



# Universal Information Extraction and Knowledge-driven Generation

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BLENDER | Cross-source Information Extraction Lab

# Information Overload: Multimedia Multilingual Data



NOW PLAYING  
Why is there conflict in Ukraine?  
Will Trump affect the war in Ukraine?  
Violence escalating in eastern Ukraine  
Ukraine locked in conflict over borders  
Sena would

## STORY HIGHLIGHTS

Congress and Ukraine long sought anti-tank weapons to battle against separatists.

(CNN) — The US is going to provide lethal anti-tank weapons to Ukraine to help it fight off separatists which have the backing of Russia, a senior State Department official told CNN.



Бойці батальйону «Донбас»

Новоизбранный президент Владимир Зеленский заявил о необходимости возвращения контроля над каждым миллиметром украинской границы

КИЕВ – Не нарушая Минских договоренностей, за год действия Операции Объединенных сил Украина вернула под свой контроль 24 квадратных километров территории на Донбассе. Об этом говорится в обращении командующего Объединенными силами генерал-лейтенанта Сергея Наева по случаю первой годовщины проведения операции на Донбассе.

## Читайте также

На Донбассе завершилась АТО и началась операция Объединенных сил



Президент России Владимир Путин (архивное фото)

В предыдущем указе Владимира Путина был упрощен порядок предоставления гражданства жителями Донбасса

КИЕВ – Россия упрощает порядок получения гражданства для украинцев, временно проживающих на ее территории, украинским беженцам, жителям отдаленных районов Донецкой и Луганской областей, а также другим категориям граждан из Украины и ряда стран.



## Ukraine: How we got here

The Ukraine crisis has become the bloodiest European conflict since the wars over the former Yugoslavia in the early 1990s -- but what triggered the violence and what is happening on the ground?



американський ракетний есмінець Preble

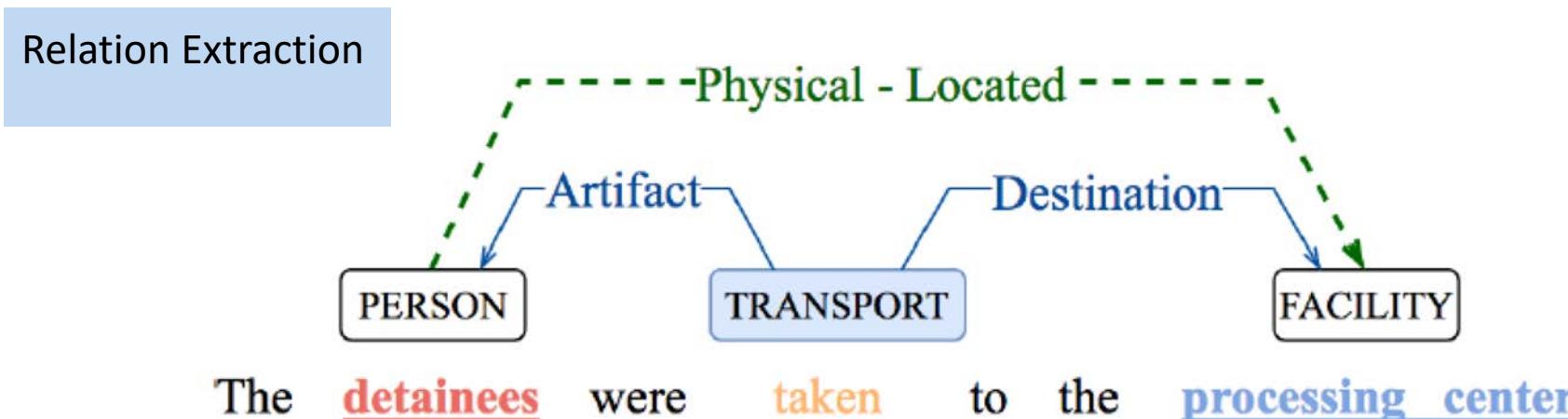
## Читайте также

Украина протестует против выдачи паспортов России жителям Донбасса

Нуждаются ли жители Донбасса в российском

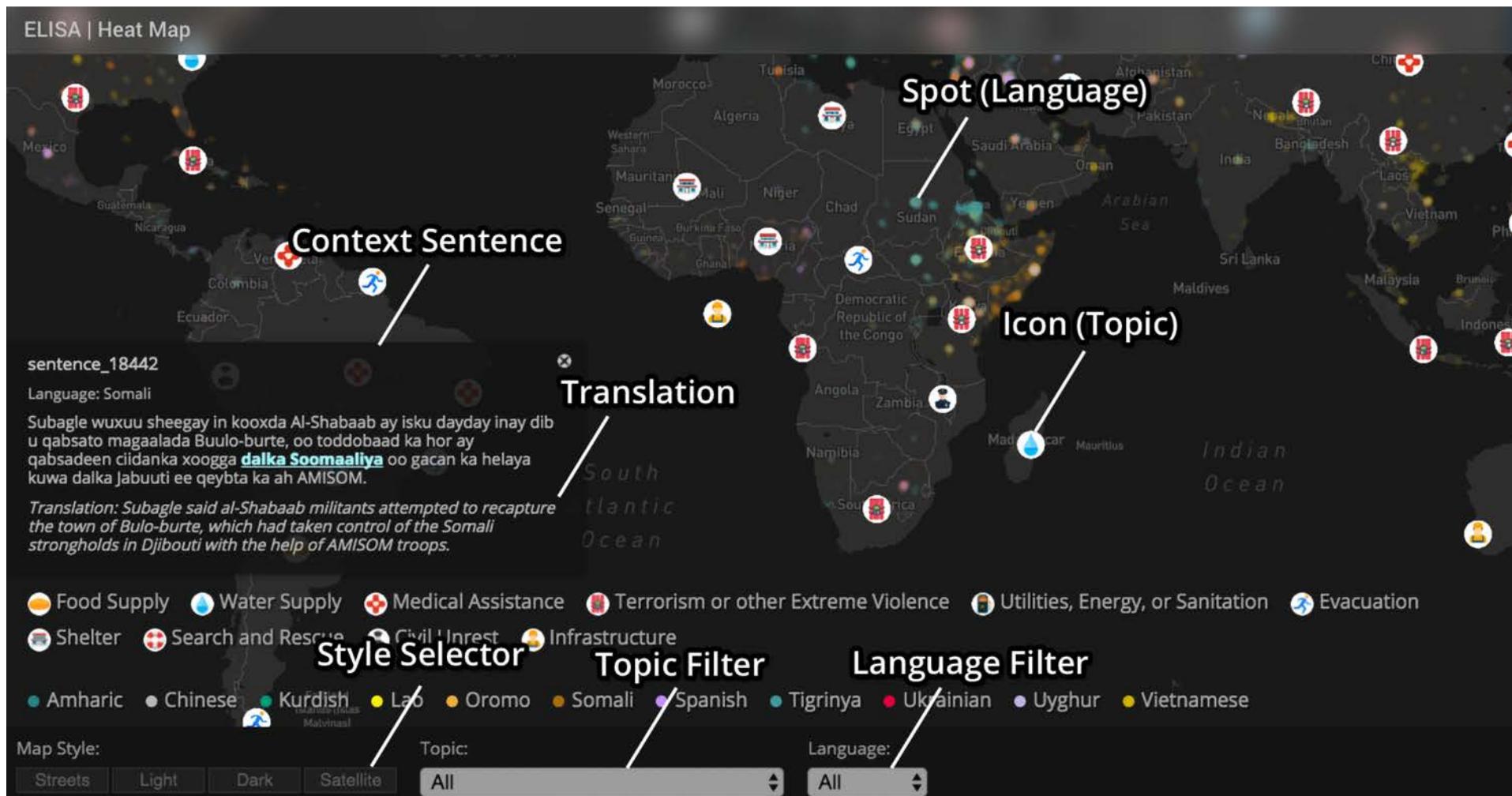
териканські військові повідомили, що два військові кораблі США пройшли близу островів, на які претендує Китай, у Південно-Китайському морі в неділю. Ці дії розгнівали Пекін у час напружених зв'язків між двома найбільшими економіками світу.

