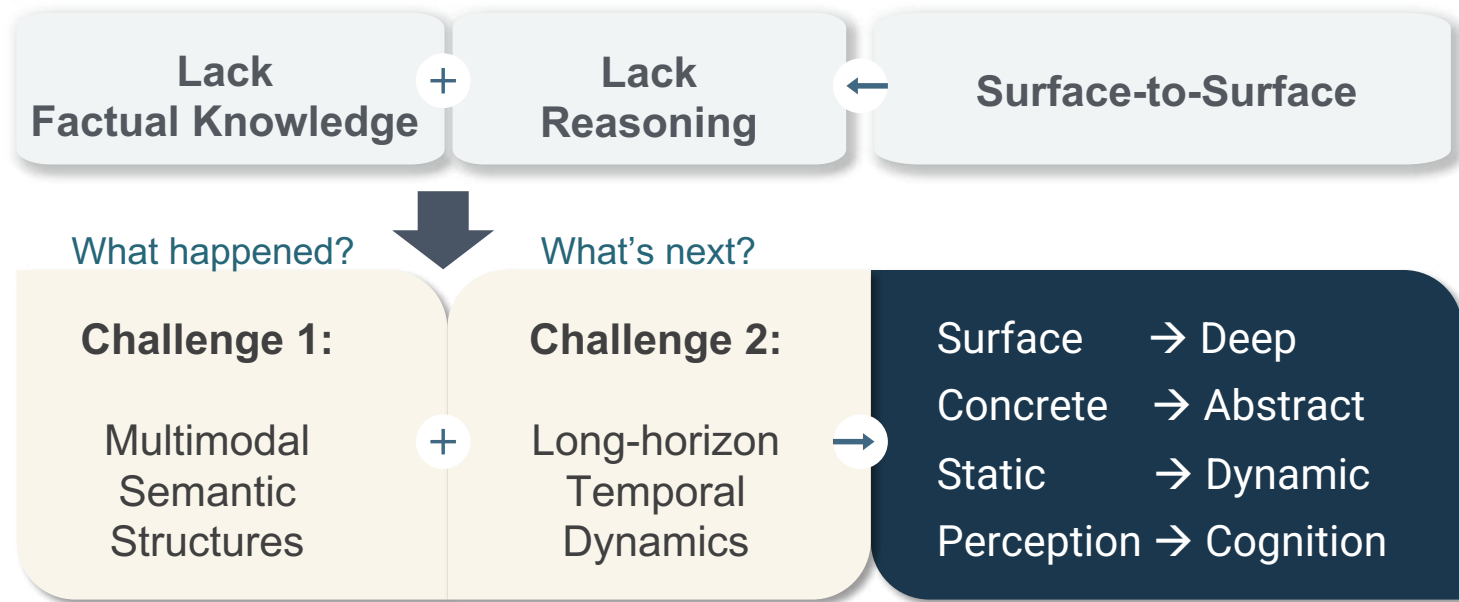
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Challenge 2: Reasoning over a long horizon



Caption: Whitney Jiusti, a parent from Espardo, and her two children attend the protest on [Oct. 18](#) at the [California State Capitol](#).

What happened?

Who?

Where?

When?

Why?

What will happen next?



Challenge 2: Reasoning over a long horizon



Mar 29, 2020: A person is **taken** on a stretcher into **treatment** after going through testing for the coronavirus in Houston, Texas, March 19, 2020. (AP/David J. Phillip)....



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What will happen next to Justi's kids?



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GPT-4's output given four pieces of news text:



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GPT-4's output given four pieces of news text:

The future actions and experiences of Justi's kids is **unclear**. However, it is important to note that vaccination mandates for school attendance have been in place for other diseases for decades and are considered a crucial public health measure to protect students, staff, and the broader community.



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Long Context → Lose focus
Fail to aggregate



Challenge 2: Long-Horizon Temporal Dynamics

- My solution: Event Graph Model



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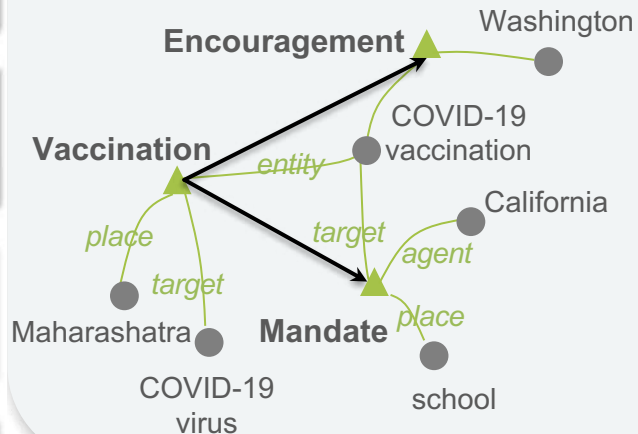


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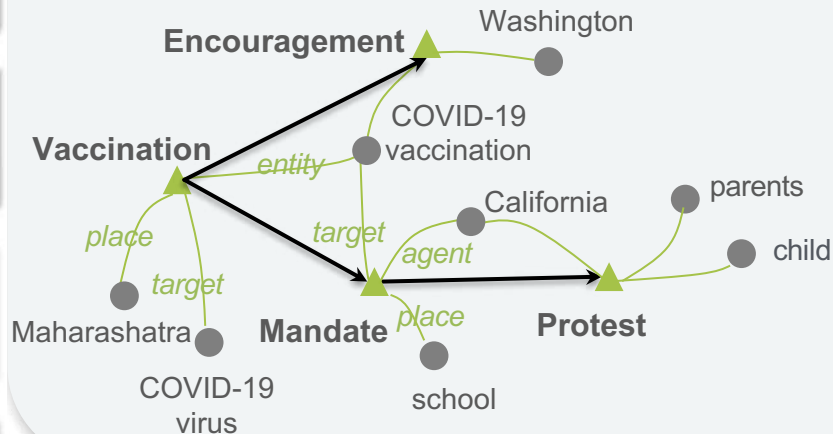


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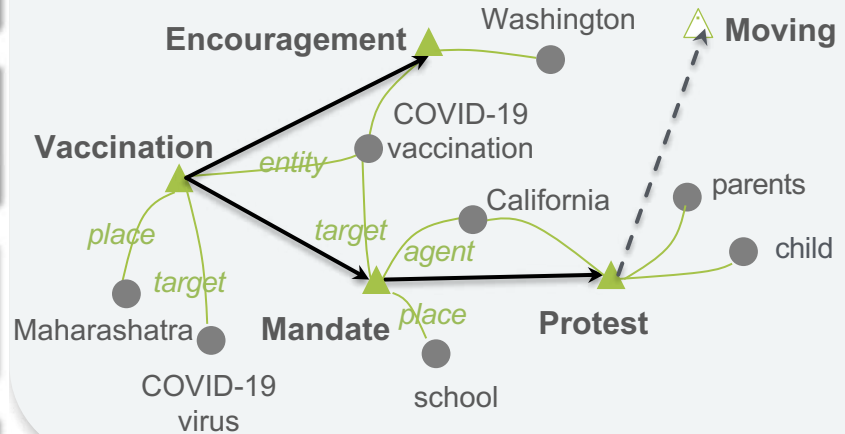


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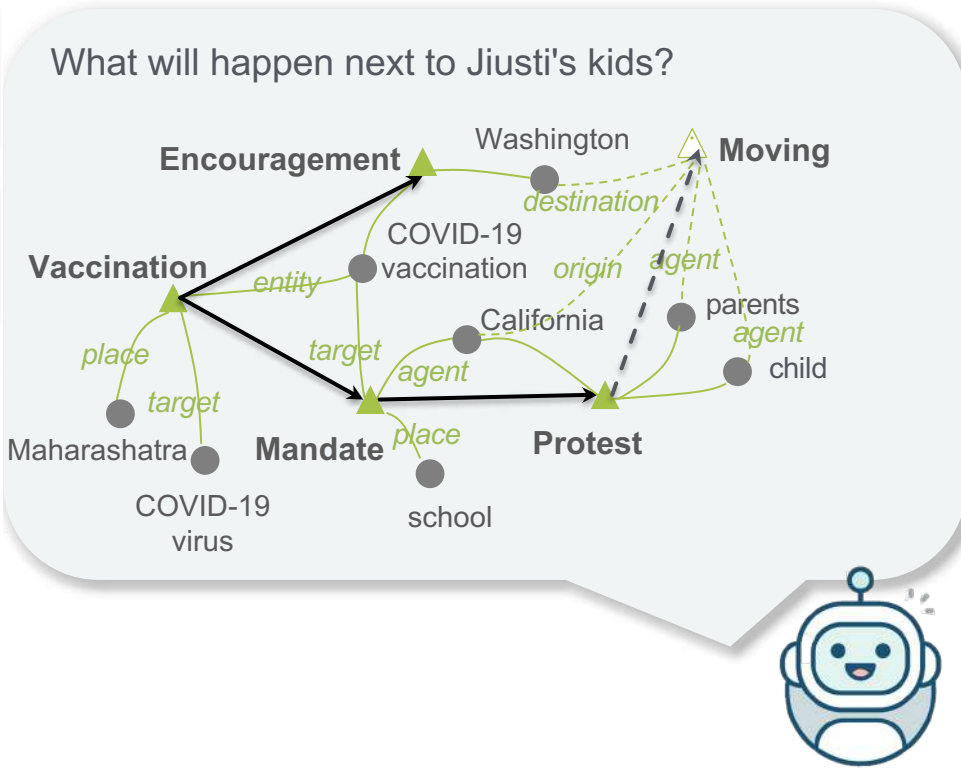
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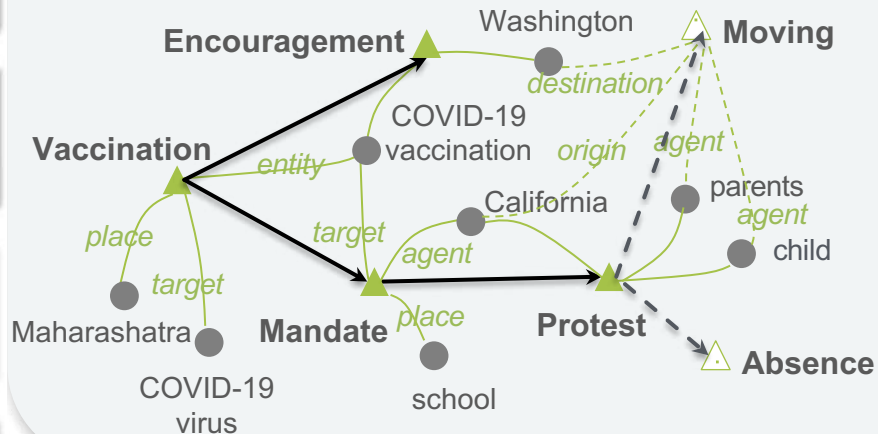


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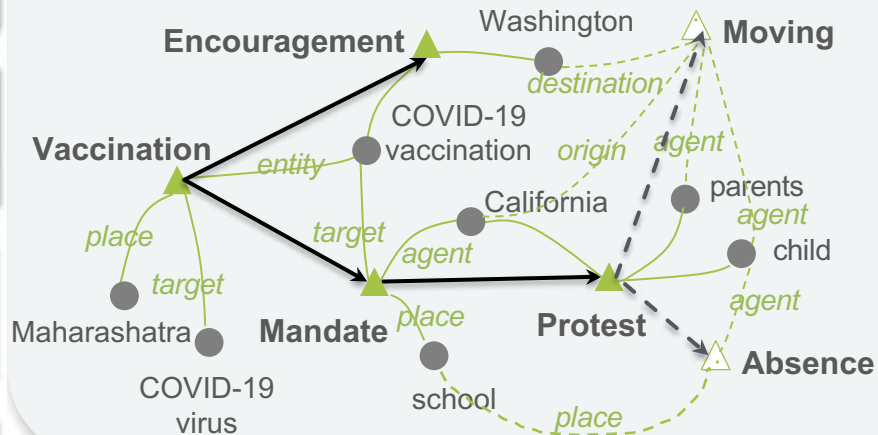


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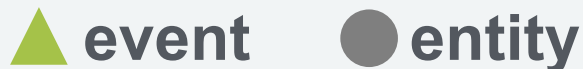
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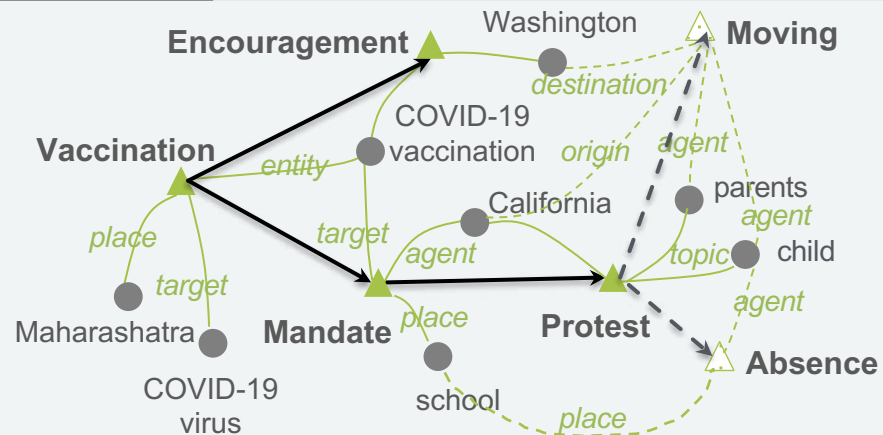


What is Event Knowledge Graph?

Nodes:



Edges:



From Entity-centric to Event-centric Multimodal Knowledge Acquisition

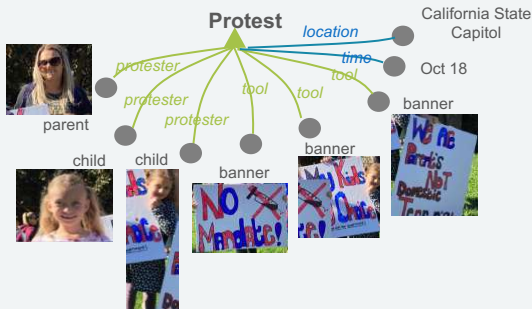
Read: Complex Situation

Think: Temporal Pattern

Challenge 1:

Multimodal
Semantic
Structures

My Solution: Structural Transfer from Text to Vision → Factual Knowledge



CLIP-Event

[CVPR'22], [NeurIPS'22]

M²E²: Multimodal Event

[ACL'20], [EMNLP'21], [AAAI'23]

GAIA: Multimodal IE

[ACL'20 Best Demo Paper] 

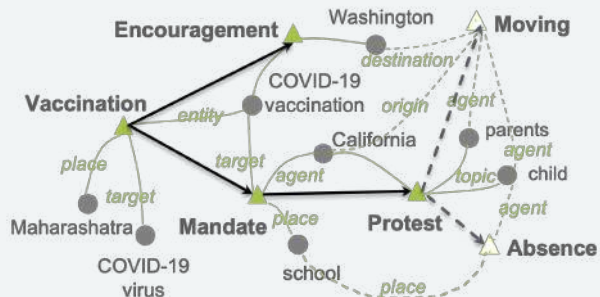
COVID-KG

[NAACL'21 Best Demo Paper] 

Challenge 2:

Long-horizon
Temporal
Dynamics

My Solution: Temporal Graph Schema Induction → Pattern Knowledge



Event Graph Model

[EMNLP'21], [NAACL'22]

Path Language Model

[EMNLP'20]

From Entity-centric to Event-centric Multimodal Knowledge Acquisition

Read: Complex Situation

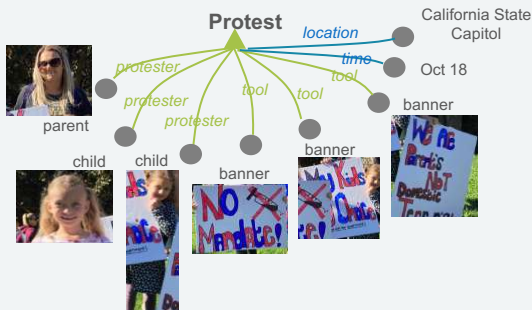
Think: Temporal Pattern

Write: Truthfully

Challenge 1:

Multimodal
Semantic
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CLIP-Event

[CVPR'22], [NeurIPS'22]

M²E²: Multimodal Event

[ACL'20], [EMNLP'21], [AAAI'23]

GAIA: Multimodal IE

[ACL'20 Best Demo Paper]



COVID-KG

[NAACL'21 Best Demo Paper]



Truthful Generation

My Solution:
Knowledge-Driven
Generation

Timeline
Summarization
[EMNLP'21]

COVID-19
Claim Detection
[ACL'22]

Multimedia
News QA
[AAAI'22]

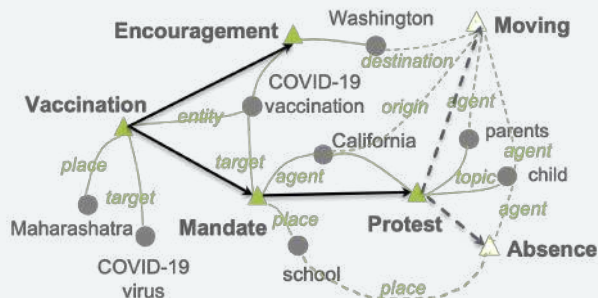
Meeting
Summarization
[ACL'19]

Event
Heatmap
[NAACL'19]

Challenge 2:

Long-horizon
Temporal
Dynamics

My Solution: Temporal Graph Schema Induction → Pattern Knowledge



Event Graph Model

[EMNLP'21], [NAACL'22]

Path Language Model

[EMNLP'20]

Live Demo: What Would the “SmartBook” Look Like? An Example Chapter

Ukraine Crisis Smart Book

Chapters >

Position of Third Parties >

Overview

What is NATO's position on the Ukraine-Russia conflict?

What is the position of China on the Ukraine-Russia conflict?

What is the position of the governments of Poland, Turkey and Moldova on the Ukraine-Russia conflict?

What is Venezuela's position on Ukraine-Russia Conflict?
Perspectives

What is the position of China on the Ukraine-Russia conflict?

Summary

China has publicly stated that it does not support the idea of ejecting Russia from the G20, and has instead called for dialogue between all parties involved in the conflict. China has also said that it is opposed to the spread of disinformation about China in an attempt to pressure the country.

Claims

Claim Sentence	Context
Since the war began, China has tried to project a neutral stance. Source	Biden-Xi call: A call between Chinese President Xi Jinping and US President Joe Biden was underway Friday. Since the war began, China has tried to project a neutral stance. It has not condemned Russian actions, and has refused to label the attack an invasion. See More
Cooperation with China was ambivalent, he said, adding the country was "struggling with the consequences of its own Covid strategy, which also has consequences for world trade."	While the G7 leaders reemphasized their condemnation of "Russia's unjustifiable, unprovoked and illegal war against Ukraine," they called on China to press Russia to withdraw its troops from Ukraine. Scholz said he also expected China not to undermine sanctions against Russia. Cooperation with China was ambivalent, he said, adding the country was "struggling with the consequences of its own Covid strategy, which also has consequences for world trade." See More
China is firmly opposed to this and will never accept it. Source	The US has indicated that China would pay an economic price if its support for Russia goes beyond rhetoric. Speaking Friday, Zhao repeated China's public rebuke, saying "some people in the US have been spreading disinformation to smear and put pressure on China , which is extremely irresponsible and will not help solve the issue. China is firmly opposed to this and will never accept it." See More
That is considered unlikely, as China has said it would not back kicking Russia out.	While US President Joe Biden has said Russia should no longer be in the G20, ejecting Moscow would require the support of all members. That is considered unlikely, as China has said it would not back kicking Russia out. See More
The White House is realistic the G20 will not collectively remove Russia from its ranks, since the decision would likely require consensus and China has been clear it doesn't support such a move.	The White House is realistic the G20 will not collectively remove Russia from its ranks, since the decision would likely require consensus and China has been clear it doesn't support such a move. See More

Multi-Lingual Claims

China's position:

[Source](#)

Original Post

中国常驻联合国副代表耿爽：各方都应摒弃政治私利，为化解乌克兰危机做切实努力 中国日报联合国9月7日电（记者张雯璐）当地时间7日，联合国安理会召开会议审议乌克兰人道问题。中国常驻联合国副代表耿爽出席会议并发言表示，乌克兰政治私利，停止激化矛盾，停止制造分裂，停止鼓吹对抗，为化解危机做出切实努力。耿爽说，历史反复证明，外交努力、谈判沟通是化解冲突、结束危机的唯一正确出路。中方再次呼吁有关当事方保持对话接触，探索政治解决的可能性，复和平稳定积累条件。耿爽指出，扎波罗热核电站的安全和安保问题事关乌克兰和整个地区上亿人的健康福祉，决不容许发生意外。中方呼吁有关当事方认真落实罗西总干事提出的七项支柱原则，避免采取危及核安全和安保的行动。中方代表团上周对扎波罗热核电站进行实地考察，赞赏机构专家驻留在核电站继续开展工作，鼓励机构就相关问题同各方保持沟通。

Translation (Google)

Geng Shuang, Deputy Permanent Representative of China to the United Nations: All parties should abandon political self-interest and make practical efforts to resolve the Ukrainian crisis China Daily, United Nations, September 7 (Reporter Zi 7th local time, the UN Security Council held a meeting to discuss the humanitarian issue in Ukraine. China's Deputy Permanent Representative to the United Nations, Geng Shuang, attended the meeting and said that all parties in the Ukraine

What is the position of China on the Ukraine-Russia conflict?

Summary

Claims

Multi-Lingual Claims

China's position:

Original Post

Translation (Google)



SmartBook: <https://blenderdemo.com/smartbook>

ClaimRadar for COVID19: <https://blenderdemo.com/covid-list>

Live Demo: What Would the “SmartBook” Look Like? An Example Chapter

Ukraine Crisis Smart Book

Sep 16th - 30th >

Oct 1st - 15th >

Oct 16th - 30th >

Ukraine on Black Sea Grain >

Drone attacks in Ukraine >

Ukraine's war with Russia >

Russian President declares martial law >

What is the reason for Putin's decision to declare martial law?