# Information Extraction: turn unstructured data to structured information



Event Extraction (Trigger Labeling + Argument Role Labeling)

# Applications: Disaster Relief



- Re-trainable Systems: [http://blender02.cs.rpi.edu:3300/elisa\\_ie/api](http://blender02.cs.rpi.edu:3300/elisa_ie/api)
- Data and Resources: <http://nlp.cs.rpi.edu/wikiann/>
- Demos: [http://blender02.cs.rpi.edu:3300/elisa\\_ie](http://blender02.cs.rpi.edu:3300/elisa_ie) [http://blender02.cs.rpi.edu:3300/elisa\\_ie/heatmap](http://blender02.cs.rpi.edu:3300/elisa_ie/heatmap) 4

# Applications: Event Recommendation

Query: Target: Януковича (Yanukovych) Number of Events: 2

Home Back

Automated Summary:  
Show Visual Knowledge Elements Hide Visual Knowledge Elements

Столкновения 20 февраля стали одним из ключевых факторов , вынудивших Президента Украины Виктора Януковича пойти на подписание Соглашения об урегулировании политического кризиса на Украине , потере доверия к самому Януковичу и к переформатированию парламентского большинства , вынесшего вечером 20 февраля постановление о запрете применения силы властью (Translation: The clashes on February 20 became one of the key factors that forced President of Ukraine Viktor Yanukovych to sign the Agreement on the settlement of the political crisis in Ukraine, the loss of confidence in Yanukovich himself and the reforming of the parliamentary majority, which issued a resolution on the evening of February 20 banning the use of force) , что согласно всем имеющимся уликам т милиционеры и демонстранты , что стали жертвами снайперского огня , застрелены одними и теми же снайперами (Translation: that according to all available evidence, those policemen and demonstrators who were victims of sniper fire were shot by the same snipers)

Date: 201402 Location: Unknown Attacker: Unknown Target: Януковича (Yanukovych) Instrument: Unknown Type of Attack: Conflict.Attack

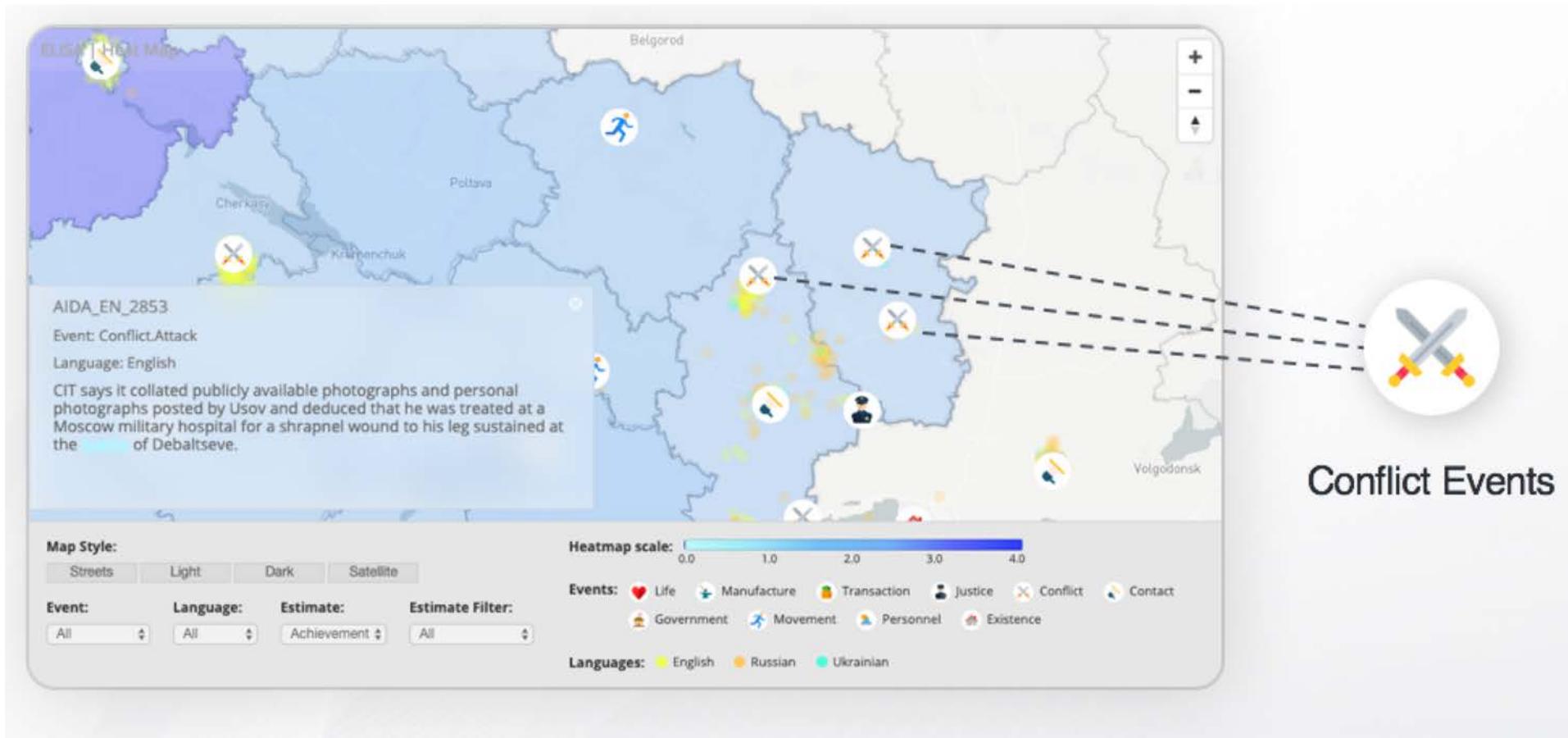
Source Document English Translation

Meta-path based Ranking Incorporating User Feedback and Cognitive Fit Theory  
Similar Events Dissimilar Events Suggested Events

Event Extraction

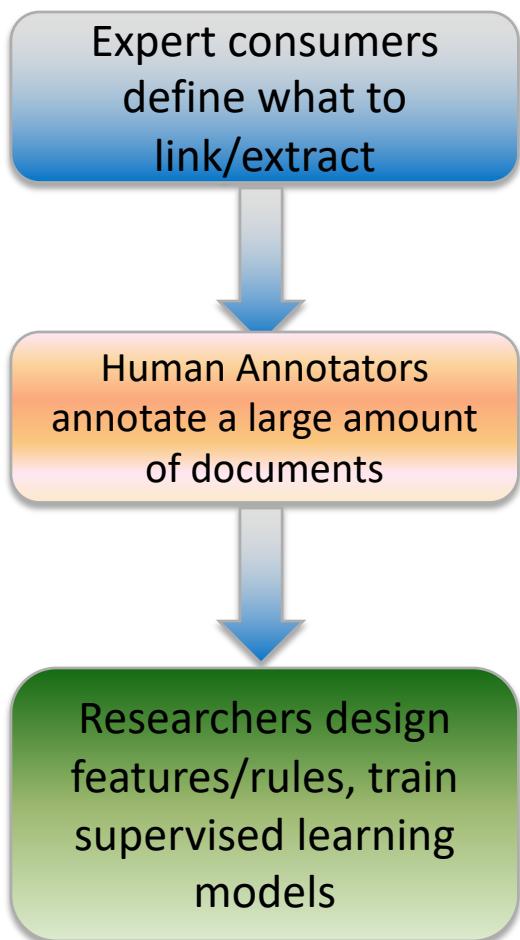
1 https://blender04.cs.rpi.edu/~lud2/video\_recommendation\_demo2019/an...  
2 criminologists near the inlet on the side opposite the Maidan  
3 5 The case of Kiev snipers question about the organizers and perpetrators of  
sniper shooting at Euromaidan participants and at the same time law  
enforcement officers in Kiev on February 20, 2014, which killed 53 people  
(49 protesters and 4 law enforcement officers)  
6 [one]  
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8 Protesters and new Ukrainian authorities accuse the Yanukovych regime of  
these events  
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11 as well as Russia.  
12 The Russian authorities and the then Ukrainian leaders, in turn, believe  
that the shooting was organized by Euromaidan representatives to create  
sacred sacrifices and exacerbate the revolutionary situation.  
13 February 24th and, about, Interior Minister Arsen Avakov reported on his  
page in one of the social networks about the initiation of a criminal case  
into the massacres of civilians, in connection with which Yanukovych and  
several other officials were wanted  
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# Applications: Ukraine Event and Moral Value Map



- Achievement, Benevolence, Conformity, Hedonism, Power, Security, Self-direction, Simulation, Tradition and Universalism (Schwartz, 2012)

# English IE: Expensive but Generally Happy



- *High Cost:* requires manual clean annotations for 500 documents
- *Poor Portability:* e.g., only covers 41 relation types and 33 event types
- Limited to a certain domain, genre, language, and data modality

# English doesn't deserve to be the center of language universe

- 6000+ living languages, 300+ languages have digital news data
- Certain information is often reported predominantly in local news in low-resource languages
  - e.g., the vast majority of Physical-Located relations and Meeting events involving Aung San Suu Kyi are only reported locally in Burmese news
  - e.g., language barrier was one of the main difficulties faced by humanitarian workers responding to the Ebola crisis in 2014
- Publicly available gold-standard annotations for IE exist for only a few languages
- Annotations for edge (relation and event) extraction are more expensive than node (entity) extraction because relations/events are structured and require a rich label space – not suitable for crowd-sourcing



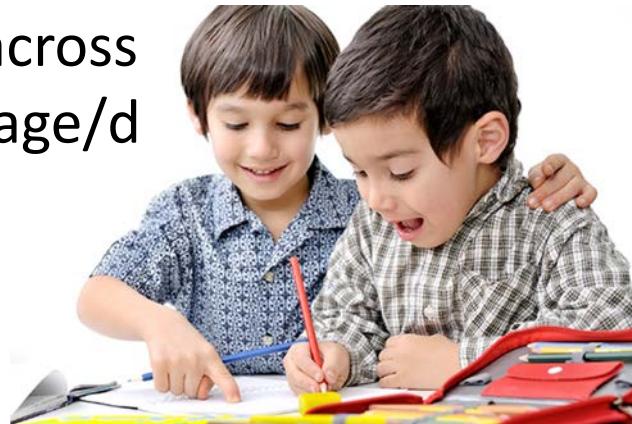
# One Possible Solution: Share and Transfer