What is the international community's response to Russian President Putin's decision to declare martial law?

What are Putin's goals in declaring martial law in four Ukrainian regions?

What implications does Putin's decision to declare martial law have for the people of the Donetsk and Luhansk regions?

Russia suspends grain deal >

'dirty bomb' in Ukraine >

What are Putin's goals in declaring martial law in four Ukrainian regions?

Summary

Vladimir Putin has declared martial law in four Ukrainian regions in order to gain control over the areas and suppress any resistance from the residents. He has also stated that this is necessary in order to protect Russia's security and future.

Claims

Claim Sentence	Context
This new step means Putin can ban public gatherings and travel, set curfews, censor information and legally seize civilian resources in the regions of Donetsk, Kherson, Luhansk and Zaporizhzhia. Source	Russian President Vladimir Putin declared martial law in four annexed Ukrainian territories on October 19. This new step means Putin can ban public gatherings and travel, set curfews, censor information and legally seize civilian resources in the regions of Donetsk, Kherson, Luhansk and Zaporizhzhia. Max Bergmann at the Center for Strategic and International Studies explained that martial law is "the suspension of the rule of law.
"What it reflects to me is, it seems his	Earlier on Wednesday, Putin announced martial law in the four Ukrainian regions he claims to have annexed: Kherson,

What are Putin's goals in declaring martial law in four Ukrainian regions?

Summary

Claims



SmartBook: <https://blenderdemo.com/smartbook>

ClaimRadar for COVID19: <https://blenderdemo.com/covid-list>

Wait ... Can GPT-4 generate reports already?

Write a report about the situation of Ukraine Crisis between Oct 16 and Oct 30th.

Here is a report I wrote about the situation of Ukraine Crisis between Oct 16 and Oct 30th:

The Ukraine Crisis is a conflict between Ukraine and Russia that started in 2014 after a popular uprising ousted pro-Russian President Viktor Yanukovich and Russia annexed Crimea, a peninsula in southern Ukraine. The crisis has since escalated into a war in eastern Ukraine, where pro-Russian separatists, backed by Russian troops and weapons, have fought against the Ukrainian government forces for control of the region ¹.

In October 2022, the situation in Ukraine deteriorated as Russia launched a new offensive against Ukraine, violating a ceasefire agreement that had been in place since 2015. According to NATO, Russia has amassed over 100,000 troops near the border with Ukraine and has been conducting airstrikes, missile attacks, and artillery shelling on Ukrainian positions and civilian areas ². Ukraine has responded with its own air and ground strikes, hitting Russian targets and repelling attacks. This resulted in hundreds of casualties, including civilians, and has displaced nearly 30% of the population, creating a humanitarian crisis ³. **Untruthful**

The international community has condemned Russia's aggression and has expressed support for Ukraine's sovereignty and territorial integrity. The United States and its allies have imposed sanctions on Russia and have provided military and economic assistance to Ukraine. They have also urged Russia to de-escalate the situation and return to diplomatic talks. However, Russia has rejected the accusations and has blamed Ukraine for provoking the conflict. Russia has also suspended its participation in the Black Sea grain initiative, a regional cooperation project that allowed food exports from Ukrainian ports ⁴.

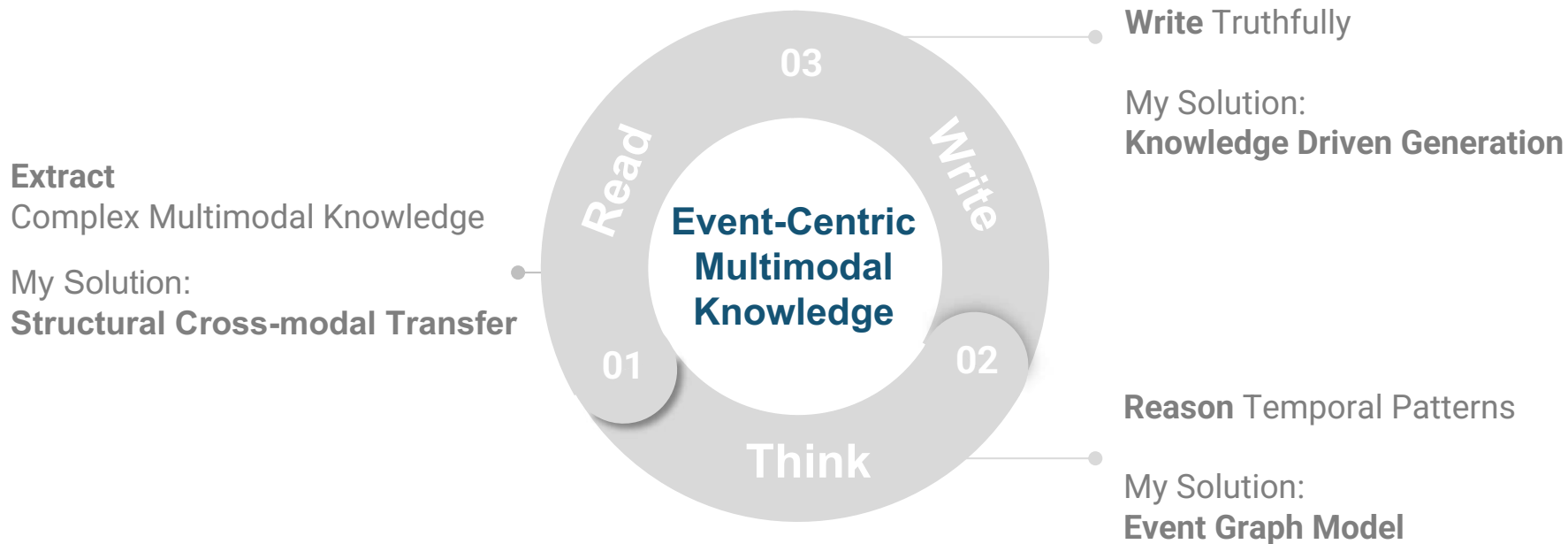
The Ukraine Crisis poses a serious threat to the regional and global security and stability, as well as to the human rights and dignity of the people affected by the violence. The crisis also challenges the principles of international law and order, and the role of multilateral institutions in resolving conflicts peacefully. The crisis requires urgent and sustained efforts from all parties involved to end the hostilities, respect the ceasefire, and engage in a constructive dialogue to find a political solution that respects the sovereignty and territorial integrity of Ukraine ⁵.

⁶: Latest Developments in Ukraine: Oct. 16 - voanews.com ⁴: Latest Developments in Ukraine: Oct 30 - voanews.com ⁷: Russia-Ukraine war, as it happened: nearly 9,000 Russian troops to be ... - theguardian.com ⁸: WHO Ukraine Crisis Response (October 2022 Bulletin) - reliefweb.int ⁵: Ukraine and the Contingency of Global Order - foreignaffairs.com ³: The Ukraine crisis, explained: 6 things you should know - concernusa.org ¹: Ukraine crisis | Ukrainian history [2013-2014] | Britannica - britannica.com ⁹: Everything you need to know about the 2014 Ukraine crisis - vox.com ²: New Russian offensive underway in Ukraine, says NATO - reuters.com

Learn more: 1. britannica.com 2. reuters.com 3. concernusa.org 4. voanews.com +5 more

- Fluent, but short, generic and boring
- No guarantee of truthful information
- Low coverage of salient events
- Not restricted to Oct 16 – Oct 30
- No multiple views (biased)
- Sources: English text only

Research Contributions



Research Contributions

Extract

Complex Multimodal Knowledge

My Solution:

Structural Cross-modal Transfer



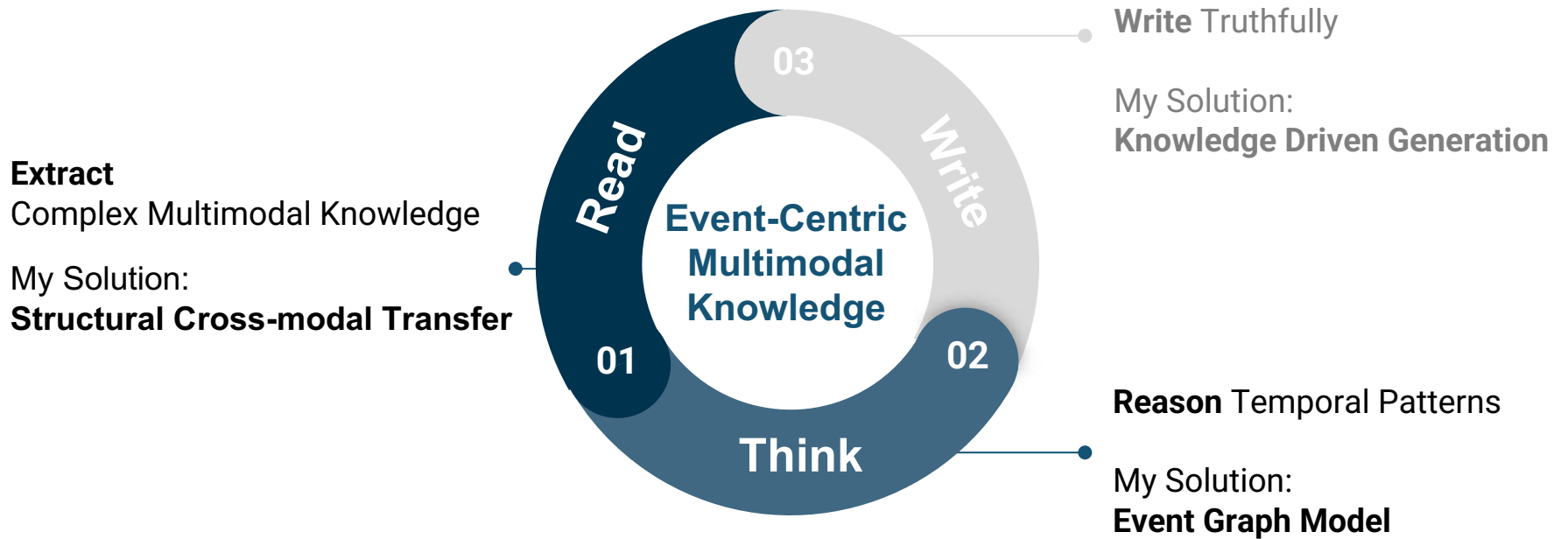
Write Truthfully

My Solution:
Knowledge Driven Generation

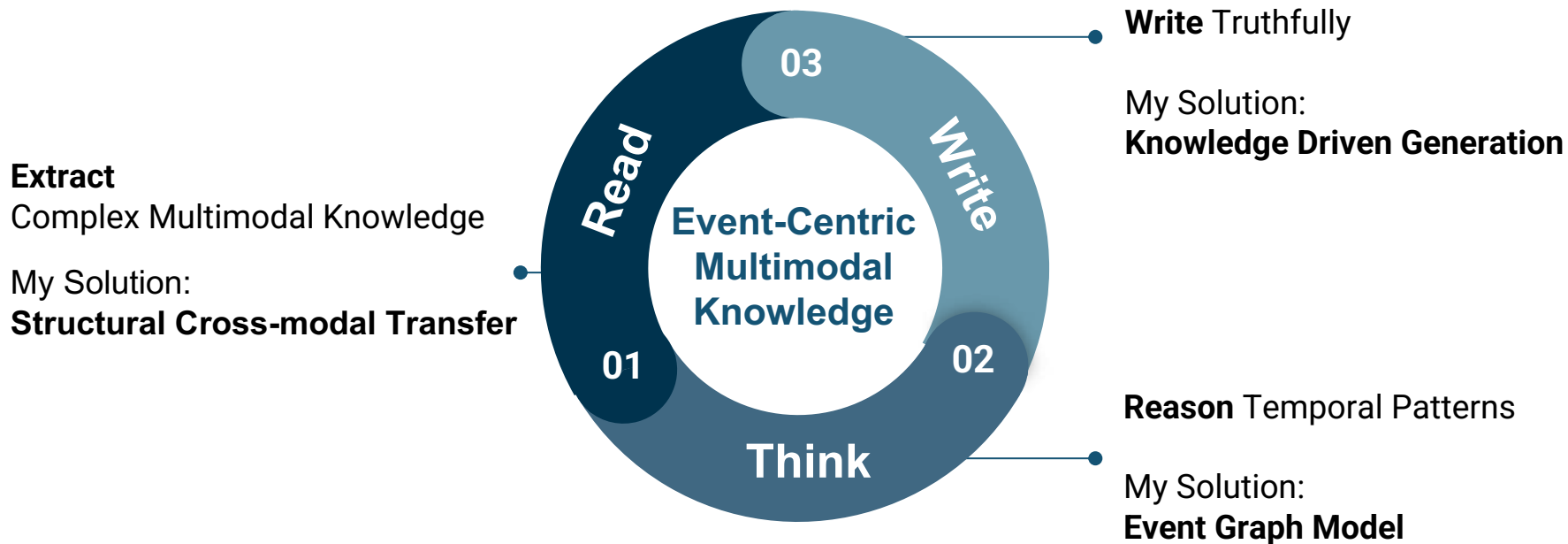
Reason Temporal Patterns

My Solution:
Event Graph Model

Research Contributions



Research Contributions



Research Contributions

New Research Direction:

- **Event-Centric Multimodal Knowledge Graph** (next generation of information access)

New Research Hypothesis:

- **Multimodal Semantic Structures** ← Structural Transfer from Text to Vision
- **Long-Horizon Temporal Dynamics** ← Event Graph Model as Pattern Knowledge

Knowledge for Truthful Generation: Timeline Summarization, etc



DARPA Riser

Invited Presentation at
DARPA Forward Event



Transition

10-year Milestone
Demo Day (NS-CTA)



Ranked 1st at TAC
SM-KBP TA1
(led 19 students)



Microsoft PhD
Fellowship



US Patent

EE CS Rising Star

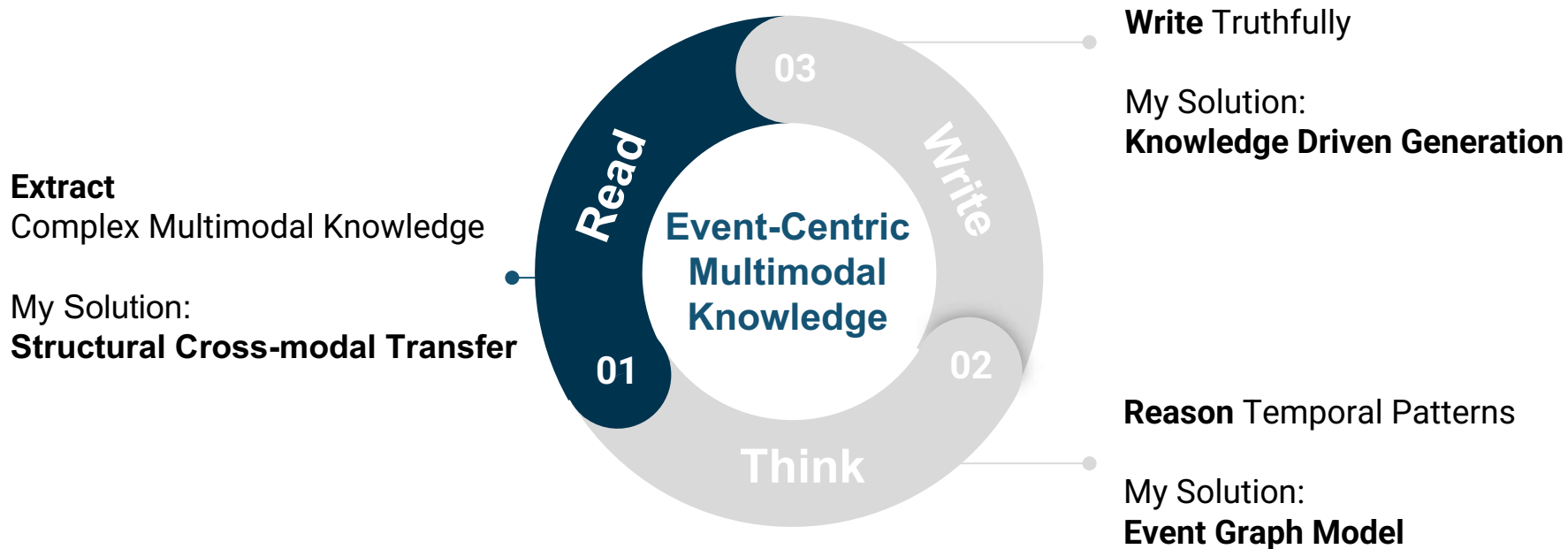


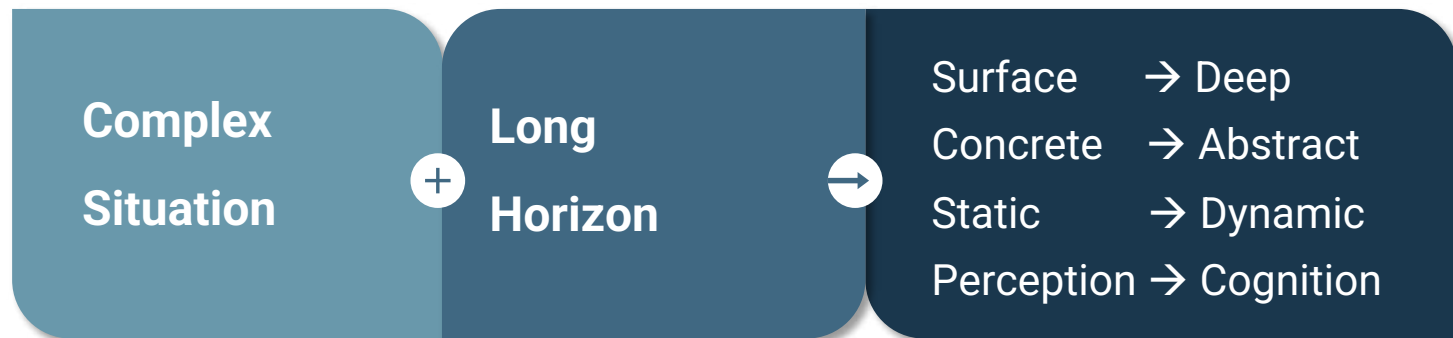
ACL'20 Best Demo Paper



NAACL'21 Best Demo Paper

Research Overview





Complex Situation

Challenge 1:

Multimodal
Semantic
Structures

+

**Long
Horizon**

→

Surface → Deep
Concrete → Abstract
Static → Dynamic
Perception → Cognition


Bottlenecks of Vision Semantic Structure Learning



ROLE		VALUE	ROLE		VALUE
AGENT	MAN		AGENT	FIREMAN	
SOURCE	SPRAY CAN		SOURCE	HOSE	
SUBSTANCE	PAINT		SUBSTANCE	WATER	
DESTINATION	WALL		DESTINATION	FIRE	
PLACE	ALLEYWAY		PLACE	OUTSIDE	

ROLE		VALUE	ROLE		VALUE
AGENT	MAN		AGENT	VET	
SOURCE	SHEEP		SOURCE	DOG	
TOOL	SHEARS		TOOL	CLIPPER	
ITEM	WOOL		ITEM	CLAW	
PLACE	FIELD		PLACE	ROOM	

(Yatskar et al., 2016, ...)



Agent	Tool	Path	Place
Man	Surfboard	Water	Ocean

Agent	Food	Eater	Source	Place
Person	Milk	Tiger	Bottle	∅

(Pratt et al., 2020, ...)

Supervised Learning

Bottleneck:
Lack of Annotation

Vision-Only

Bottleneck:
Cross-modal Fusion

Transfer
Language → Vision


Bottlenecks of Vision Semantic Structure Learning



ROLE		VALUE	ROLE		VALUE
AGENT	MAN		AGENT	FIREMAN	
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(Yatskar et al., 2016, ...)



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(Pratt et al., 2020, ...)

Supervised Learning

Bottleneck:
Lack of Annotation

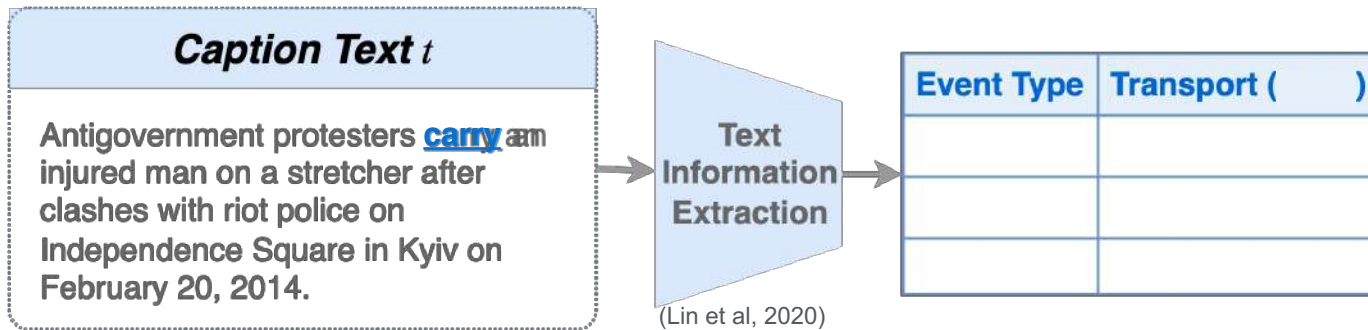
Vision-Only

Bottleneck:
Cross-modal Fusion

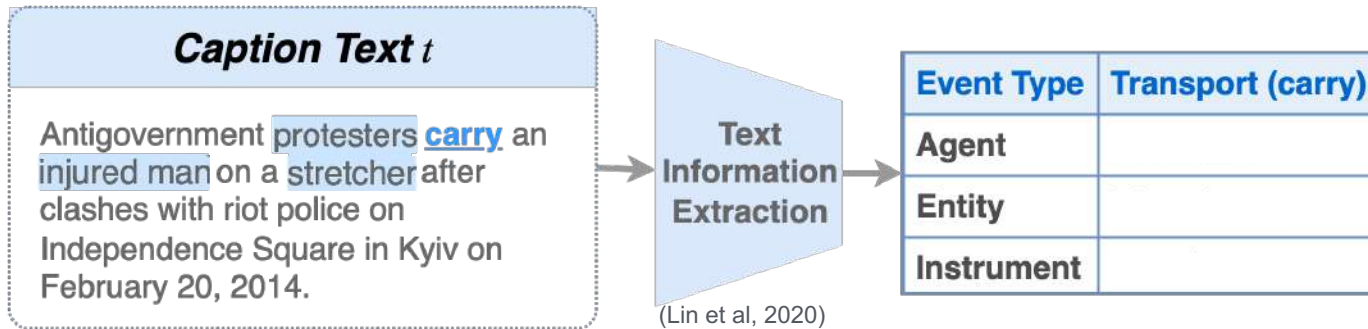
Structural
Transfer

Language → Vision

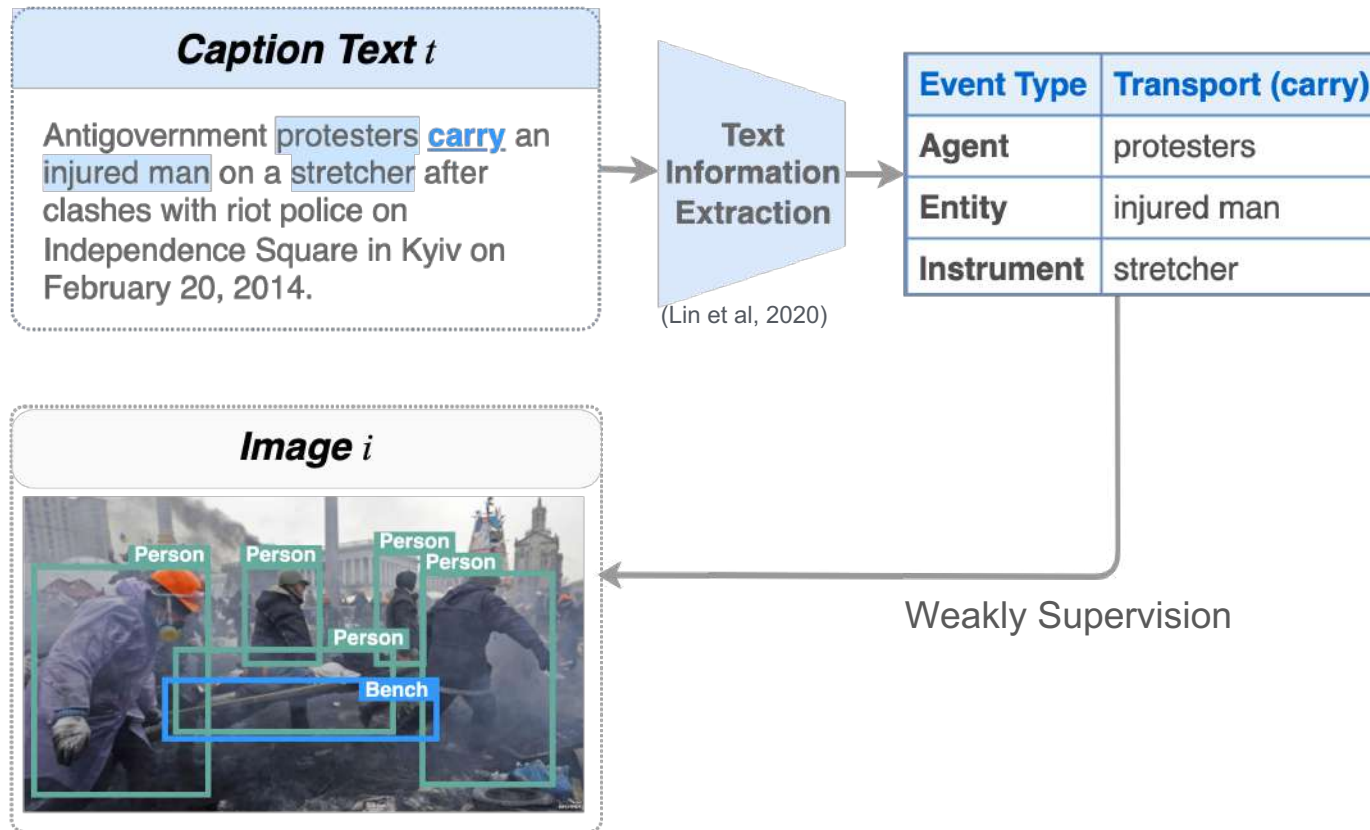
CLIP-Event: Event-Driven Vision-Language Pretraining [CVPR'22]



CLIP-Event: Event-Driven Vision-Language Pretraining [CVPR'22]



Transfer text event knowledge to images



Hard negatives via manipulating event structures



Hard negatives via manipulating event structures

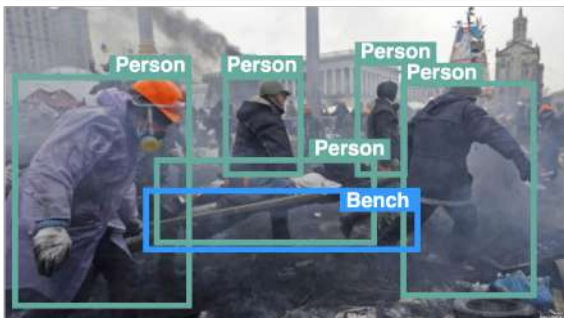
Caption Text i

Antigovernment protesters carry an injured man on a stretcher after clashes with riot police on Independence Square in Kyiv on February 20, 2014.

Text
Positive
Labels

Event Type	Transport (carry)
Agent	protesters
Entity	injured man
Instrument	stretcher

Image i



Negative
Labels
(events)

Event Type	Arrest (arrest)
Agent	protesters
Entity	injured man
Instrument	stretcher

Negative
Labels
(arguments)

Event Type	Transport (carry)
Agent	protesters
Entity	injured man
Instrument	stretcher

Role
Switching

Hard negatives via manipulating event structures

Caption Text i

Antigovernment protesters carry an injured man on a stretcher after clashes with riot police on Independence Square in Kyiv on February 20, 2014.

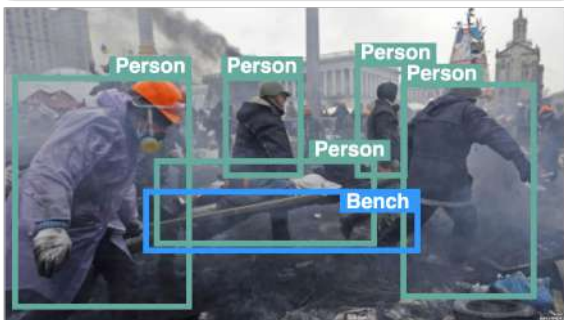
Text
Labels

Event Type	Transport (carry)
Agent	protesters
Entity	injured man
Instrument	stretcher

prompt

Protesters transported injured man using a stretcher.

Image i



Negative
Labels
(events)

Event Type	Arrest (arrest)
Agent	protesters
Entity	injured man
Instrument	stretcher

prompt

Protesters arrested injured man using a stretcher.

Negative
Labels
(arguments)

Event Type	Transport (carry)
Agent	injured man
Entity	stretcher
Instrument	protesters

prompt

Injured man transported a stretcher with protesters.

Hard negatives via manipulating event structures

Caption Text i

Antigovernment protesters carry an injured man on a stretcher after clashes with riot police on Independence Square in Kyiv on February 20, 2014.

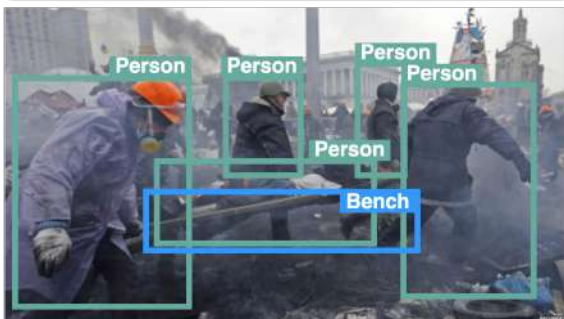
Text
Positive
Labels

Event Type	Transport (carry)
Agent	protesters
Entity	injured man
Instrument	stretcher

prompt

Protesters transported injured man using a stretcher.

Image i



Negative
Labels
(events)

Event Type	Arrest (arrest)
Agent	protesters
Entity	injured man
Instrument	stretcher

prompt

Protesters **arrested** injured man using a stretcher.

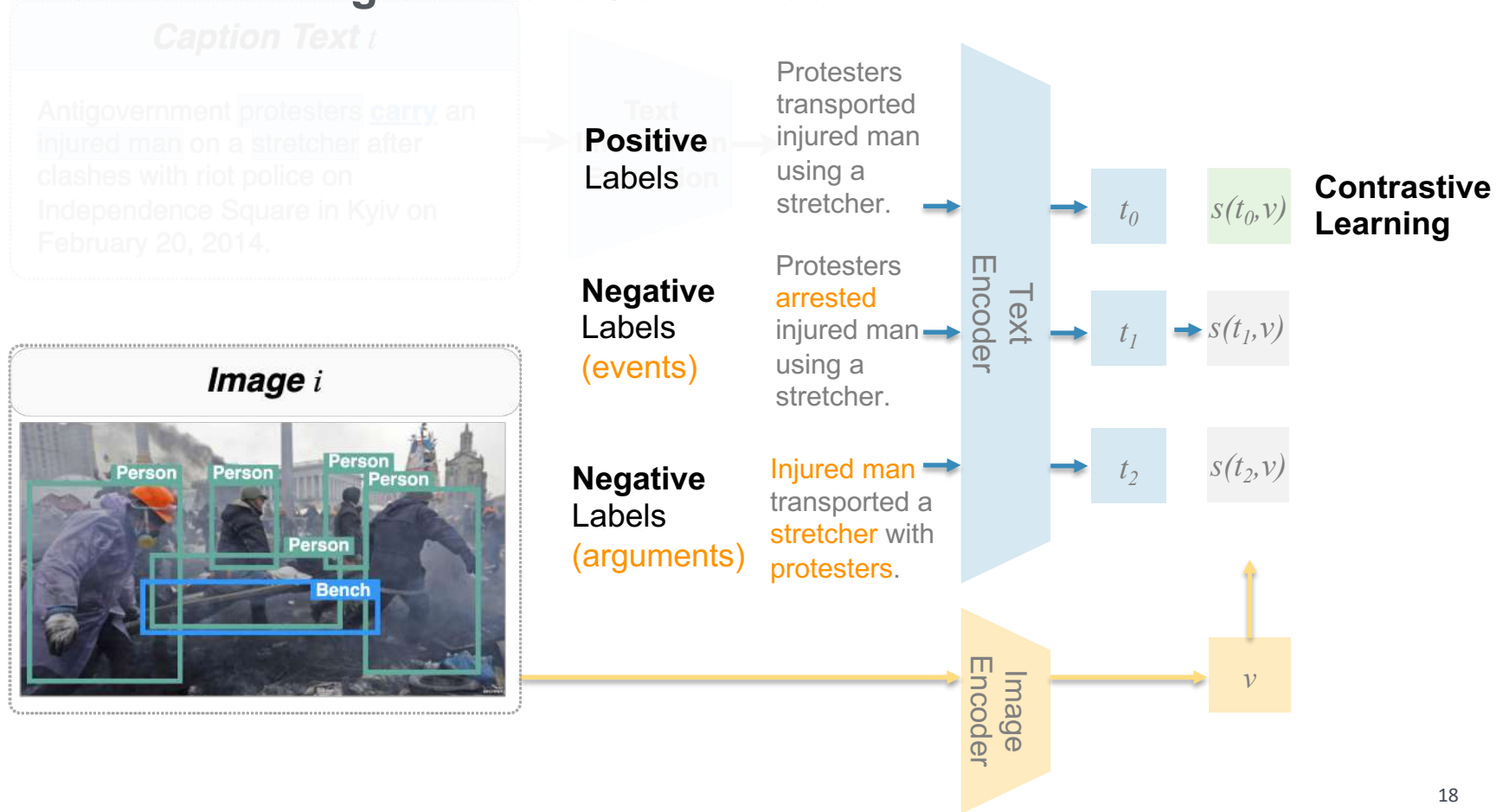
Negative
Labels
(arguments)

Event Type	Transport (carry)
Agent	injured man
Entity	stretcher
Instrument	protesters

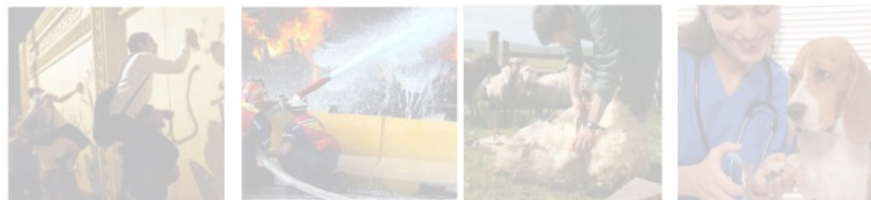
prompt

Injured man transported a **stretcher** with **protesters**.

Contrastive Learning on Event Semantics



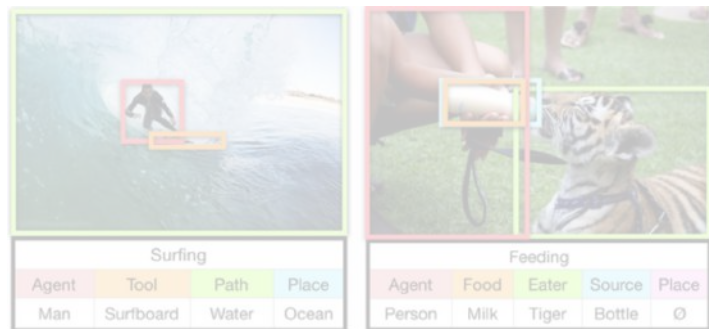
Bottlenecks of Vision Semantic Structure Learning



ROLE		VALUE	ROLE		VALUE
AGENT		MAN	AGENT		FIREMAN
SOURCE		SPRAY CAN	SOURCE		HOSE
SUBSTANCE		PAINT	SUBSTANCE		WATER
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PLACE		ALLEYWAY	PLACE		OUTSIDE

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TOOL		SHEARS	TOOL		CLIPPER
ITEM		WOOL	ITEM		CLAW
PLACE		FIELD	PLACE		ROOM

(Yatskar et al., 2016, ...)



Agent		Tool		Path		Place	
Man		Surfboard		Water		Ocean	

Agent		Food		Eater		Source		Place	
Person		Milk		Tiger		Bottle		∅	

(Pratt et al., 2020, ...)

Supervised Learning

Bottleneck:
Lack of Annotation

Vision-Only

Bottleneck:
Cross-modal Fusion

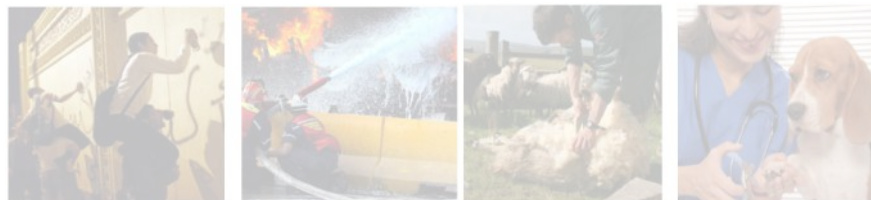
Structural
Transfer

Language



Vision

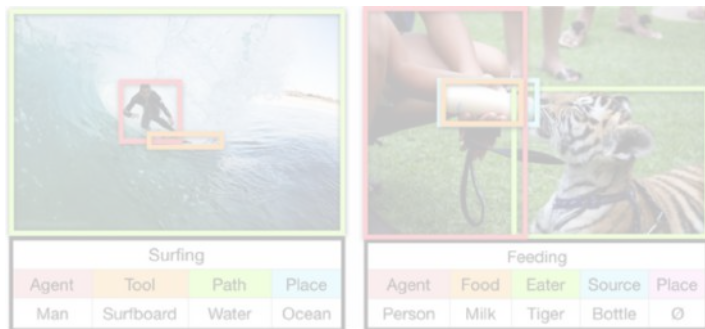
Bottlenecks of Vision Semantic Structure Learning



ROLE		VALUE	ROLE		VALUE
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(Yatskar et al., 2016, ...)



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(Pratt et al., 2020, ...)

Supervised Learning

Bottleneck:
Lack of Annotation

Vision-Only

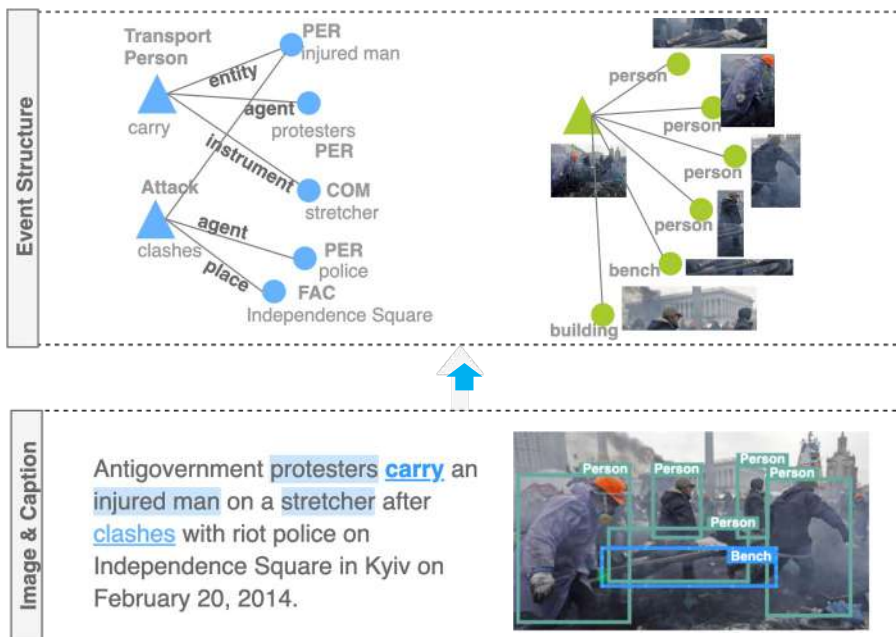
Bottleneck:
Cross-modal Fusion

Structural
Transfer

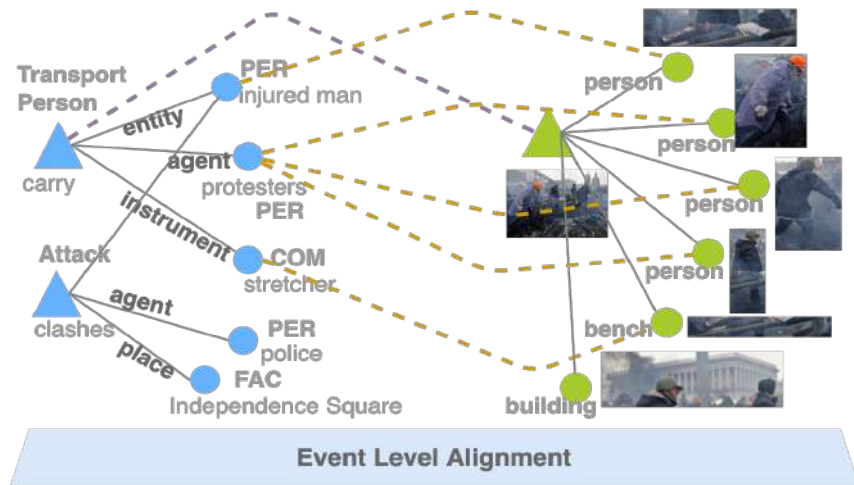
Language → Vision

The first V+L Pretraining with Event Semantic Structures

Challenge: Structured Encoding



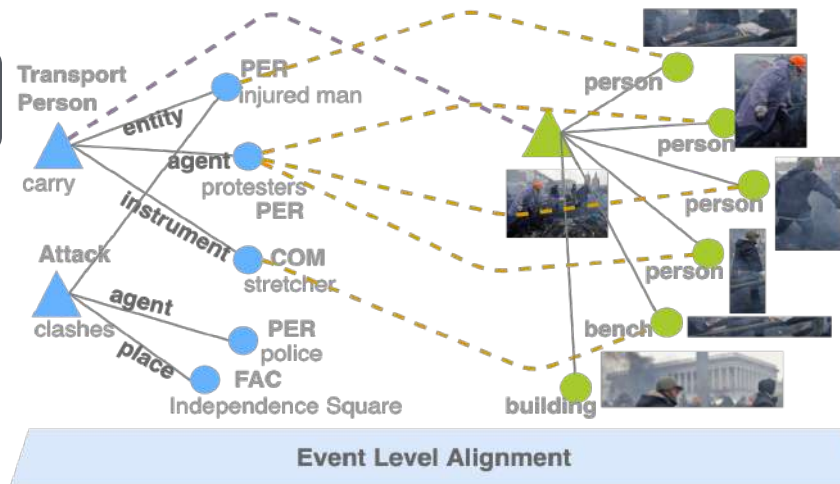
The first V+L Pretraining with Event Semantic Structures