Enhance Quality with deep knowledge acquisition and reasoning



Transfer knowledge across domain/genre/language/data modality

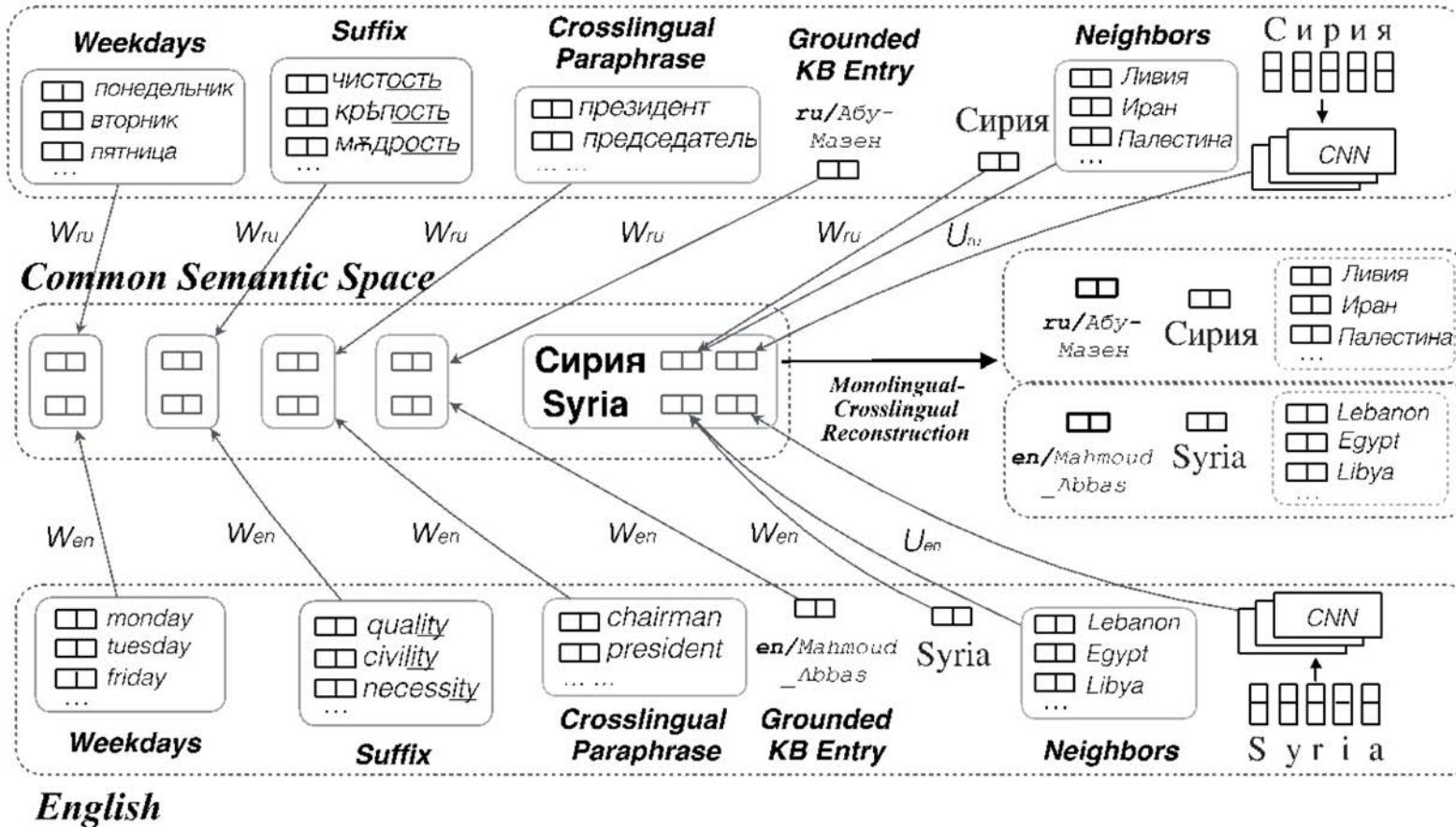


# Cross-lingual Node (Entity) Transfer

- Leverage Language-Universal Non-Conventional Linguistic Resources
- Cross-lingual Embedding Representations
  - Cluster-consistent embedding: avoid using bi-lingual dictionaries or parallel corpora
  - Joint Entity and Word embedding
  - Cross-lingual language modeling for contextualized embedding
- Cross-lingual Transfer Learning
  - Multi-task Multi-lingual transfer learning
  - Adversarial learning to select language-universal resources and features
- Allow non-speakers to annotate any language

# Share: Multi-lingual Cluster-consistent Common Space Construction

## Russian



## English

- Our new hypothesis: Cluster distribution tends to be consistent across languages (Huang et al., EMNLP2018)

# Share: Cross-lingual Joint Entity and Word Embedding Learning

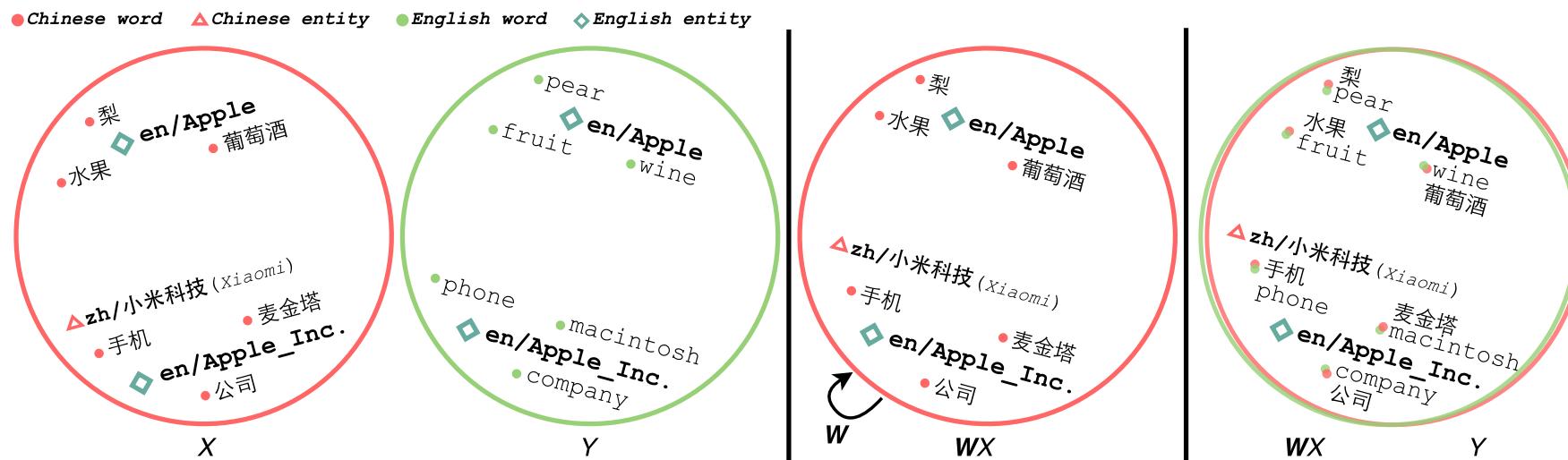
- (Pan et al., DeepLo2019)