The first V+L Pretraining with Event Semantic Structures

Structured Alignment via Optimal Transport

Text Event Graph \longleftrightarrow Image Event Graph

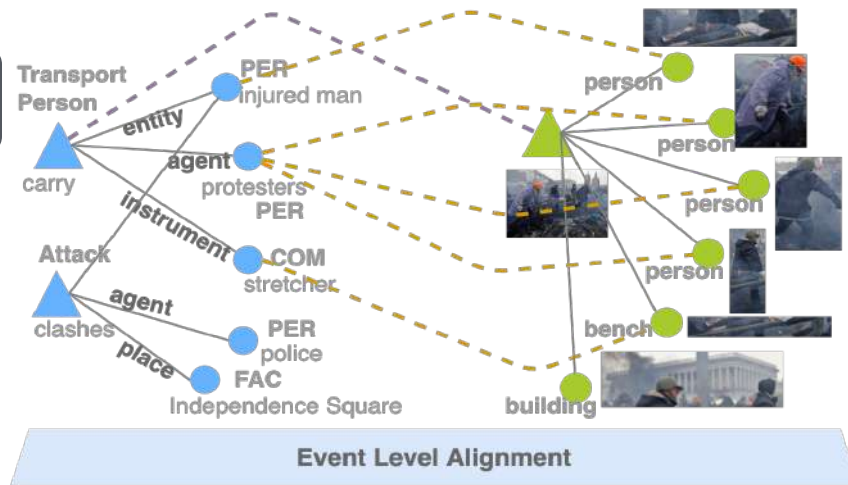


The first V+L Pretraining with Event Semantic Structures

Structured Alignment via Optimal Transport

Text Event Graph \longleftrightarrow Image Event Graph

1 Define cost matrix C (embedding similarity)



The first V+L Pretraining with Event Semantic Structures

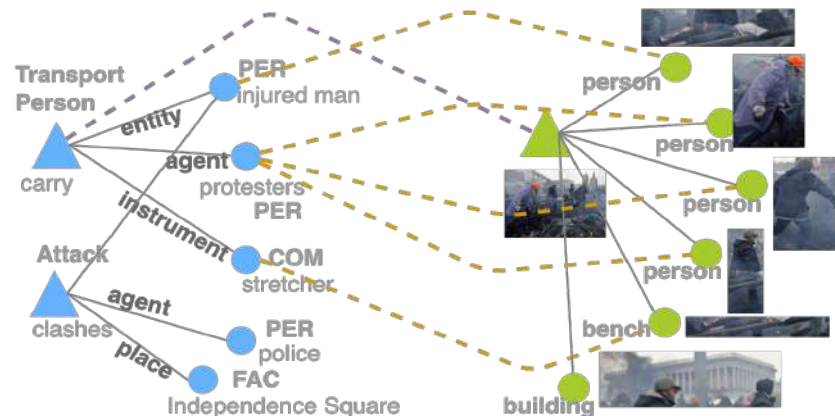
Structured Alignment via Optimal Transport

Text Event Graph \longleftrightarrow Image Event Graph

1 Define cost matrix C (embedding similarity)

2 Optimization Goal: minimize transport distance

$$D(S, T) = \min_T T \cdot C$$



Event Level Alignment

The optimal T is approximated by a differentiable Sinkhorn Knopp algorithm (Sinkhorn, 1964; Cuturi, 2013)

$$T = \text{diag}(p) \exp(-C/\gamma) \text{diag}(q)$$

for $i = 0, 1, 2, \dots$ until convergence,

$$p^{i+1} = \mathbf{1} \oslash (K q^i),$$

$$q^{i+1} = \mathbf{1} \oslash (K^\top p^{i+1}),$$

$$T^k := \text{diag}(p^k) K \text{diag}(q^k)$$

The first V+L Pretraining with Event Semantic Structures

Structured Alignment via Optimal Transport

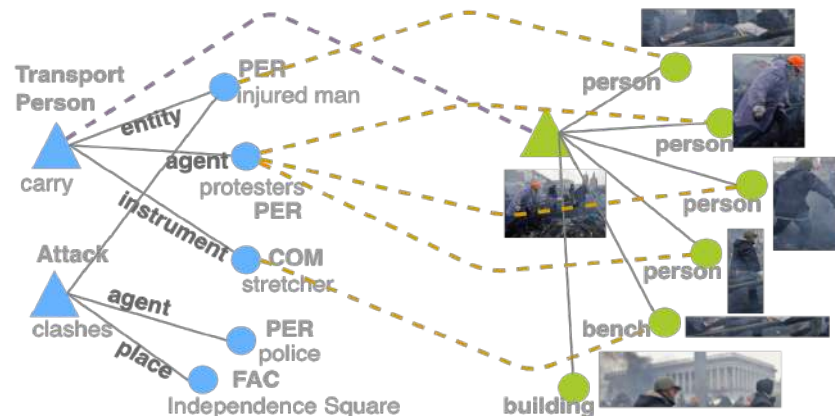
Text Event Graph \longleftrightarrow Image Event Graph

1 Define cost matrix C (embedding similarity)

2 Optimization Goal: minimize transport distance

$$D(S, T) = \min_T T \cdot C$$

3 Optimize the transport plan T within k iterations



Event Level Alignment

The optimal T is approximated by a differentiable Sinkhorn Knopp algorithm (Sinkhorn, 1964; Cuturi, 2013)

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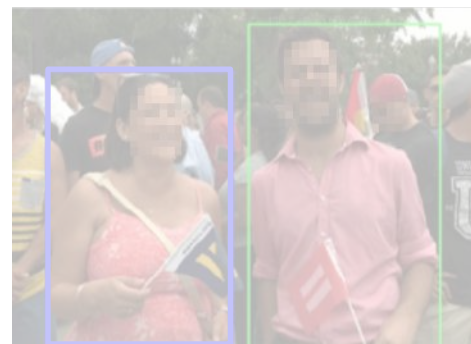
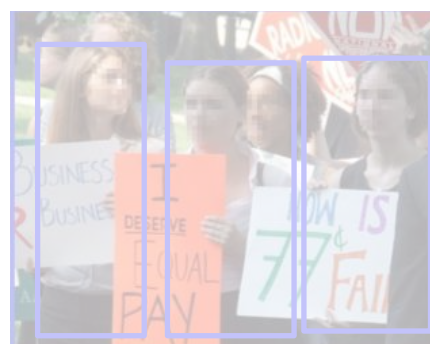
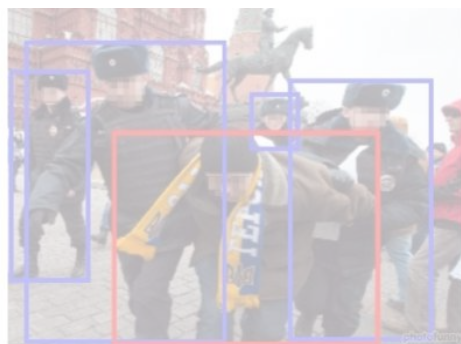
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$$q^{i+1} = \mathbf{1} \oslash (K^\top p^{i+1}),$$

$$T^k := \text{diag}(p^k) K \text{diag}(q^k)$$

CLIP-Event on Visual Event Extraction

Supporting Zero-shot Vision Event Extraction the first time.



Vaccination

agent agent target



Arrest

agent agent agent detainee



Protest

demonstrator



Celebration

attendee attendee



CLIP-Event on Visual Event Extraction

Supporting Zero-shot Vision Event Extraction the first time.



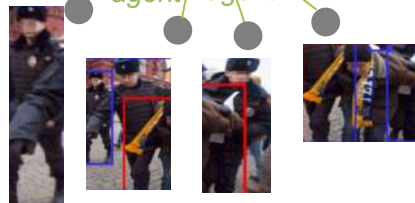
Vaccination

agent agent target



Arrest

agent agent agent detainee



Protest

demonstrator



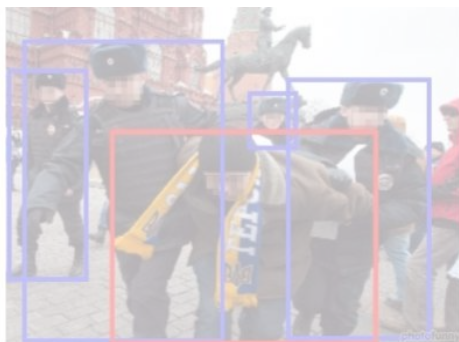
Celebration

attendee attendee



CLIP-Event on Visual Event Extraction

Supporting Zero-shot Vision Event Extraction the first time.



Vaccination

agent agent target



Arrest

agent agent agent detainee



Protest

demonstrator



Celebration

attendee attendee



Video Events as Argument State Changes [AAAI'23]



Video Event

=

Status Changes of Objects

Video Events as Argument State Changes [AAAI'23]



Video Event

=

Status Changes of Objects

Status Changes of an Object

=

Displacement

+

Pixel Changes

Impact: Introducing Event Semantic Structures to V+L Pretraining

Ambiguous Images With Human Judgments for Robust Visual Event Classification

Kate Sanders Reno Kriz Anqi Liu Benjamin Van Durme
 Johns Hopkins University
 Human Language Technology Center of Excellence
 {ksande25, rkriz1, aliu74, vandurme}@jhu.edu

Multimedia Event Extraction From News With a Unified Contrastive Learning Framework

Jian Liu Yufeng Chen Jinan Xu
 Beijing Key Lab of Traffic Data Analysis and Mining, Beijing Jiaotong University, Beijing, China
 jianliu@bjtu.edu.cn chenyl@bjtu.edu.cn jaxu@bjtu.edu.cn

Visual Semantic Role Labeling for Video Understanding

Arka Sadhu¹ Tanmay Gupta³ Mark Yatskar² Ram Nevatia¹ Aniruddha Kembhavi³
¹University of Southern California ²University of Pennsylvania ³PRIOR @ Allen Institute for AI
 {asadhu|nevatia}@usc.edu myatskar@seas.upenn.edu {tannoy|anik}@allenai.org
vidaitu.org

Deep Multi-Modal Structural Equations For Causal Effect Estimation With Unstructured Proxies

Shachi Deshpande^{1,2}, Kaiwen Wang^{1,2}, Dhruv Sreenivas², Zheng Li^{1,2}, Volodymyr Kuleshov^{1,2}
 Department of Computer Science, Cornell Tech¹ and Cornell University²
 {ssd86, kw437, ds844, zli634, kuleshov}@cornell.edu

Video Question Answering with Phrases via Semantic Roles

Arka Sadhu¹ Kan Chen² Ram Nevatia¹
¹University of Southern California ²Facebook Inc.
 {asadhu|nevatia}@usc.edu kanchen18@fb.com

Multimodal
 Semantic
 Structure

Follow-ups
 from Others

Language
 as
 Supervision

Zero-Shot Video Question Answering via Frozen Bidirectional Language Models

Antoine Yang^{1,2}, Antoine Miech³, Josef Sivic¹, Ivan Laptev^{1,2}, Cordelia Schmid^{1,2}
¹Inria Paris ²Département d'informatique de l'ENS, CNRS, PSL Research University
³DeepMind ⁴CIIRC CTU Prague
<https://antoyang.github.io/frozenbilm.html>

PromptCap: Prompt-Guided Task-Aware Image Captioning

Yushi Hu^{♦*} Hang Hua^{♦*} Zhengyuan Yang[◇]
 Weijia Shi[♦] Noah A. Smith^{♦†} Jiebo Luo[◇]
[♦]University of Washington [◇]University of Rochester
[▽]Microsoft Corporation [†]Allen Institute for Artificial Intelligence
 {yushihu, swj0419, nasmith}@washington.edu
 {hua2, jluo}@cs.rochester.edu zhengyang@microsoft.com

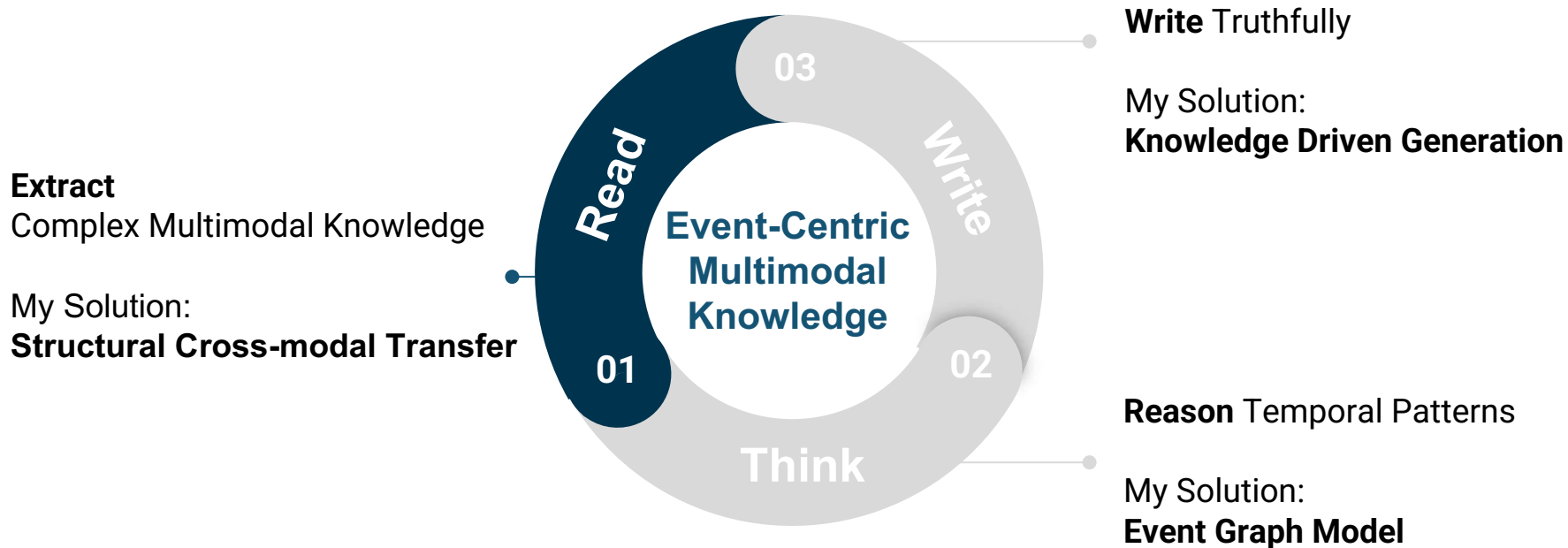
Text2Mol: Cross-Modal Molecule Retrieval with Natural Language Queries

Carl Edwards, ChengXiang Zhai, Heng Ji
 University of Illinois Urbana-Champaign
 {cne2, czhai, hengji}@illinois.edu

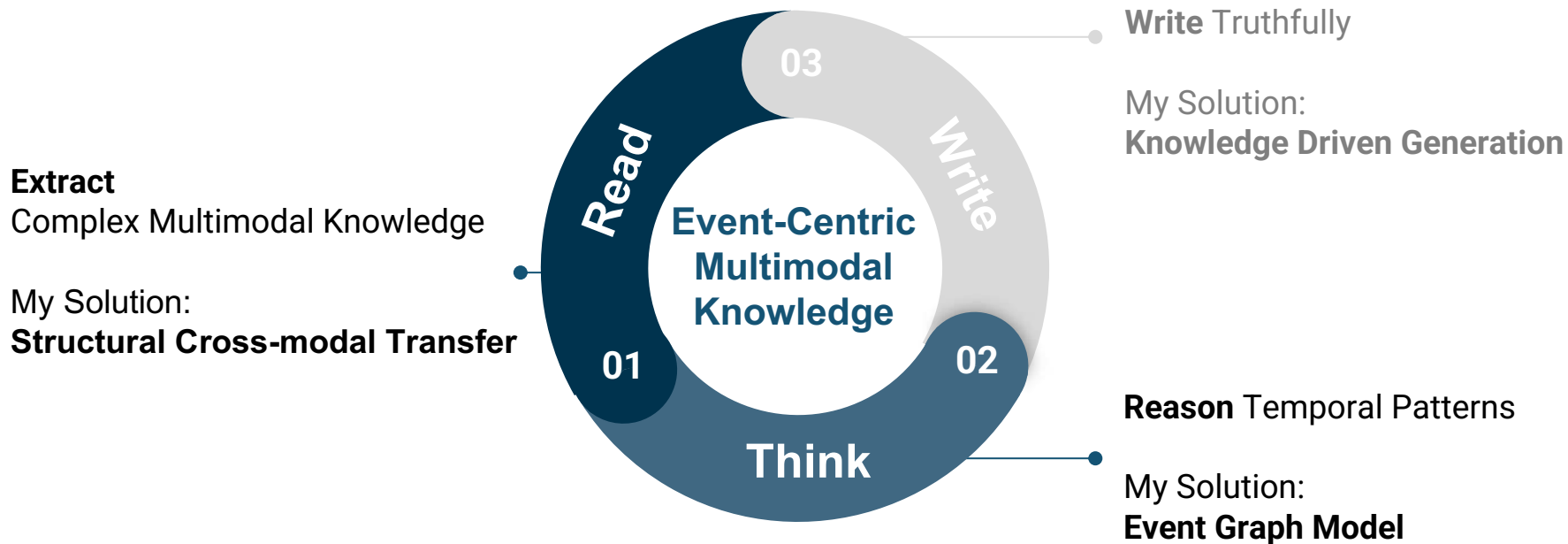
VoLTA: VISION-LANGUAGE TRANSFORMER WITH WEAKLY-SUPERVISED LOCAL-FEATURE ALIGNMENT

Shraman Pramanick¹, Li Jing², Sayan Nag³, Jiachen Zhu⁴, Hardik Shah², Yann LeCun^{2,4}, Rama Chellappa¹
¹Johns Hopkins University ²Meta AI ³University of Toronto ⁴New York University
 {spraman3, rchella4}@jhu.edu, {ljjng, h3shah}@fb.com
 sayan.nag@mail.utoronto.ca, {jiachen.zhu, yann.lecun}@nyu.edu

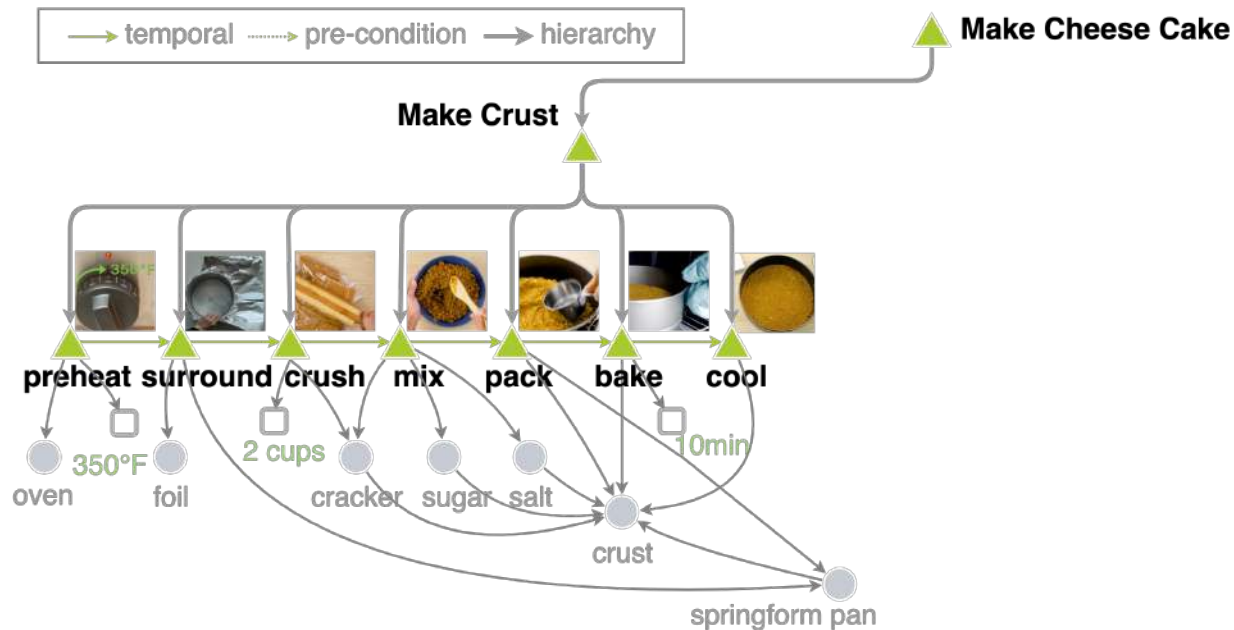
Quick Questions?



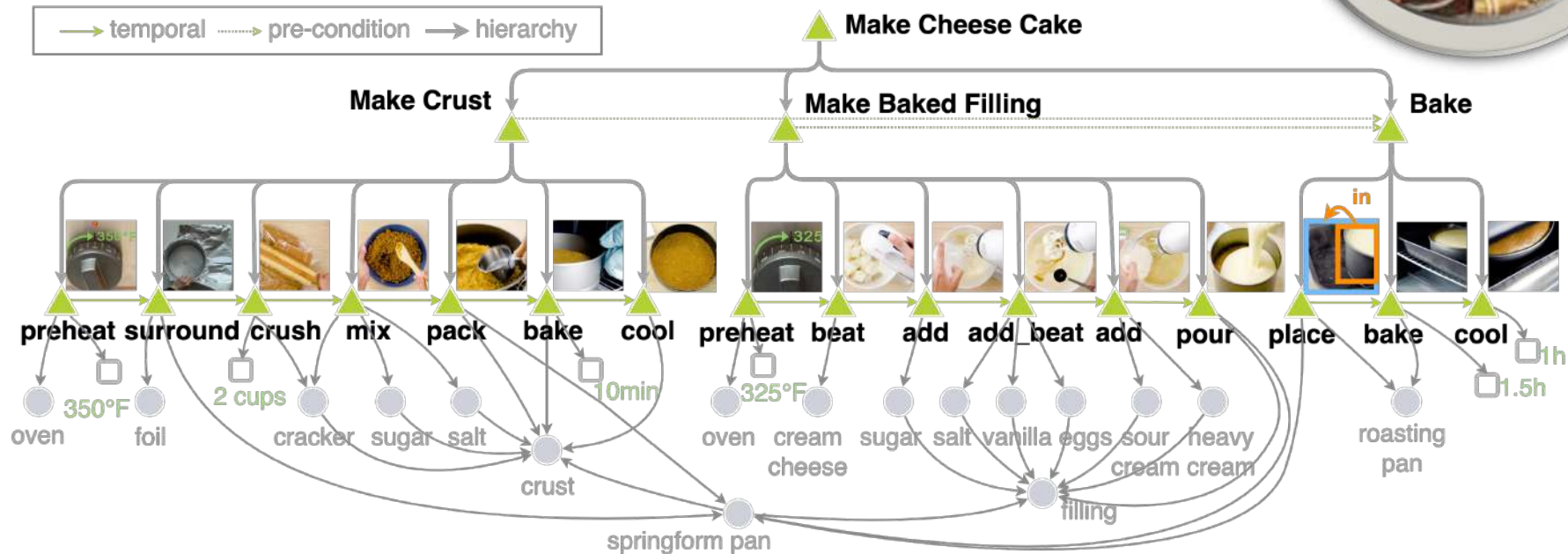
Challenge 2: Long-Horizon Temporal Dynamics



Procedure repeats itself



Procedure repeats itself



History repeats itself

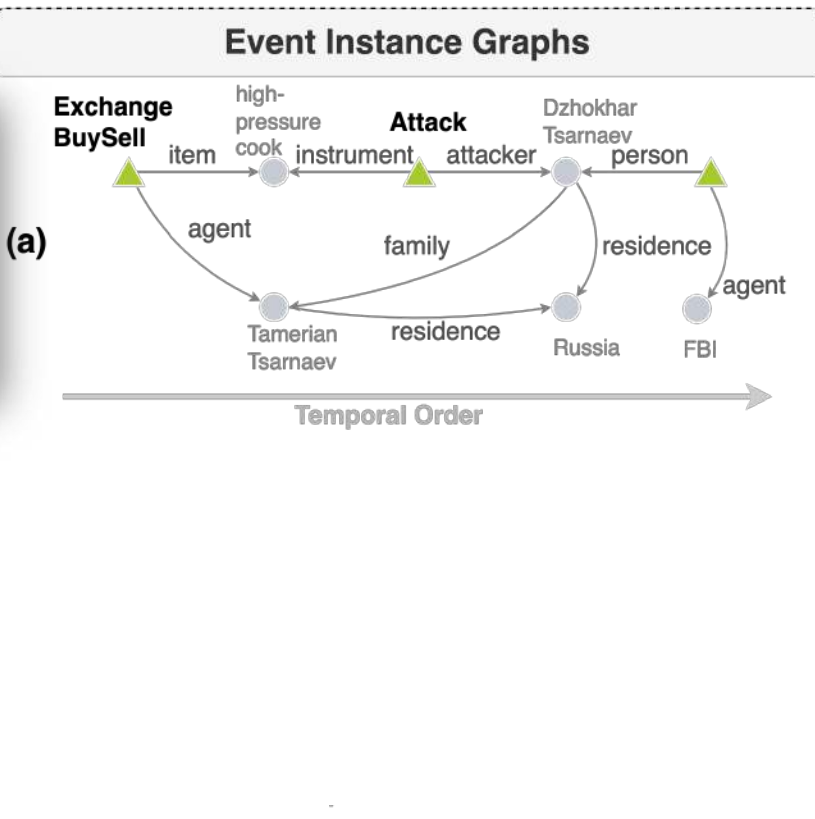
Boston Marathon bombing

From Wikipedia, the free encyclopedia Coordinates: 42°20′55.2″N 71°4′44.1″W

"*Boston attack*" redirects here. For the incident in 1770, see *Boston Massacre*.