- Code-switch cross-lingual entity/word data generation

*Example Chinese Wikipedia Sentence:*  
[[小米科技|小米]] 被 誉为 中国的 [[苹果公司|苹果]]。  
 $\text{link} \downarrow \text{langlink}$        $\text{link} \downarrow \text{langlink}$   
 $\text{zh}/\text{小米科技} \xrightarrow{\times} \text{zh}/\text{苹果公司} \rightarrow \text{en}/\text{Apple\_Inc.}$

*Our Approach:*  
 $\text{zh}/\text{小米科技}$  被 誉为 中国的  $\text{en}/\text{Apple\_Inc.}$ .  
(Xiaomi) (is) (known as) (Chinese)

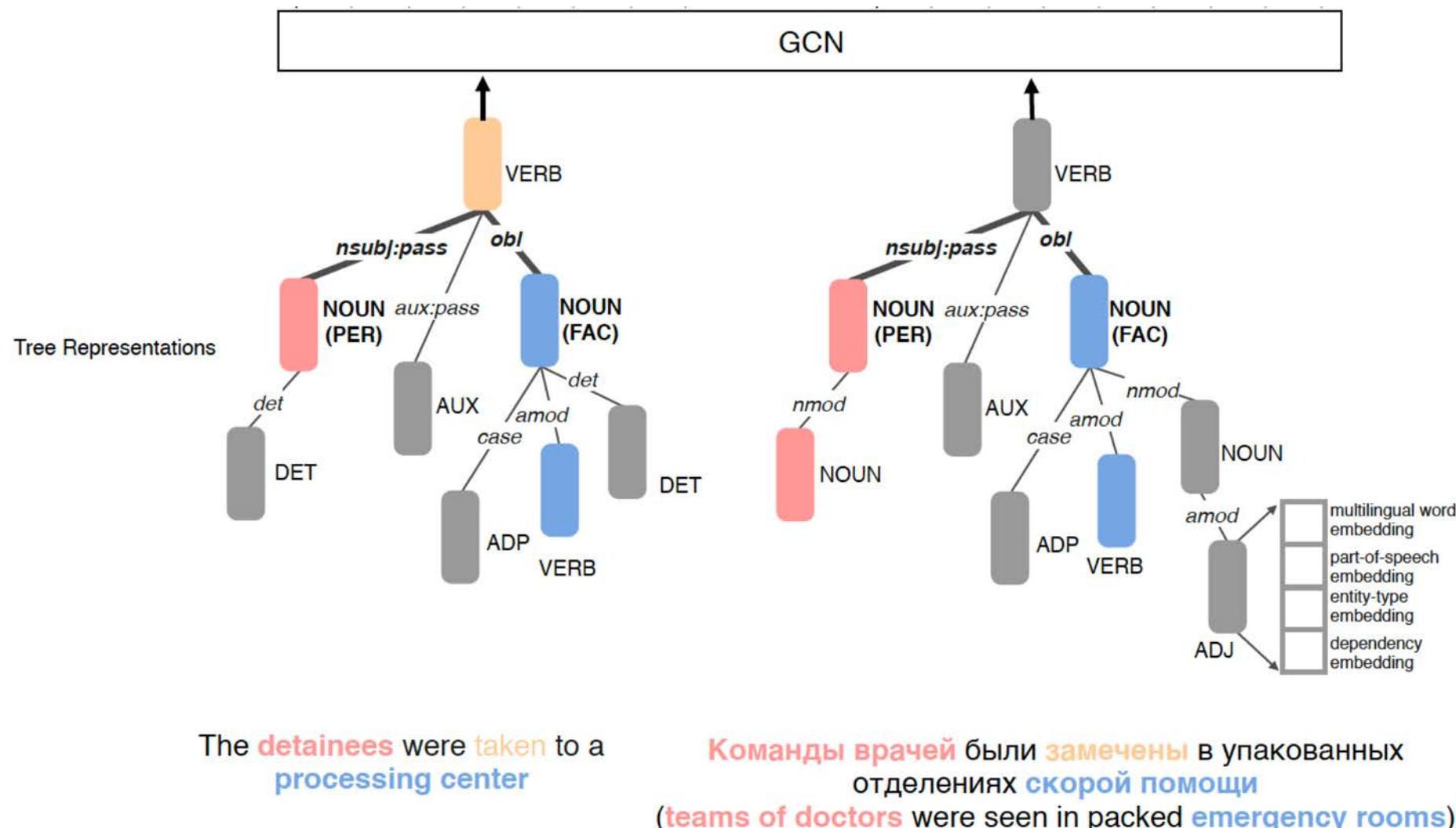
- Use English entities as anchor points to learn a mapping (rotation matrix)  $W$



# Cross-lingual Edge (Relation and Event Argument) Transfer

- (Subburathinam et al., EMNLP2019)
- Hypothesis: Relational facts are typically expressed by identifiable patterns which are consistent across languages (Lin et al., 2017)
- Language-universal symbolic representations
  - POS tagging and dependency parsing are available for 84 languages (Nivre et al., 2018)
  - Entity extraction is available for 282 languages (Pan et al., 2017)
- Language-universal distributional representations
  - multi-lingual word embedding is available for 44 languages (Bojanowski et al., 2017; Joulin et al., 2018)