"*Boston bomber*" redirects here. For the Douglas Boston bomber aircraft, see *Douglas A-20 Havoc*.

The **Boston Marathon bombing** was a domestic terrorist attack that took place during the annual Boston Marathon on April 15, 2013. Two terrorists, brothers Dzhokhar Tsarnaev and Tamerlan Tsarnaev, planted two homemade pressure cooker bombs, which detonated 14 seconds



History repeats itself

Boston Marathon bombing

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Suspect In Would-Be Airport Bombing Nabbed With Help From REI

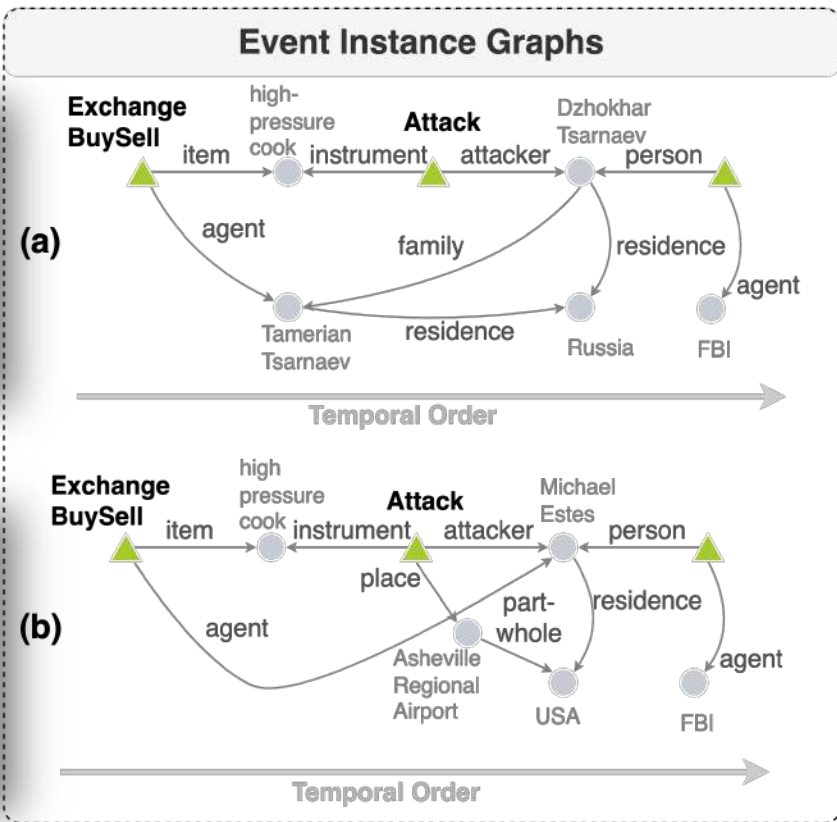
October 12, 2007 6:48 PM EDT

Someone left a bomb at the Asheville Regional Airport. That wasn't clear: The question was, who?

The airport in Asheville, N.C., serves tens of thousands of people every month. According to an affidavit, federal marshals called the FBI on Oct. 6 to request the presence of an improvised explosive device.

Both technicians examined the device, which was packed inside a glass jar. Both also noticed the presence of explosive material. Analysis determined that the bomb was powered by ammonium nitrate, packed with sticks to serve as a stopwatch, and set to go off on a timer — an alarm clock, minus its bells, set to 6 of dock.

As for the man who dropped it off, FBI investigators had surveillance footage — a white male wearing black clothes, with a black cap. He'd walked in after midnight and left a bag inside the building.

History repeats itself

Boston Marathon bombing

From Wikipedia, the free encyclopedia Coordinates: 42°20′52″N 71°14′44″W﻿ / ﻿42.34778°N 71.24556°W﻿ / 42.34778; -71.24556

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Suspect In Would-Be Airport Bombing Nabbed With Help From REI

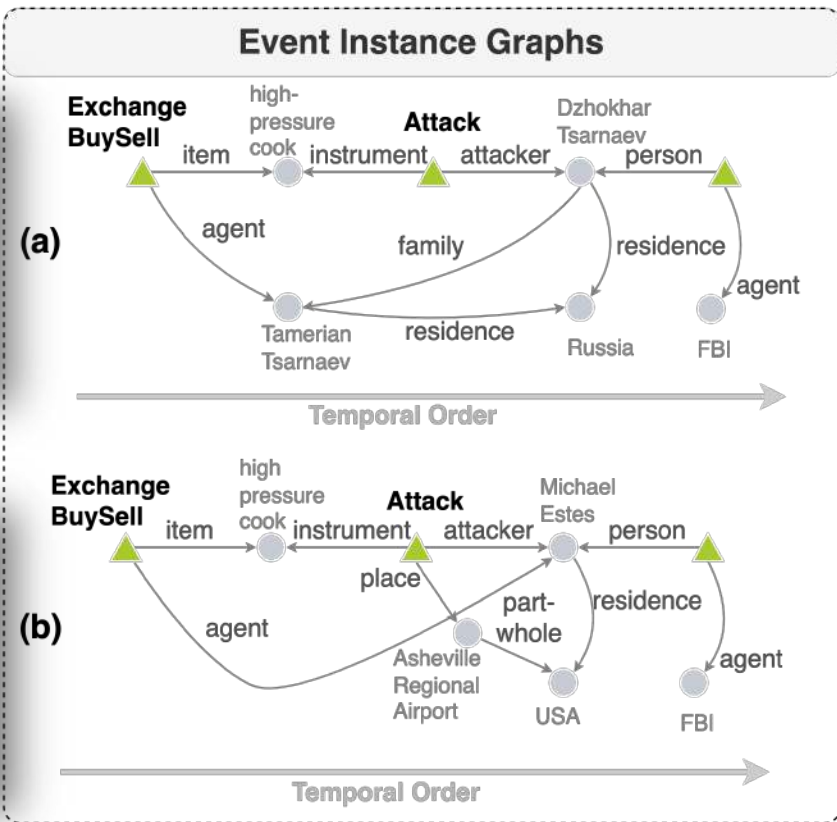
October 12, 2017 6:48 PM EDT LEADS & SOURCEBOOK

Someone left a bomb at the Asheville Regional Airport. That wasn't a hoax: The question was, who?

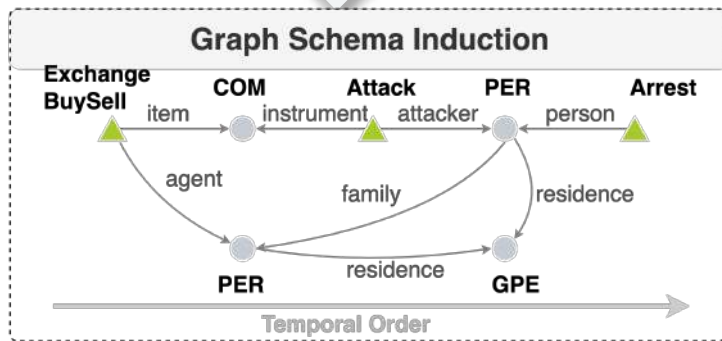
The airport in Asheville, N.C., serves tens of thousands of people every month. According to an affidavit, federal marshals called the FBI on Oct. 6 to report the presence of an improvised explosive device.

Both technicians reactivated the device, which was packed inside a glass jar. Bomb dogs indicated the presence of explosive material. Analysis determined that the bomb was powered by ammonium nitrate, packed with nails to serve as shrapnel, and set to go off on a timer — an alarm clock, minus its bells, set to 6 of dock.

As for the man who dropped it off, FBI investigators had surveillance footage — a white male wearing black clothes, with a black bag. He'd walked in after midnight and left a bag inside the building.

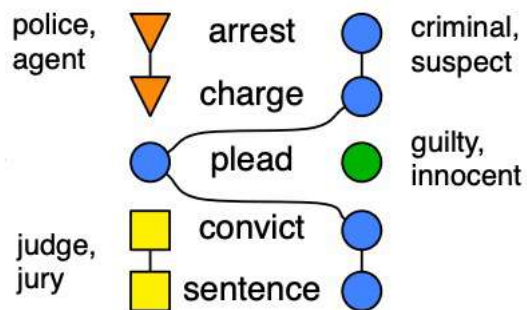



Frequently Recurring Pattern



What is Schema Induction?

Schemas, or **scripts**, were originally defined by (Schank and Abelson, 1975) as “a predetermined, stereotyped sequence of actions that defines a well-known situation”.



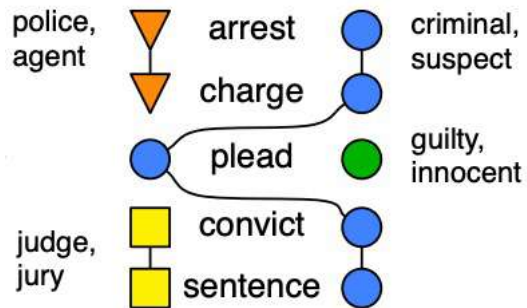
Previous Work:

Event Narrative Chain

[Chambers and Jurafsky, 2008, 2009, 2010]

Bottleneck

Schemas, or **scripts**, were originally defined by (Schank and Abelson, 1975) as “a predetermined, stereotyped sequence of actions that defines a well-known situation”.



Event Language Model ?

Previous Work:
Event Narrative Chain
[Chambers and Jurafsky, 2008, 2009, 2010]

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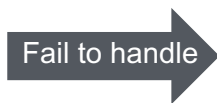
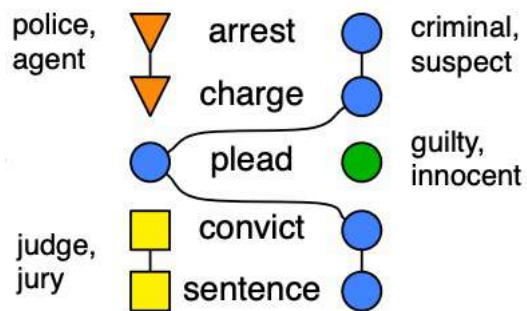
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Real-world Events

Multiple
Actors

Intertwined
Relations

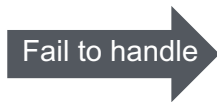
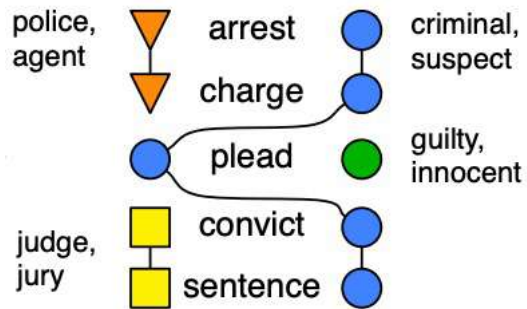
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Real-world Events

Multiple
Actors

Intertwined
Relations

Complex
Timelines

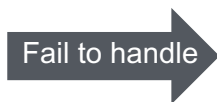
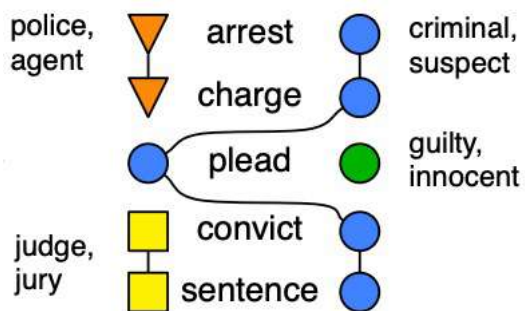
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Bottleneck

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Real-world Events

Multiple
Actors

Intertwined
Relations

Complex
Timelines

Alternative
Outcomes

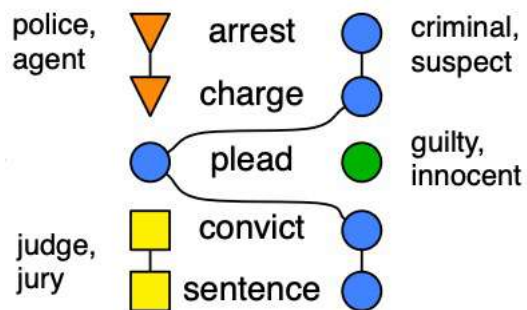
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My Solution: Event Graph Models as Schemas

Schemas, or **scripts**, were originally defined by (Schank and Abelson, 1975) as “a predetermined, stereotyped sequence of actions that defines a well-known situation”.



Event Language Model ?

Event Graph Model

Previous Work:

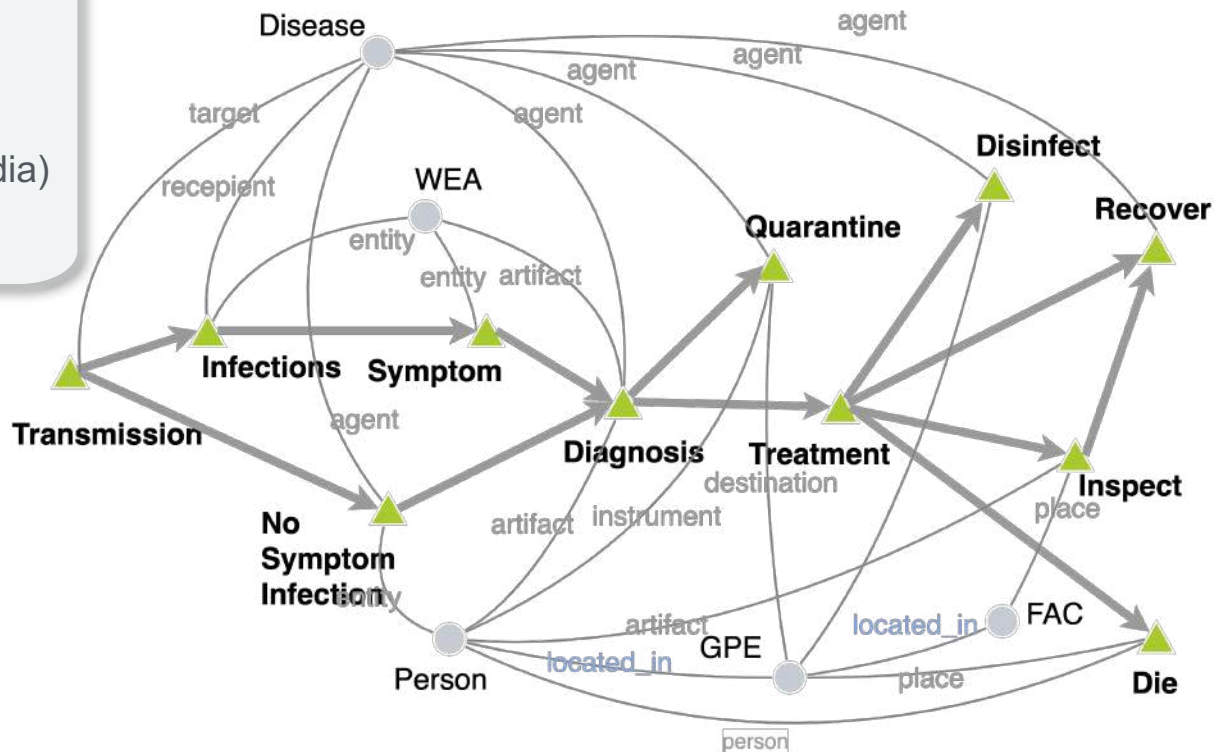
Event Narrative Chain

[Chambers and Jurafsky, 2008, 2009, 2010]

A new paradigm: Models as Schemas

Input:

Historical event graphs
(automatically extracted from Wikipedia)



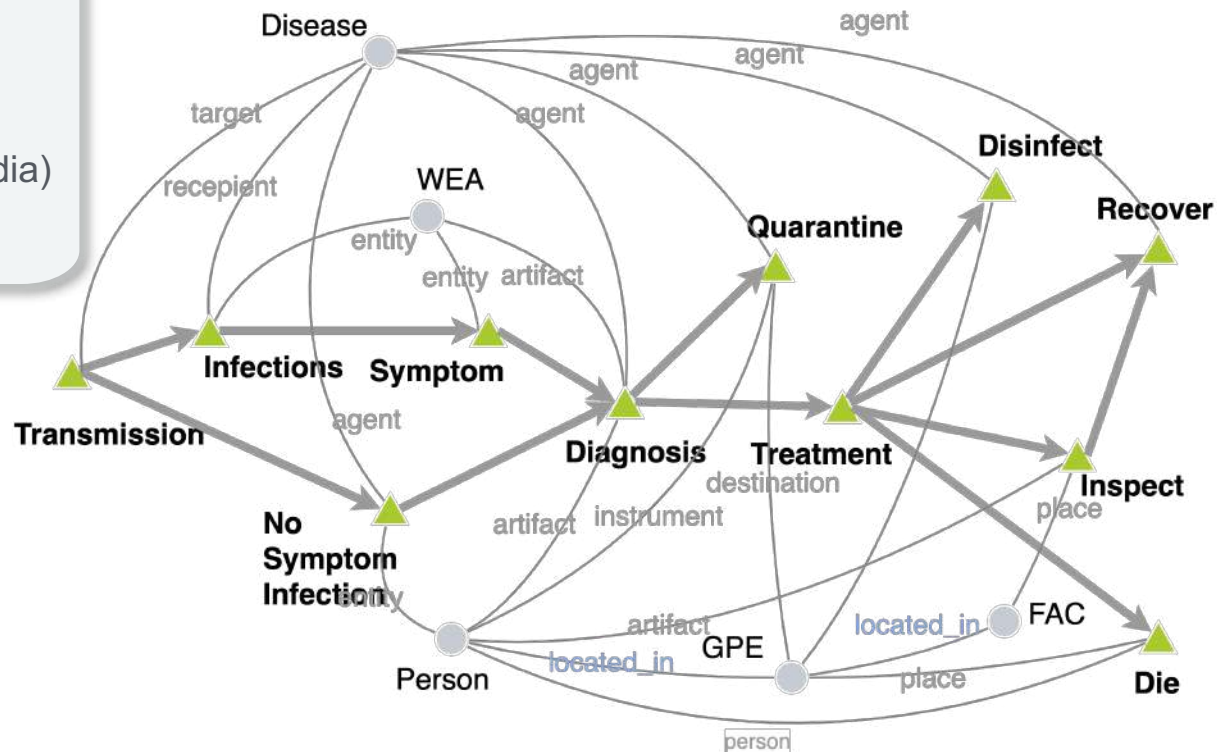
A new paradigm: Models as Schemas

Input:

Historical event graphs
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Output:

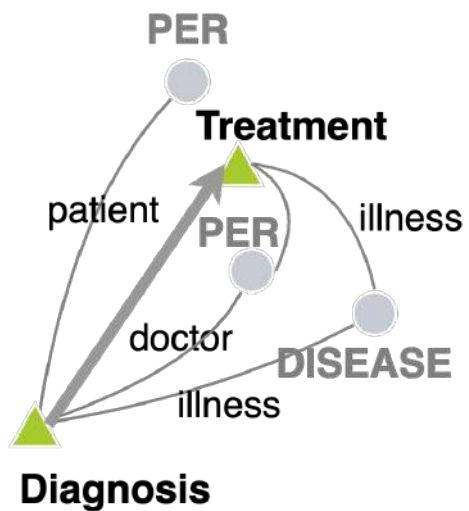
Schema
(frequent patterns)



Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i}).$$

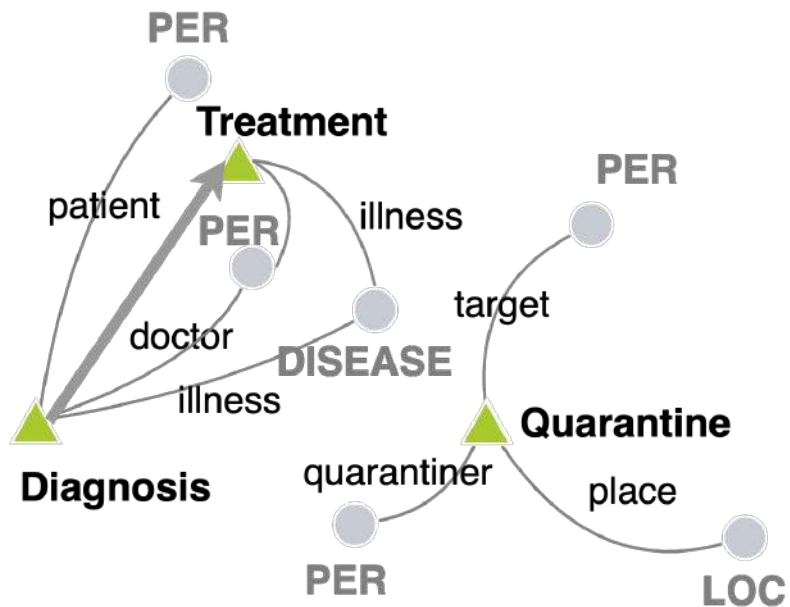


Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i}).$$

1 Event Node Generation



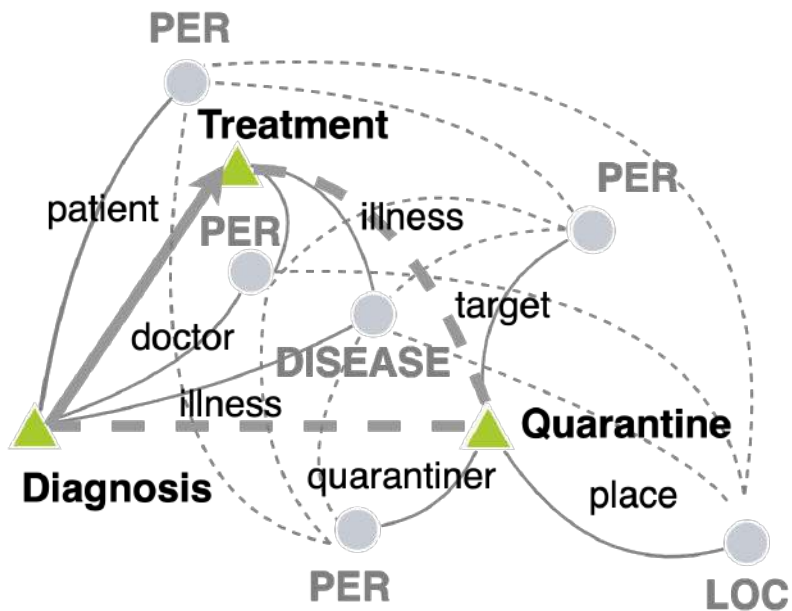
Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i}).$$

1 Event Node Generation

2 Message Passing

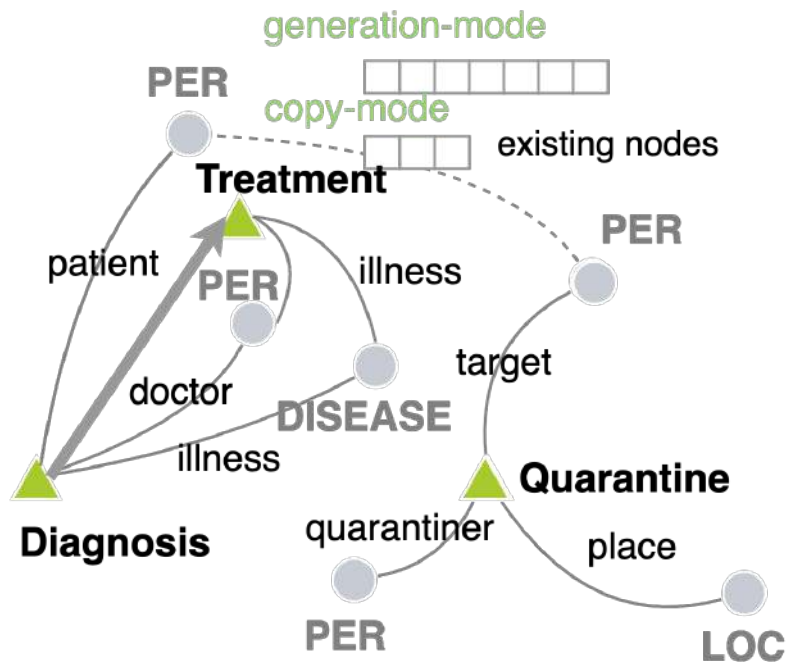


Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i}).$$

- 1 Event Node Generation
- 2 Message Passing
- 3 Argument Node Generation

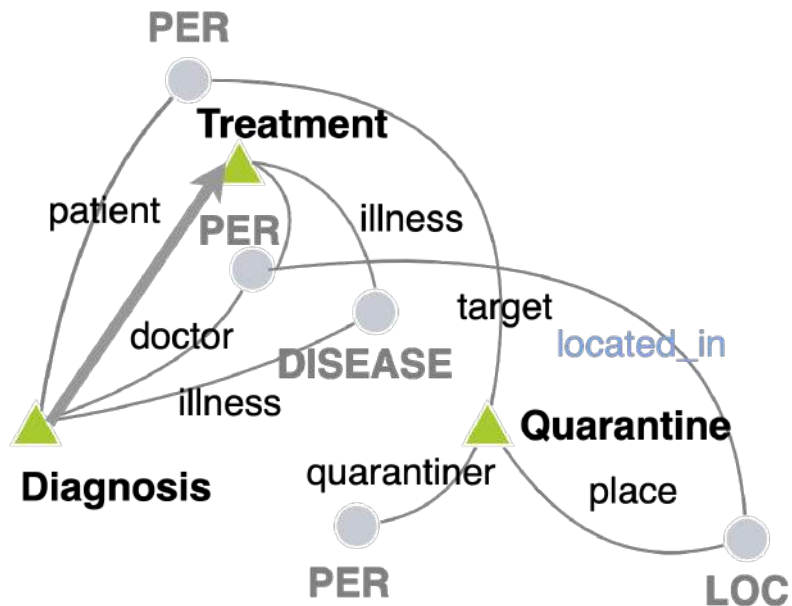


Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i}).$$

- 1 Event Node Generation
- 2 Message Passing
- 3 Argument Node Generation
- 4 Relation Edge Generation

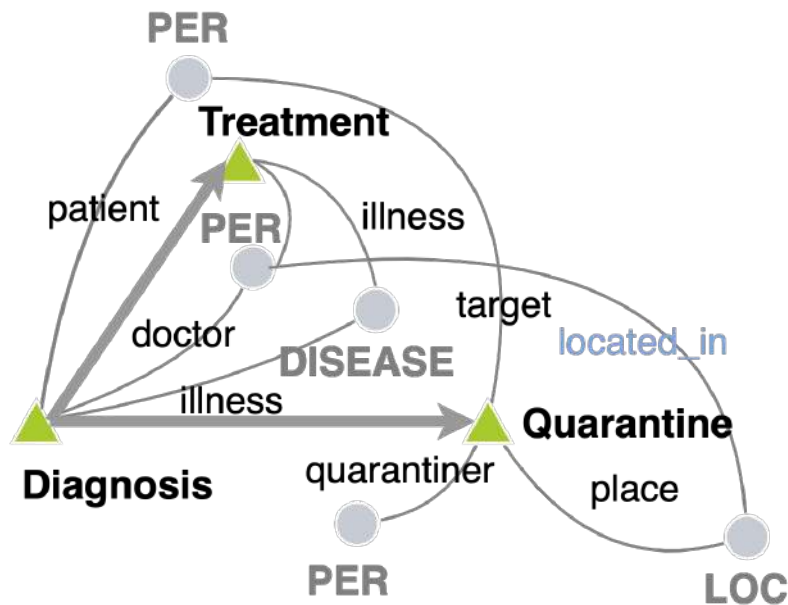


Event Graph Generative Model

Schemas are the hidden knowledge to control instance graph generation

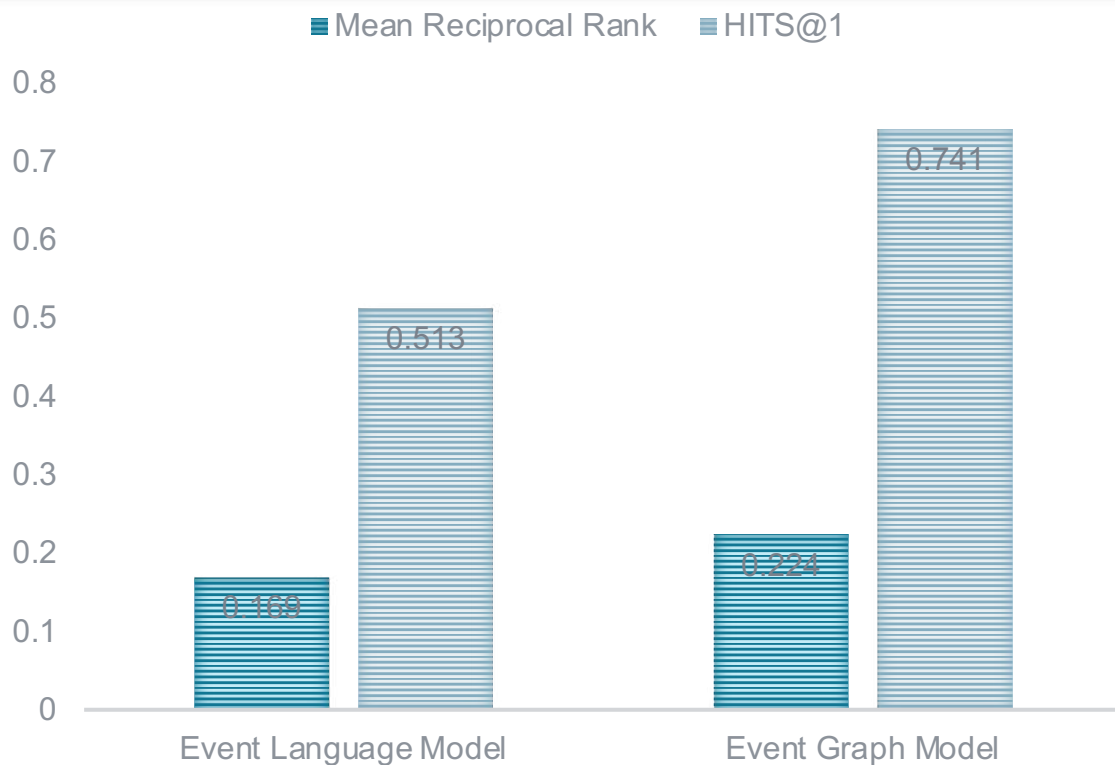
$$p(G) = \prod_{i=0}^{|\mathcal{E}|} p(G_i | G_{<i})$$

- 1 Event Node Generation
- 2 Message Passing
- 3 Argument Node Generation
- 4 Relation Edge Generation
- 5 Temporal Edge Generation



Evaluation: Event Prediction triples human schema

Schema-guided Event Prediction: The task aims to predict ending events.



Impact: Open doors to Event Graph Context

Corpus-based Event Induction
(Shen et al., 2021)

EcoNet
(Han et al., 2020)

Prototype Learning
(Deng et al., 2022)

Graph Autoencoder
(Jin et al., 2022)

...

What is Event Knowledge Graph: A Survey

Saiping Guan, Xueqi Cheng, Long Bai, Fujun Zhang, Zixuan Li, Yutao Zeng, Xiaolong Jin, and Jiafeng Guo

Abstract—Beside knowledge in the increasingly important quantitative investment and application view related representation summarize prospective directions to facilitate future research on EKG.

Index Terms—Event knowledge graph, schema, event acquisition, script event prediction, temporal knowledge graph prediction.

Survey paper following my new research direction

Event Graph

Models as Schemas

Visual Goal-Step Pred
(Yang et al., 2022)

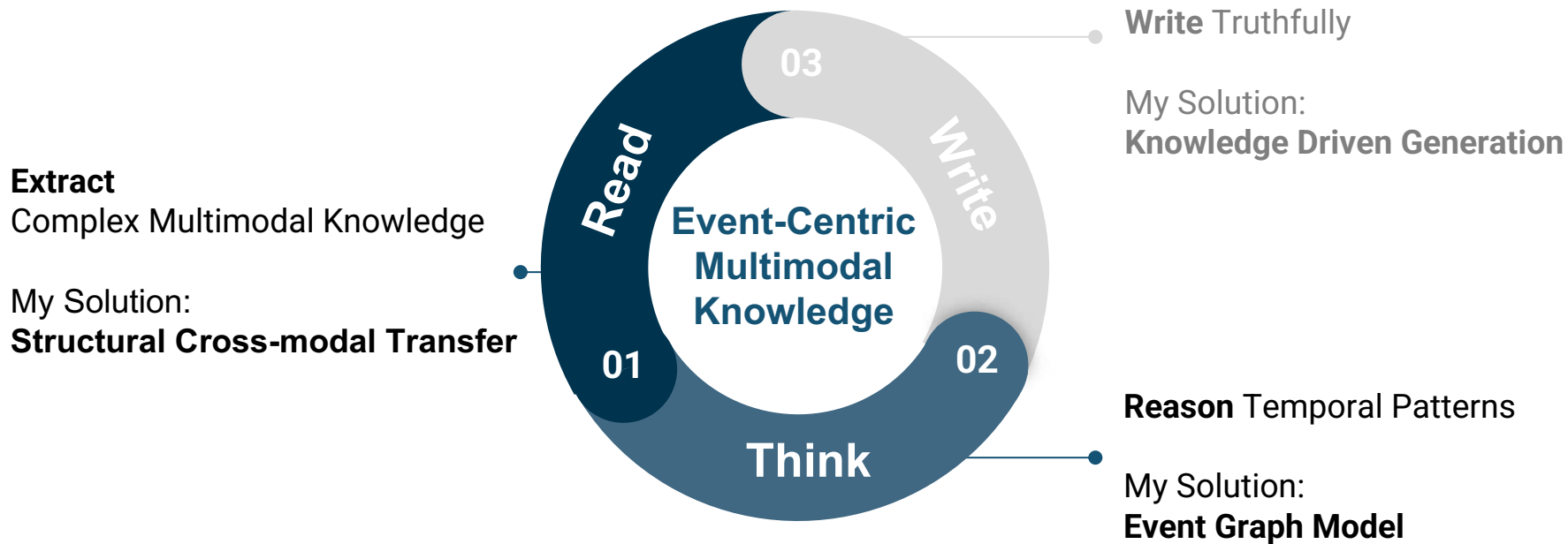
Goal-oriented script construction
(Lyu et al., 2021)

Saliency-aware event chain
(Zhang et al., 2021)

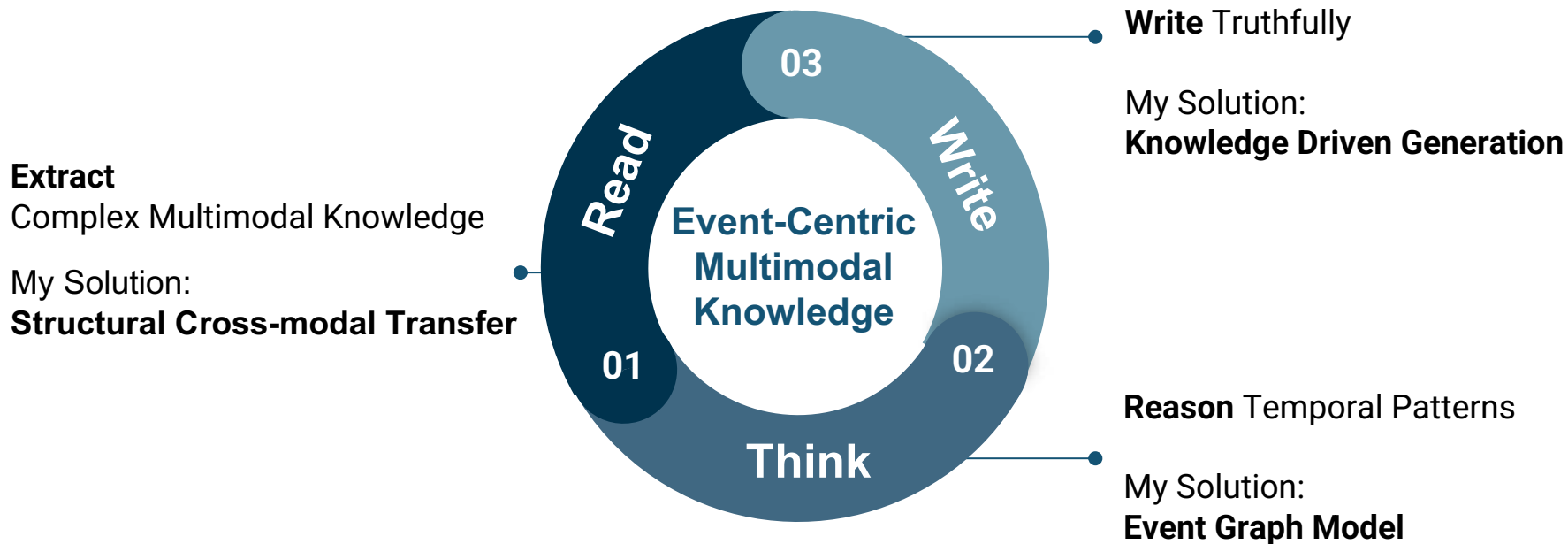
Association Rules in big graphs
(Fan et al., 2022)

...

Quick Questions?



Research Direction 3



Timeline Summarization: Extreme Long Context [EMNLP'21]

Goal: Summarize hundreds or thousands of input documents into a timeline.

Input Documents

2009-06-27

There was no sign of foul play in the death of Michael Jackson.....A recording of the telephone call made to emergency services has been released , in which the caller said Jackson was unconscious and had stopped breathing.

Born : August 29, 1958, Gary, Indiana, US.
Also known as : The King of Pop

2009-06-27

Police also want to speak to Jackson's doctor who witnessed his collapse

On Friday night thousands of fans came together in London's Trafalgar Square to light candles and sing some of his biggest hits

2009-06-28

She said Dr Murray had traveled in ambulance with Jackson after he collapsed last Thursday ...

Dr Murray had been hired by Jackson in May to accompany him as he prepared to embark on a gruelling series of 50 concerts in London in July

2009-06-28

Jackson family left speechless and devastated by star's death. Los Angeles police investigating the death of Michael Jackson say they have carried out an extensive interview with his doctor, Conrad Murray

2009-06-28

Jackson's body was released to the family on Friday night. A spokeswoman for Dr Murray said he had been interviewed for three hours by police on Saturday He owes it to the family and to the public to say: ' These were the last hours of Michael's life and here's what happened' . "

2009-06-29

Paramedics were called to Jackson' s Los Angeles mansion while Dr Murray was performing CPR , according to a recording of the 911 call

2009-07-22

The Houston clinic of Michael Jackson 's doctor has been searched by drug police looking for evidence of manslaughter

Dr Murray 's spokeswoman told the BBC the raid was a surprise to us and it was a surprise to the attorneys.

2009-07-28

Police raid Jackson doctor 's home

.....

2009-07-30

Jackson died at his Los Angeles home on 25 June aged 50

.....

Event Graph
Construction

Graph
Compression

Output Timeline

2009-06-25

Dr Murray finds Jackson unconscious in the bedroom of his Los Angeles mansion. Paramedics are called to the house while Dr Murray is performing CPR , according to a recording of the 911 emergency call . He travels with the singer in an ambulance to UCLA medical center where Jackson later dies .

2009-06-28

Los Angeles police interview Dr Murray for three hours. His spokeswoman insists he is not a suspect".

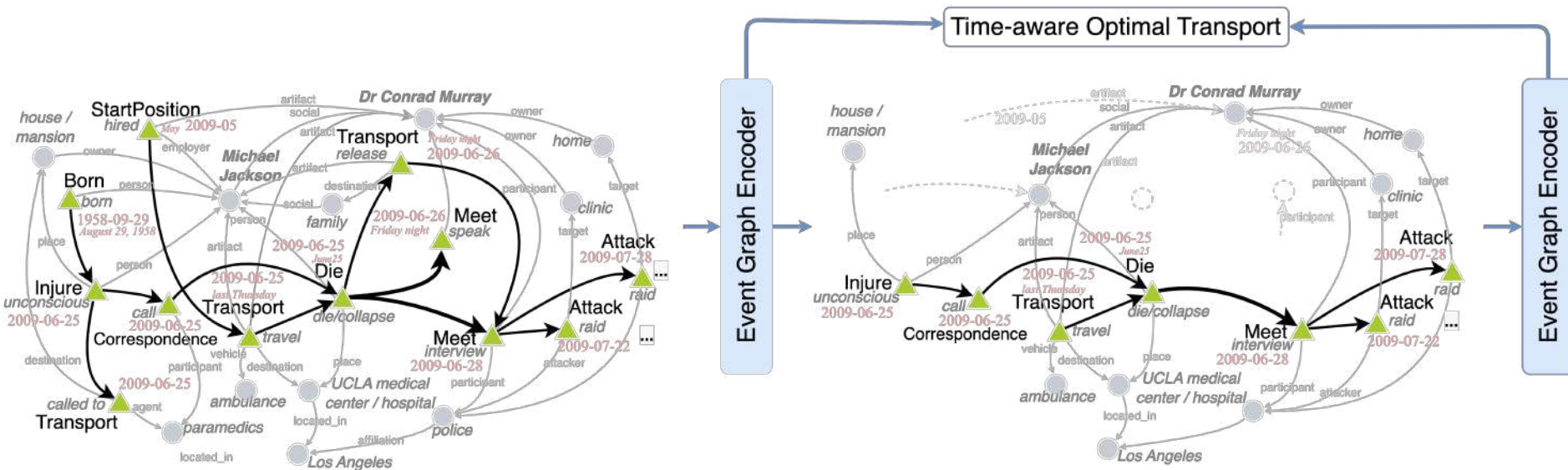
2009-07-22

The doctor 's clinic in Houston is raided by officers from the Drug Enforcement Agency -LRB- DEA -RRB- looking for evidence of manslaughter .

Event Graph Compression with Optimal Transport (OT)

Optimization Goal: minimize the distance between summary graph and original graph

Constraint: Only select $k\%$ (e.g. 5%) nodes to summary graph.



Example Results on Timeline Summarization

Event Graph demonstrate strong power in improving event facts coverage.

2011-02-15

Protests began February 15 in the eastern city of Benghazi , Libya 's second largest . Witness says square in Benghazi is full of protesters , but there is little sign of police or military Tanks surrounded demonstrators in Benghazi , a protester says 50 reportedly **killed** since Tuesday , 20 of them Friday U.S. president condemns the government crackdowns in Libya , Bahrain and Yemen (CNN) – At least 20 people were **killed** and 200 more were **injured** Friday in the northern Mediterranean city of Benghazi , Libya 's second-largest , said a medical source in Benghazi who was not identified for security reasons .

2011-02-21

Among other things , Washington was taking a close look at a speech early Monday by Saif al-Islam Gadhafi – the Libyan leader 's son – which included warnings of a civil **war** if **demonstrations** in the North African country do n't stop . The United States on Monday condemned the violence in Libya and called for a halt to the " unacceptable bloodshed " in response to civil unrest , Secretary of State Hillary Clinton said in a statement .

Baseline

2011-02-16

Source : Several people **arrested** after police confronted **protesters** in Benghazi , Libya .

2011-02-18

An Iranian opposition member warns that street **protests** could lead to civil **war** " Nastaran " warns that **protests** are strengthening Iran ' s Revolutionary Guard and pro - government militia.

2011-02-19

A Libyan woman supportive of the **protesters** , who was not identified to protect her safety , told CNN that army soldiers on Saturday initially claimed solidarity with the **demonstrators** , only to reverse their tack and open **fire** on the crowd .

Three of those **injured** are in critical condition , the sources said .

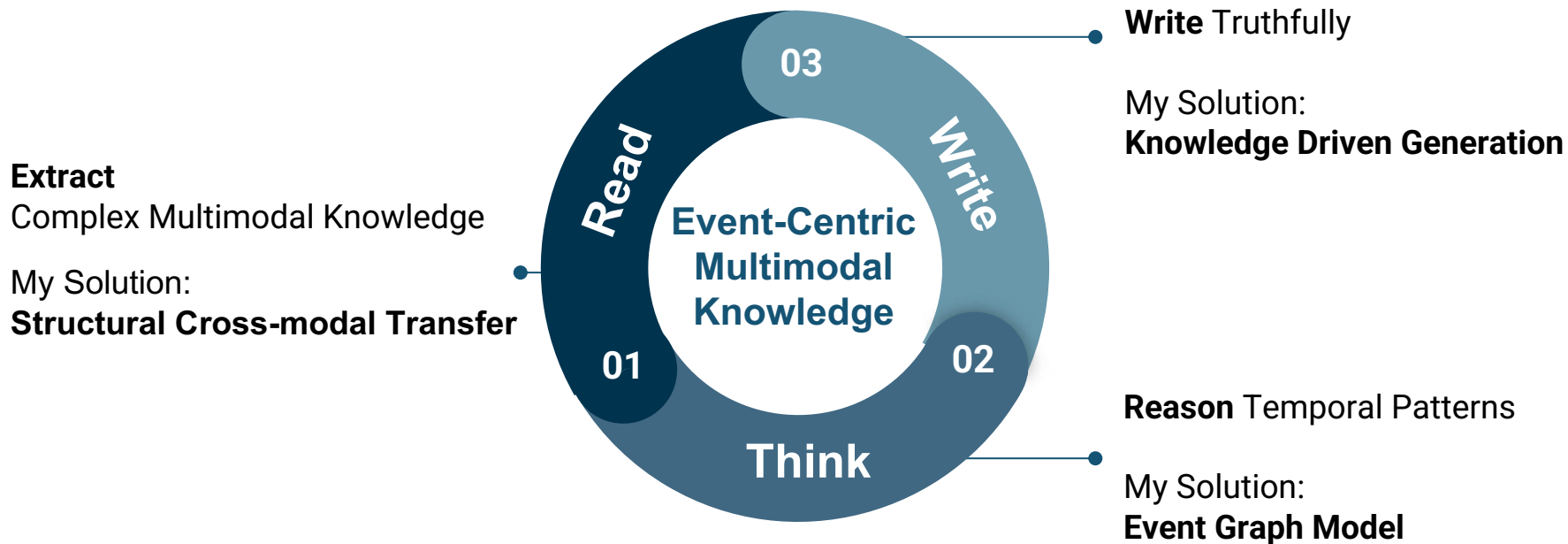
While Human Rights Watch , citing interviews with hospital staff and witnesses , reported 84 **deaths** since Tuesday , the total number is unknown and could n ' t be independently confirmed by CNN .

2011-02-20

Protests continue to turn **violent** , however the **death** and **injury** toll is unclear .

Ours

Research Contributions



Research Contributions

New Research Direction:

- **Event-Centric Multimodal Knowledge** (next generation of information access)

New Research Hypothesis:

- **Complex Multimodal Knowledge** ← Cross-modal Structural Transfer
- **Long-horizon Temporal Dynamics** ← Event Graph Schema Model

Knowledge for Truthful Generation: Timeline Summarization, ...

Received broad attention in the community

What is Event Knowledge Graph: A Survey

Saiping Guan, Xueqi Cheng, Long Bai, Fujun Zhang, Zixuan Li, Yutao Zeng, Xiaolong Jin, and Jiafeng Guo

Abstract—Besides entity-centric knowledge, usually organized as Knowledge Graph (KG), events are also an essential kind of knowledge in the world, which trigger the spring up of event-centric knowledge representation form like Event KG (EKG). It plays an increasingly important role in many downstream applications, such as search, question-answering, recommendation, financial quantitative investments, and text generation. This paper provides a comprehensive survey of EKG from history, ontology, instance, and application views. Specifically, to characterize EKG thoroughly, we focus on its history, definition, schema induction, acquisition, related representative graphs/systems, and applications. The development processes and trends are studied therein. We further summarize prospective directions to facilitate future research on EKG.

Index Terms—Event knowledge graph, schema, event acquisition, script event prediction, temporal knowledge graph prediction.

Multi-Modal Knowledge Graph Construction and Application: A Survey

Xiangru Zhu, Zhixu Li *Member, IEEE*, Xiaodan Wang, Xueyao Jiang, Penglei Sun, Xuwu Wang, Yanghua Xiao *Member, IEEE*, Nicholas Jing Yuan *Member, IEEE*,

Abstract—Recent years have witnessed the resurgence of knowledge engineering which is featured by the fast growth of knowledge graphs. However, most of existing knowledge graphs are represented with pure symbols, which hurts the machine's capability to understand the real world. The multi-modalization of knowledge graphs is an inevitable key step towards the realization of human-level machine intelligence. The results of this endeavor are Multi-modal Knowledge Graphs (MMKGs). In this survey on MMKGs constructed by texts and images, we first give definitions of MMKGs, followed with the preliminaries on multi-modal tasks and techniques. We then systematically review the challenges, progresses and opportunities on the construction and application of MMKGs respectively, with detailed analyses of the strengths and weaknesses of different solutions. We finalize this survey with open research problems relevant to MMKGs.

Research Contributions

New Research Direction:

- **Event-Centric Multimodal Knowledge** (next generation of information access)

New Research Hypothesis:

- **Complex Multimodal Knowledge** ← Cross-modal Structural Transfer
- **Long-horizon Temporal Dynamics** ← Event Graph Schema Model

Knowledge for Truthful Generation: Timeline Summarization, ...



DARPA Riser

Invited Presentation at
DARPA Forward Event



Transition

10-year Milestone
Demo Day (NS-CTA)



Ranked 1st at TAC
SM-KBP TA1
(led 19 students)

Microsoft[®]



Microsoft PhD
Fellowship

IBM



US Patent

EE CS Rising Star



ACL'20 Best Demo Paper



NAACL'21 Best Demo Paper

Open-source Multimodal Information Extraction System

[Manling Li, et al., ACL 2020 Best Demo Paper; led 19 students to develop it]

GAIA at SM-KBP 2020 - A Dockerized Multi-media Multi-lingual Knowledge Extraction, Clustering, Temporal Tracking and Hypothesis Generation System

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⁵ University of Florida daisyw@ufl.edu

- ARL Transition
- ARL Demo Day
- AFRL Transition
- DARPA Demo Day
- DARPA Riser in 2022
- Ranked 1st at TAC SM-KBP 2019 and 2020 Evaluation (10% higher than the second ranked team in 2019)
- Publicly Available at <http://blender.cs.illinois.edu/software/gaia-ie>



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



USC University of
Southern California
Information Sciences Institute



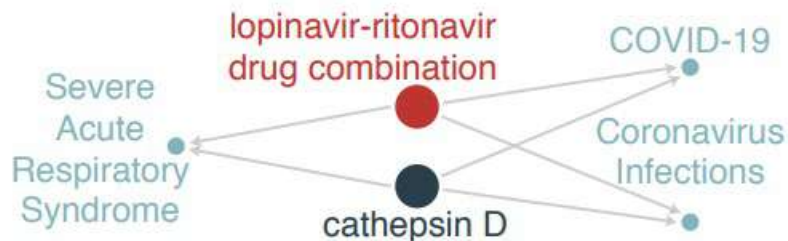
COLUMBIA
UNIVERSITY



UNIVERSITY of
FLORIDA

COVID-19 Literature Knowledge Graph Construction

[Qingyun Wang, Manling Li, et al., NAACL 2021 Best Demo Paper]

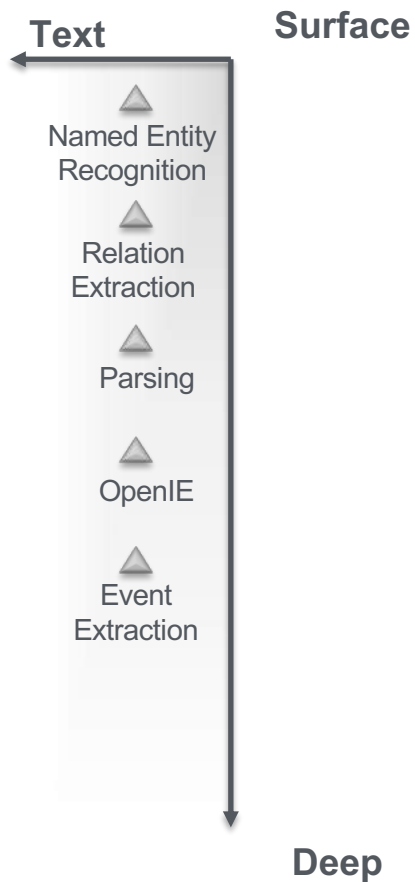


- Help with drug re-purposing report generation during collaborations with Prof David Liem from UCLA Data Science in Cardiovascular Medicine.
- Widely used by other researchers, the KB has downloaded more than 2000 times.

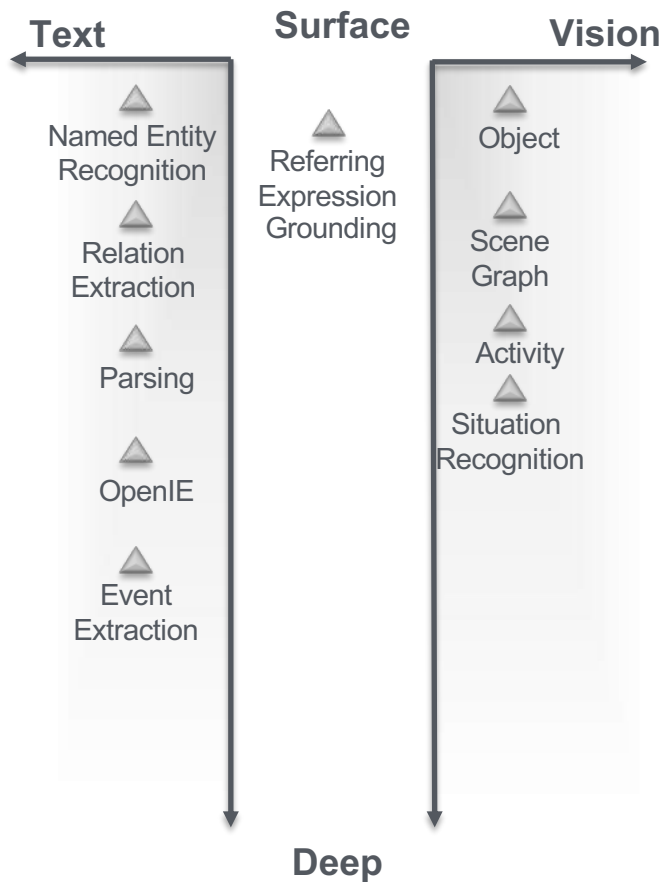
Question	Example Answers	
Q1	Drug Class	angiotensin-converting enzyme (ACE) inhibitors
	Disease	hypertension
	Evidence Sentences	[PMID:32314699 (PMC7253125)] Past medical history was significant for hypertension, treated with amlodipine and benazepril, and chronic back pain. [PMID:32081428 (PMC7092824)] On the other hand, many ACE inhibitors are currently used to treat hypertension and other cardiovascular diseases. Among them are captopril, perindopril, ramipril, lisinopril, benazepril, and moexipril.

Publicly Available at
<https://blender.cs.illinois.edu/covid19/>

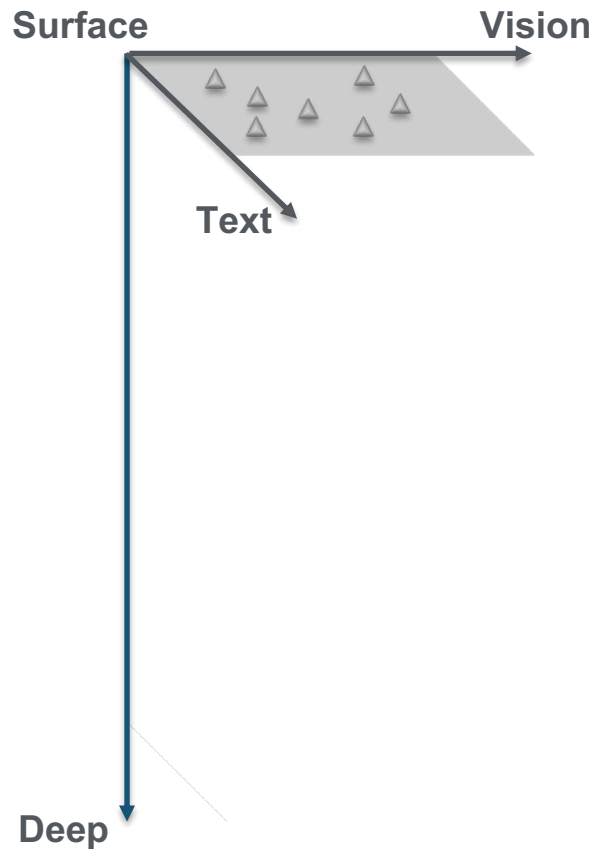
Future Research: Next Generation of Information Extraction (IE)



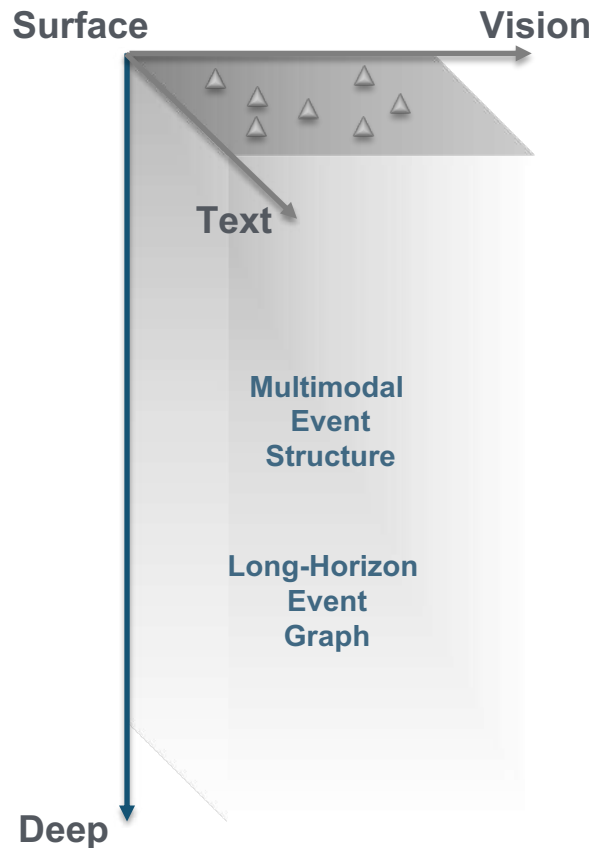
Future Research: Next Generation of Information Extraction (IE)



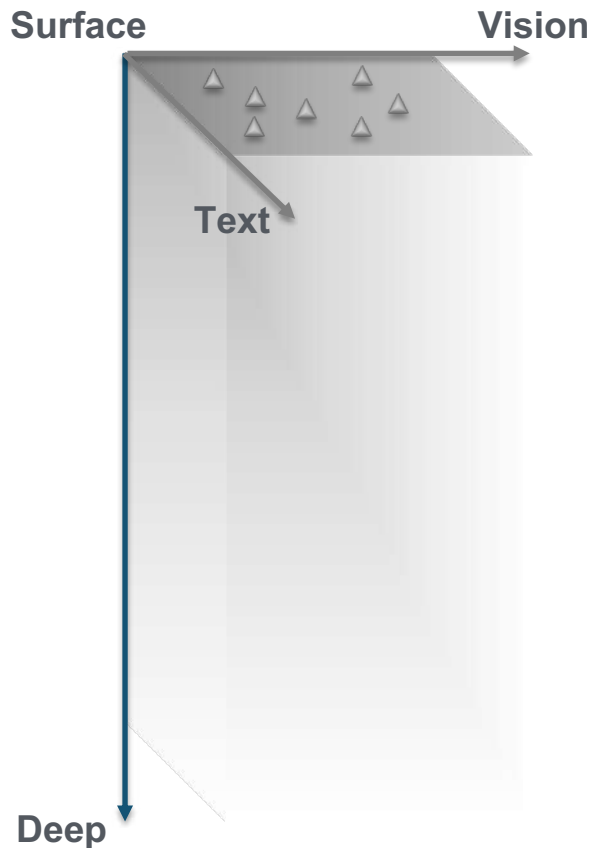
Future Research: Next Generation of Information Extraction (IE)



Future Research: Next Generation of Information Extraction (IE)



Future Research: Next Generation of Information Extraction (IE)



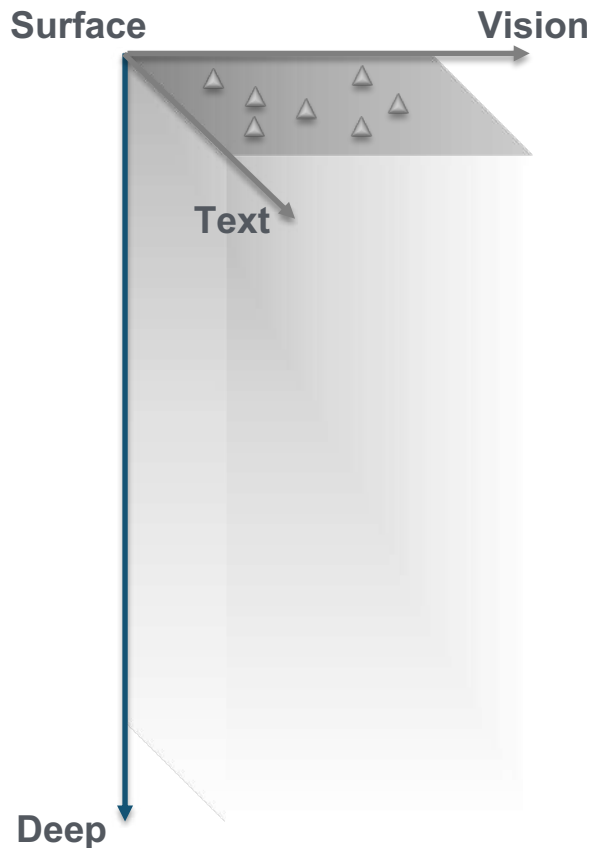
The Beauty of IE

Knowledge-Intense
Structure

Long Context

Compositional

Future Research: Next Generation of Information Extraction (IE)



The Beauty of IE

Knowledge-Intense
Structure

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Compositional

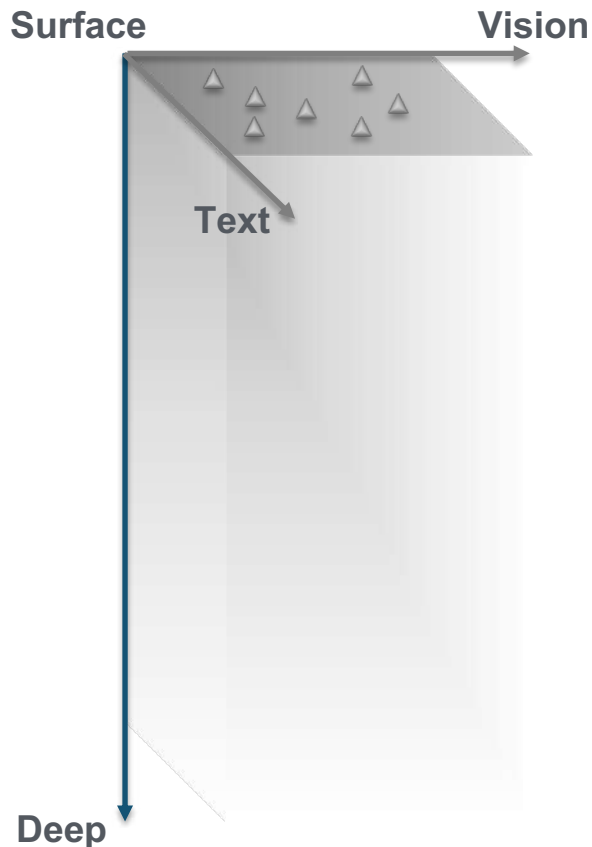
The Bottleneck of IE

Structure Annotation

Limited Ontology

Performance

Future Research: Next Generation of Information Extraction (IE)