# Toward more Structured Representations



The **detainees** were **taken** to a  
processing center

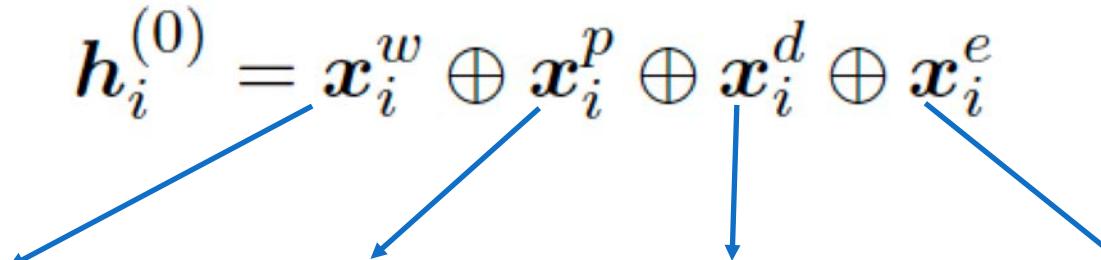
Команды врачей были замечены в упакованных  
отделениях **скорой помощи**  
(teams of doctors were seen in packed **emergency rooms**)

# Graph Convolutional Networks (GCN) Encoder

- Extend the monolingual design (Zhang et al., 2018) to cross-lingual
- Convert a sentence with  $N$  tokens into  $N \times N$  adjacency matrix  $A$
- Node: token, each edge is a directed dependency edge
- Initialization of each node's representation

$$\mathbf{h}_i^{(0)} = \mathbf{x}_i^w \oplus \mathbf{x}_i^p \oplus \mathbf{x}_i^d \oplus \mathbf{x}_i^e$$

Word embedding   POS tag   Dependency relation   Entity type



- At the  $k^{\text{th}}$  layer, derive the hidden representation of each node from the representations of its neighbors at previous layer

$$\mathbf{h}_i^{(k)} = \text{ReLU} \left( \sum_{j=0}^N \frac{\mathbf{A}_{ij} \mathbf{W}^{(k)} \mathbf{h}_j^{(k-1)}}{d_i + b^{(k)}} \right)$$

# Application on Relation Extraction

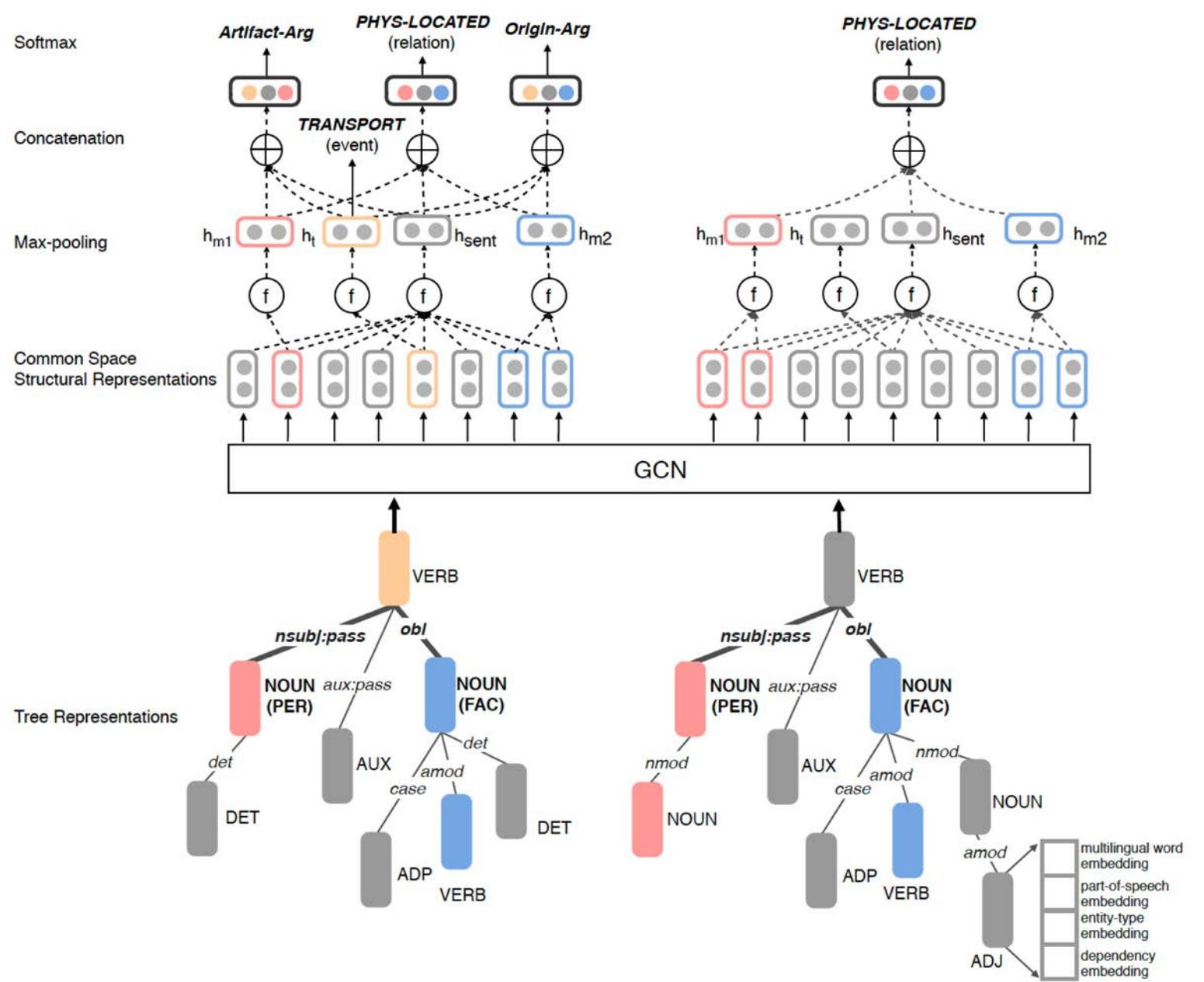
- Task: Classify each pair of entity mentions into one of pre-defined relation types or NONE
- Max-pooling over the final node representations to obtain representations for sentence and two entity mentions, and concatenate them
- A softmax output layer for relation type classification

$$L^r = \sum_{i=1}^N \sum_{j=1}^{L_i} y_{ij} \log(\sigma(\mathbf{U}^r \cdot [\mathbf{h}_i^{m1}; \mathbf{h}_{ij}^s; \mathbf{h}_j^{m2}])))$$

# Application on Event Argument Extraction

- Task: Classify each pair of event trigger and entity mentions into one of pre-defined event argument roles or NONE
- Max-pooling over the final node representations to obtain representations for sentence, trigger and argument candidate, and concatenate them
- A softmax output layer for argument role labeling

$$L^a = \sum_{i=1}^N \sum_{j=1}^{L_i} y_{ij} \log(\sigma(\mathbf{U}^a \cdot [\mathbf{h}_i^t; \mathbf{h}_{ij}^s; \mathbf{h}_j^a]))$$



The detainees were taken to a processing center

Команды врачей были замечены в упакованных отделениях скорой помощи  
(teams of doctors were seen in packed emergency rooms)

# Overall Performance

- Relation Extraction

Train \ Test	English	Chinese	Arabic
Train			
English	68.2	<b>42.5</b>	<b>58.7</b>
Chinese	<b>62.6</b>	69.4	54.0
Arabic	58.6	35.2	67.4

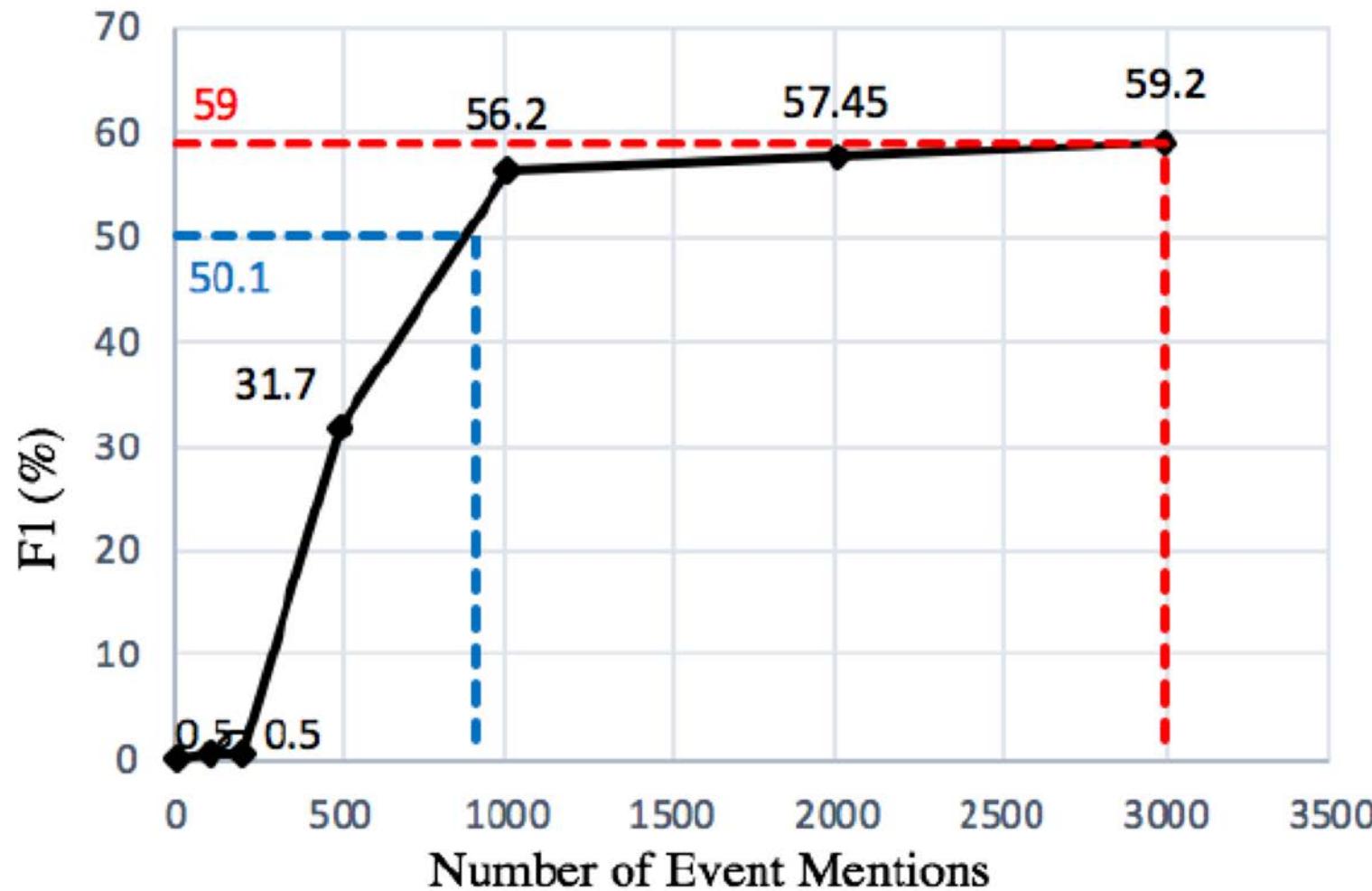
- Event Argument Extraction

Train \ Test	English	Chinese	Arabic
Train			
English	63.9	<b>59.0</b>	<b>61.8</b>
Chinese	<b>51.6</b>	59.3	60.6
Arabic	43.1	50.1	64.0
English + Chinese	–	–	<b>63.1</b>
English + Arabic	–	<b>60.1</b>	–
Chinese + Arabic	<b>51.9</b>	–	–