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Performance

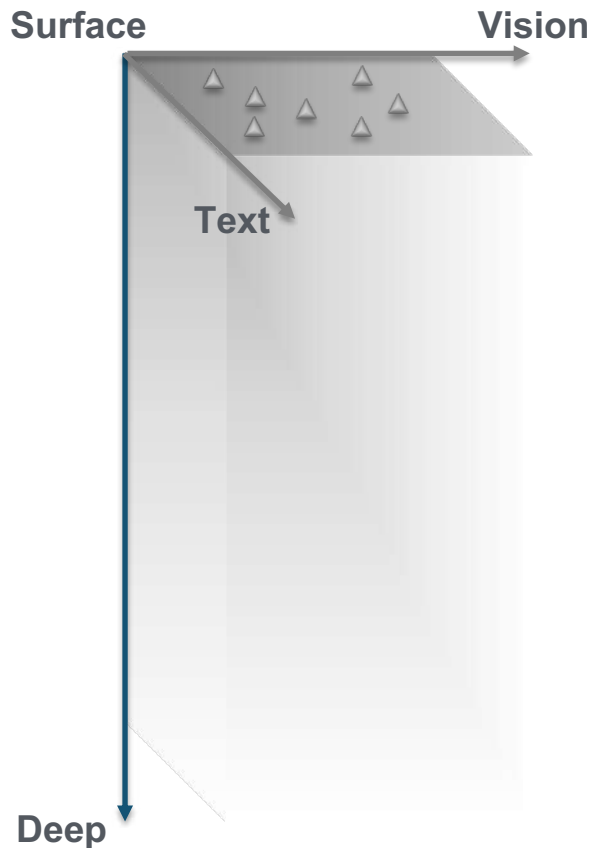
Future: Universal IE

Factual

Multimodal

Situational

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Future: Universal IE

Factual

Corpus-level

Cross-Validation

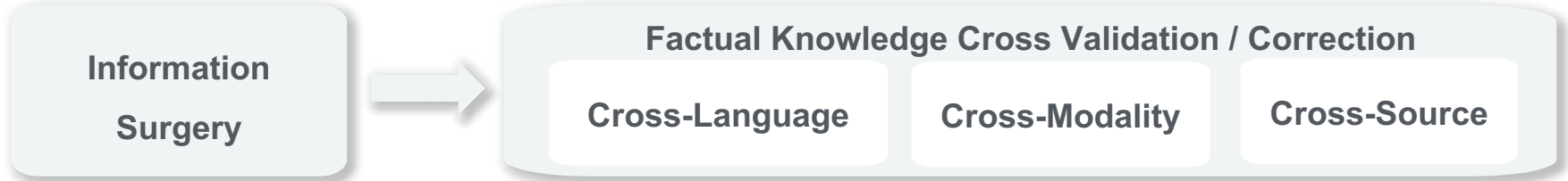
Multimodal

Situational

Future Research 1

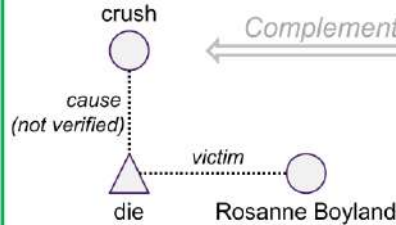
Factuality, Evidence and Truth in Information Access

Potential Collaborations: Prof Kris Hammond, Prof Ken Forbus, Prof Samir Khuller, Prof Han Liu, Prof Haoqi Zhang, Prof Matthew Kay, Prof Lawrence Birnbaum, et al



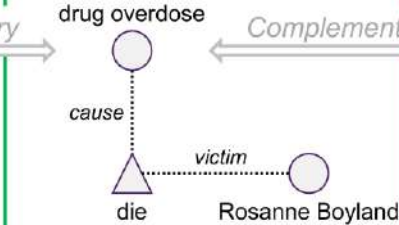
Real News 1

...Rosanne Boyland, a 34-year-old Trump supporter from Georgia who died during the attack on the Capitol on Jan. 6, appears to have been killed in a crush of fellow rioters...The chief medical examiner of Washington, D.C., said Boyland's cause and manner of death are "pending". ...



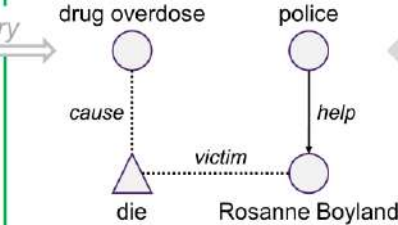
Real News 2

...The medical examiner ruled that Rosanne Boyland, 34, of Kennesaw, Ga., died of accidental acute amphetamine intoxication. ...The drug cited in Boyland's death is addictive and can be prescribed to treat attention-deficit disorder and narcolepsy. ...



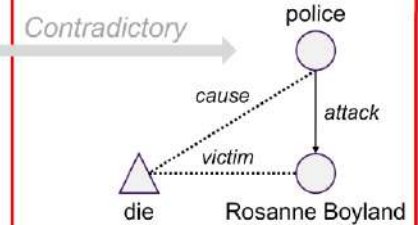
Real News 3

...Officer A.W. stepped out of a tunnel where police were congregated and into the crowd to help Rosanne Boyland, 34, a rioter and QAnon supporter who was trampled by the mob. She died of an accidental drug overdose, according to Washington, DC's chief medical examiner. ...



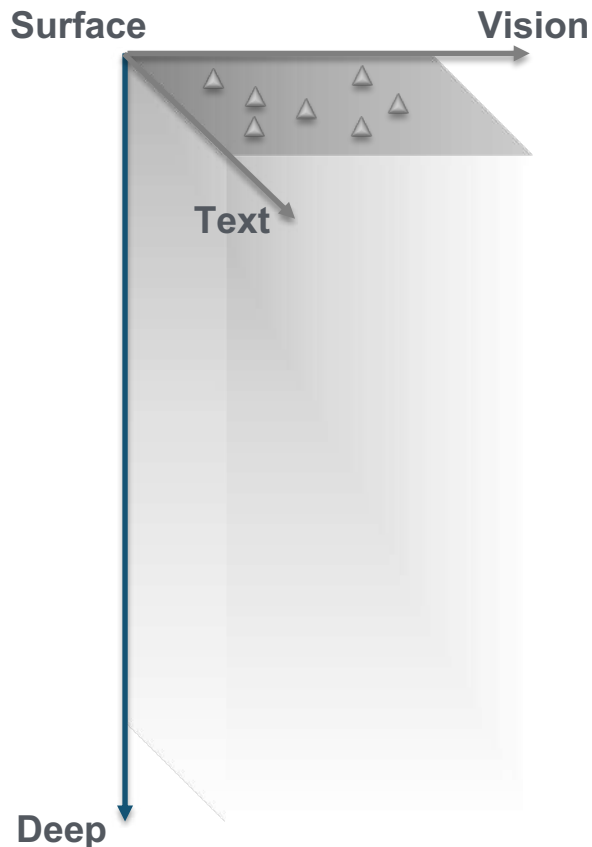
Fake News

Newly-released video from the Jan. 6 U.S. Capitol display appears to show U.S. Capitol police kicking 34-year-old Rosanne Boyland to death. ...This video seems to confirm previous reports from The Gateway Pundit suggesting that Boyland was killed by U.S. Capitol police. ...



Shared across all news

Future Research: Next Generation of Information Extraction (IE)



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The Bottleneck of IE

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Limited Ontology

Performance

Future: Universal IE

Factual

Corpus-level

Cross-Validation

Multimodal

Text

Vision + Robotics + Sensor

Situational

Future Research 2: Modeling the semantics of vision world and physical world

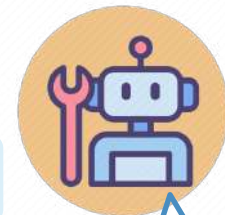
Potential Collaborations: Prof Ken Forbus, Prof Mike Rubenstein, Prof Brenna Argall, Prof Larry Birnbaum, Prof Emma Alexander, Prof Michael S. Horn, Prof Lawrence Birnbaum, et al



pushed behind (blue chair; red chair)
pushed behind (yellow chair; blue chair)
placed on (book; chair in front of blue chair)

Q: A blue chair is pushed behind a red chair, a yellow chair is pushed behind the blue chair, and a book is placed on the chair in front of the blue chair. What color is the chair that the book is on?

Answer:

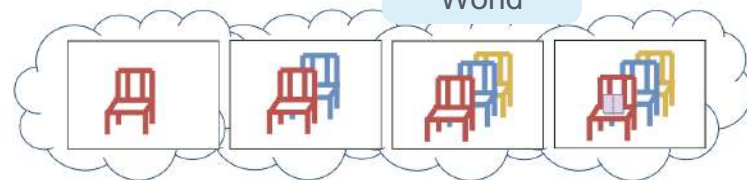


Event World

Language World

The book is on the red chair.

Physical World



Compositional

COVID
Vaccination

Vaccination

social
distance

Open-World

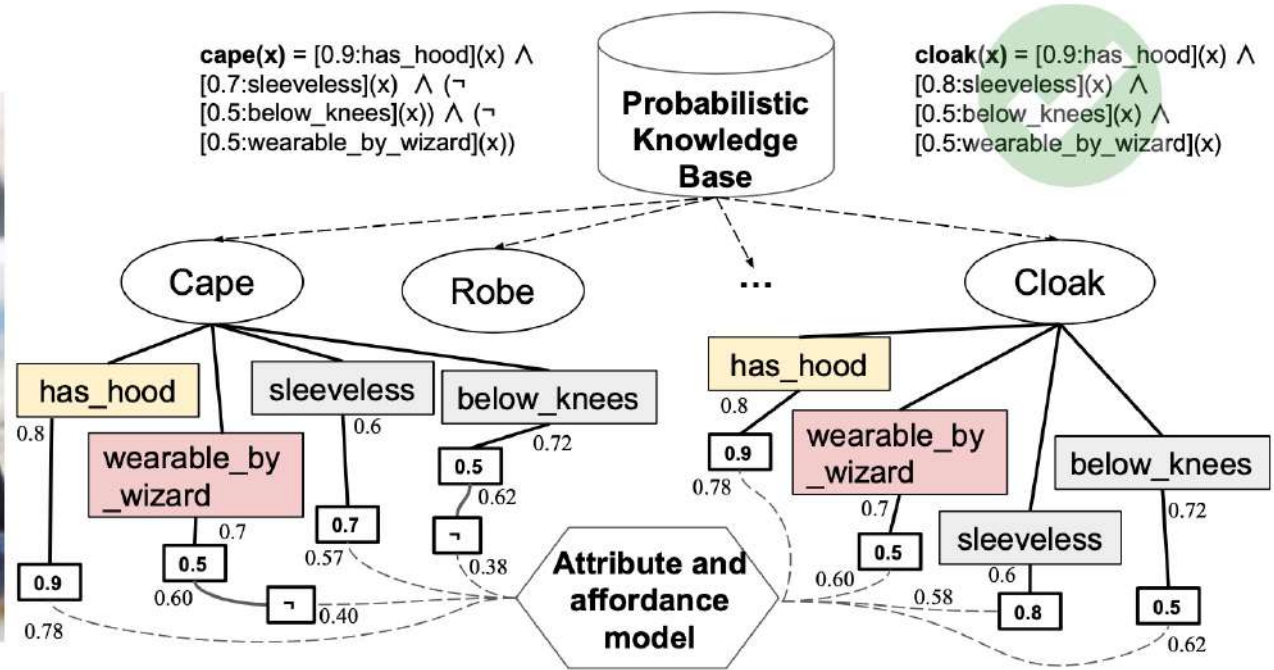
medical
personnel

injection

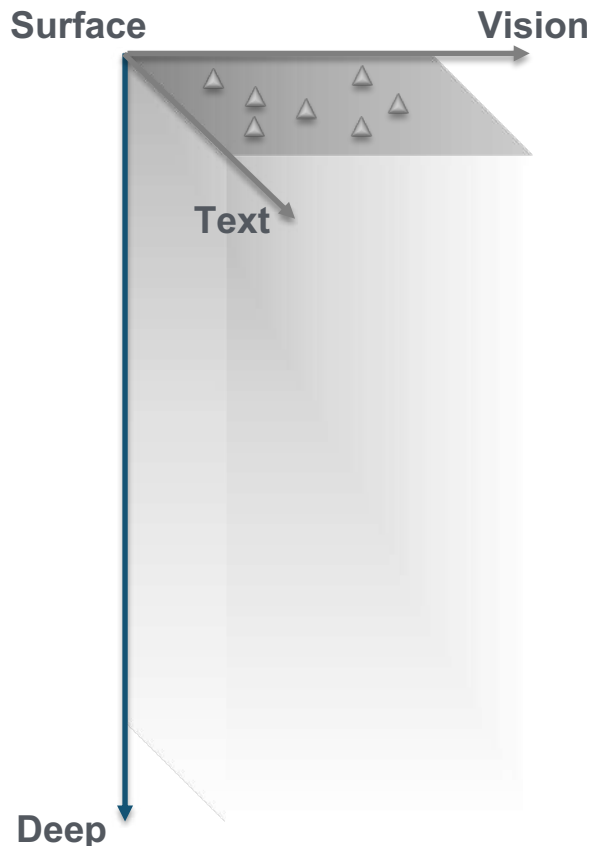
Future Research 2: Modeling the semantics of vision world and physical world

Potential Collaborations: Prof Ken Forbus, Prof Mike Rubenstein, Prof Brenna Argall, Prof Larry Birnbaum, Prof Emma Alexander, Prof Michael S. Horn, Prof Lawrence Birnbaum, et al

Image and object bounding box



Future Research: Next Generation of Information Extraction (IE)



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Factual

Corpus-level

Cross-Validation

Multimodal

Text

Vision + Robotics + Sensor

Situational

Semi-structured

External Context

Future Research 3

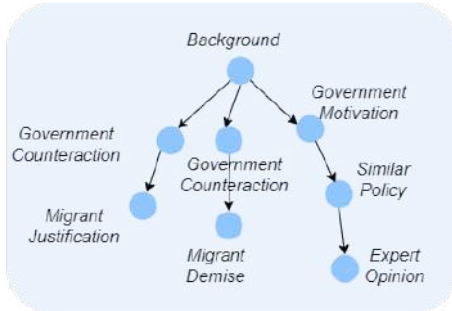
Explainable Knowledge Reasoning via Semi-Structured Graph

Potential Collaborations: Prof Ken Forbus, Prof Kris Hammond, Prof Chris Riesbeck, Prof Jessica Hullman, Prof Han Liu, Prof Samir Khuller, Prof Brent J. Hecht, Prof Aravindan Vijayaraghavan, Prof Matthew Kay, et al

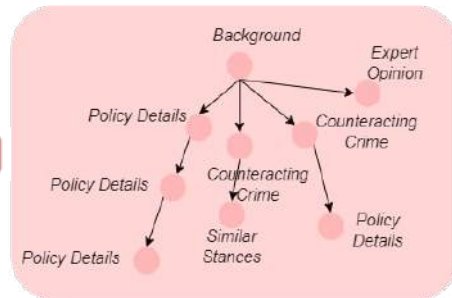
Social/Propaganda Knowledge

UK and France sign \$74 mln agreement to tackle illegal migration

Left



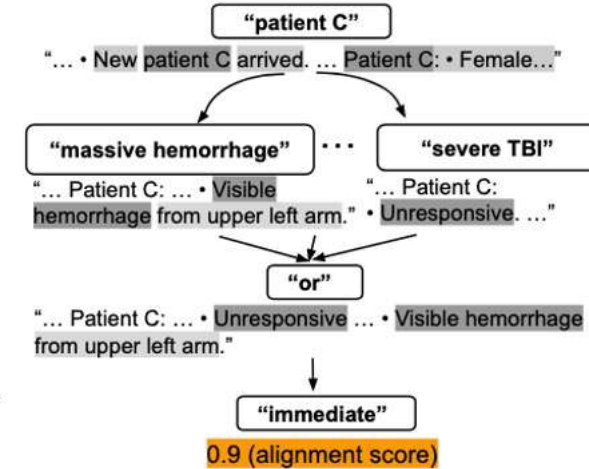
Right



Healthcare Knowledge

- Category I which requires **immediate** actions includes patients with any MARCH issues, airway obstruction, fall/open chest wound, tension-pneumothorax/hemothorax, massive hemorrhage, 20-70% burns, unstable Vital Signs, or severe TBI (unconscious alive Pt).
- Category II which can be **delayed** includes patients with open fractures w/PMS intact, soft tissue injuries, moderate TBI (stable vital signs) or open abdominal wounds.
- Category III which requires **minimal** actions includes patients with minor abrasions, burns, sprains lacerations, moderate/mild anxiety, fractures/dislocations w/PMS or mild TBI.

Attention-based program from Guideline#1



Open-Source Systems & Demos

- COVID-19 Claim Radar (lead author) [[Code](#)]
 - A structured claim extraction system, as well as refuting/supporting claim discovery.
- GAIA: A Fine-grained Multimedia Knowledge Extraction System (lead author) [[Code](#)]
 - Entity, relation, event extraction with coreference for multilingual (English, Spanish, and Russian) multimedia corpus.
- Cross-lingual Entity Discovery and Linking (lead author) [[Code](#)]
 - Entity extraction and coreference for English, Spanish, and Chinese.
- Multilingual Entity, Relation, Event and Human Value Extraction (lead author) [[Code](#)]
 - Knowledge extraction system with human values for English, Russian, and Ukrainian.
- RESIN: Schema-Guided Cross-document Cross-lingual Cross-media Event Extraction and Tracking [[Code](#)]
 - Schema-Guided cross-document information extraction and tracking system.

Live Demo: Multimodal Event Recommendation [Manling Li et al., ACL 2020]

Search for Attack Event

Jan 01 2000 ~ May 31 2019

Live Demo: What Would the “SmartBook” Look Like? An Example Chapter

Ukraine Crisis Smart Book

Chapters >

Position of Third Parties >

Overview

What is NATO's position on the Ukraine-Russia conflict?

[What is the position of China on the Ukraine-Russia conflict?](#)

What is the position of the governments of Poland, Turkey and Moldova on the Ukraine-Russia conflict?

What is Venezuela's position on Ukraine-Russia Conflict?

Perspectives

What is the position of China on the Ukraine-Russia conflict?

Summary

China has publicly stated that it does not support the idea of ejecting Russia from the G20, and has [instead called for dialogue between all parties involved in the conflict](#). [China has also said that it is opposed to the spread of disinformation about China in an attempt to pressure the country](#)

Claims

Claim Sentence	Context
Since the war began, China has tried to project a neutral stance. Source	Biden-Xi call: A call between Chinese President Xi Jinping and US President Joe Biden was underway Friday. Since the war began, China has tried to project a neutral stance . It has not condemned Russian actions, and has refused to label the attack an invasion. See More
Cooperation with China was ambivalent, he said, adding the country was "struggling with the consequences of its own Covid strategy, which also has consequences for world trade."	While the G7 leaders reemphasized their condemnation of "Russia's unjustifiable, unprovoked and illegal war against Ukraine," they called on China to press Russia to withdraw its troops from Ukraine. Scholz said he also expected China not to undermine sanctions against Russia. Cooperation with China was ambivalent, he said, adding the country was "struggling with the consequences of its own Covid strategy, which also has consequences for world trade." See More
China is firmly opposed to this and will never accept it. Source	The US has indicated that China would pay an economic price if its support for Russia goes beyond rhetoric. Speaking Friday, Zhao repeated China's public rebuke, saying "some people in the US have been spreading disinformation to smear and put pressure on China , which is extremely irresponsible and will not help solve the issue. China is firmly opposed to this and will never accept it." See More
That is considered unlikely, as China has said it would not back kicking Russia out.	While US President Joe Biden has said Russia should no longer be in the G20, ejecting Moscow would require the support of all members. That is considered unlikely, as China has said it would not back kicking Russia out. See More
The White House is realistic the G20 will not collectively remove Russia from its ranks, since the decision would likely require consensus and China has been clear it doesn't support such a move.	The White House is realistic the G20 will not collectively remove Russia from its ranks, since the decision would likely require consensus and China has been clear it doesn't support such a move . See More

Multi-Lingual Claims

China's position:

[Source](#)

Original Post

中国常驻联合国副代表耿爽：各方都应摒弃政治私利，为化解乌克兰危机做切实努力 中国日报联合国9月7日电（记者张雯璐）当地时间7日，联合国安理会召开会议审议乌克兰人道问题，中国常驻联合国副代表耿爽出席会议并发言表示，摒弃政治私利，停止激化矛盾、停止制造分裂、停止鼓吹对抗，为化解危机做出切实努力。耿爽说，历史反复证明，外交努力、谈判沟通是化解冲突、结束危机的唯一正确出路。中方再次呼吁有关当事方保持对话接触，探索政治解决的可行和平稳定积累条件。耿爽指出，扎波罗热核电站的安全和安保问题事关乌克兰和整个地区上亿人的健康福祉，决不容许发生意外，中方呼吁有关当事方认真落实格罗西总干事提出的七项支柱原则，避免采取危及核安全和安保的行动。代表团对扎波罗热核电站进行实地考察，赞赏机构专家驻留在核电站继续开展工作，鼓励机构就相关问题同各方保持沟通。

Translation (Google)

Geng Shuang, Deputy Permanent Representative of China to the United Nations: All parties should abandon political self-interest and make practical efforts to resolve the Ukrainian crisis China Daily, United Nations, September 7 (Repr 7h local time, the UN Security Council held a meeting to discuss the humanitarian issue in Ukraine. China's Deputy Permanent Representative to the United Nations, Geng Shuang, attended the meeting and said that all parties in the

What is the position of China on the Ukraine-Russia conflict?

Summary

Claims

Multi-Lingual Claims

China's position:
[Original Post](#)
[Translation \(Google\)](#)

<https://blenderdemo.com/smartbook>



Collaborators



Advisor



References



Collaborators