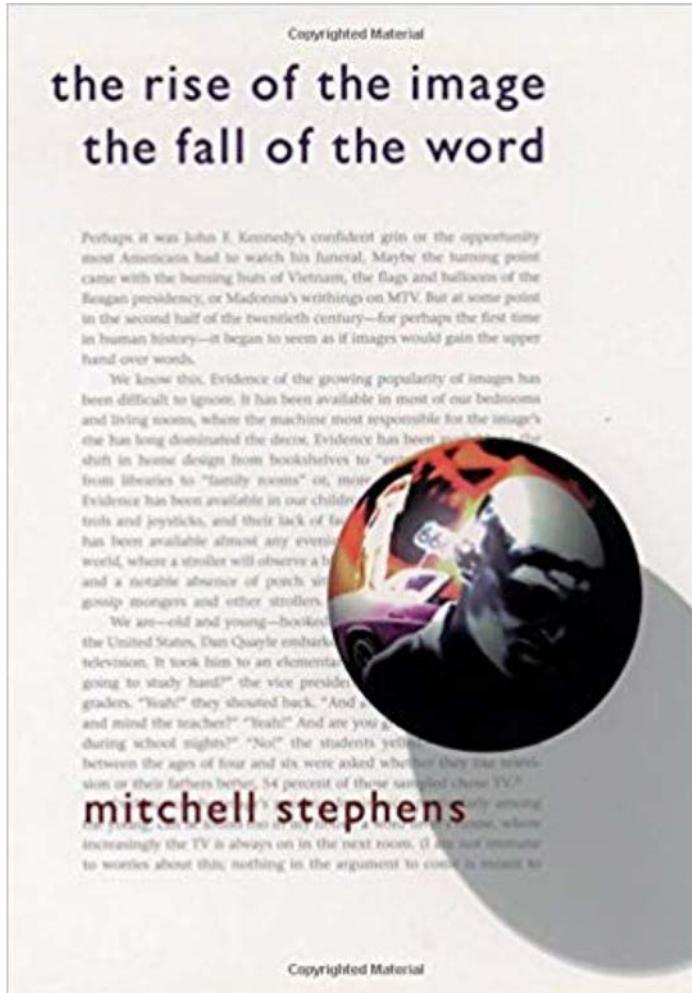
Much better than state-of-the-art on cross-lingual transfer (47.7%, Hsi et al., 2016)

# Comparison with Supervised Approach

- Chinese Event Argument Extraction



# Ongoing Work: Cross-media Event Structure Transfer



- We produce and consume news content simultaneously through different media
- By randomly checking 100 multimedia documents from Voice of America, 34% images contain visual objects that serve as event arguments which are not mentioned in surrounding texts



*Vote\_? = soldier*



*TransportPerson\_Instrument = stretcher*

# Multimedia Common Space Construction

- Treat Image/Video as a foreign language

Language	Vision
Word Sense/Phrase	Image Region
Entity	Visual Concept
Relation	Visual Relation
Entity-Relation Graph	Scene Graph
Event	Visual Event
AMR and Dependency Graph	Visual Semantic Graph



# A New Task: Multimedia Event Extraction

- Input: News Article & Events

In March , Turkish forces escalated **attacks** [Conflict.Attack] on the YPG in northern Syria , forcing U.S. to deploy [Movement.TransportPerson] a small number of forces in and around the town of Manbij to the northwest of Raqqa to “deter” Turkish - SDF clashes and ensure the focus remains on Islamic State. Meanwhile, Raqqa is being pummeled by **airstrikes** [Conflict.Attack] mounted by U.S.-led coalition forces and Syrian warplanes. Local anti-IS activists say the air **raids** [Conflict.Attack] fail to distinguish between military and non-military targets ..

- Input: Image & Visual Objects

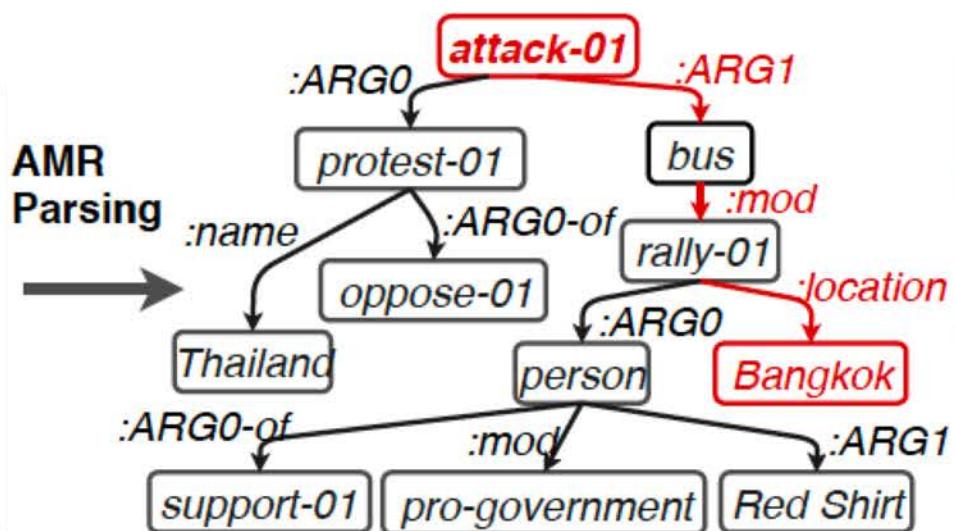


- Output: Image-related Events & Visual Argument Roles

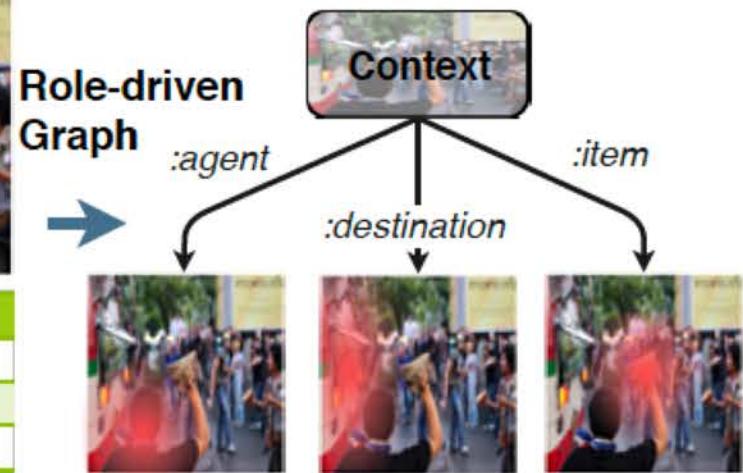
Visual Events	airstrikes [Conflict.Attack] raids [Conflict.Attack]	
Visual Arguments	Target	airplane
	Target	vehicle

# Multi-media Structured Common Space Construction

Thai opposition protesters **attack** a bus carrying pro-government Red Shirt supporters on their way to a rally at a stadium in **Bangkok**

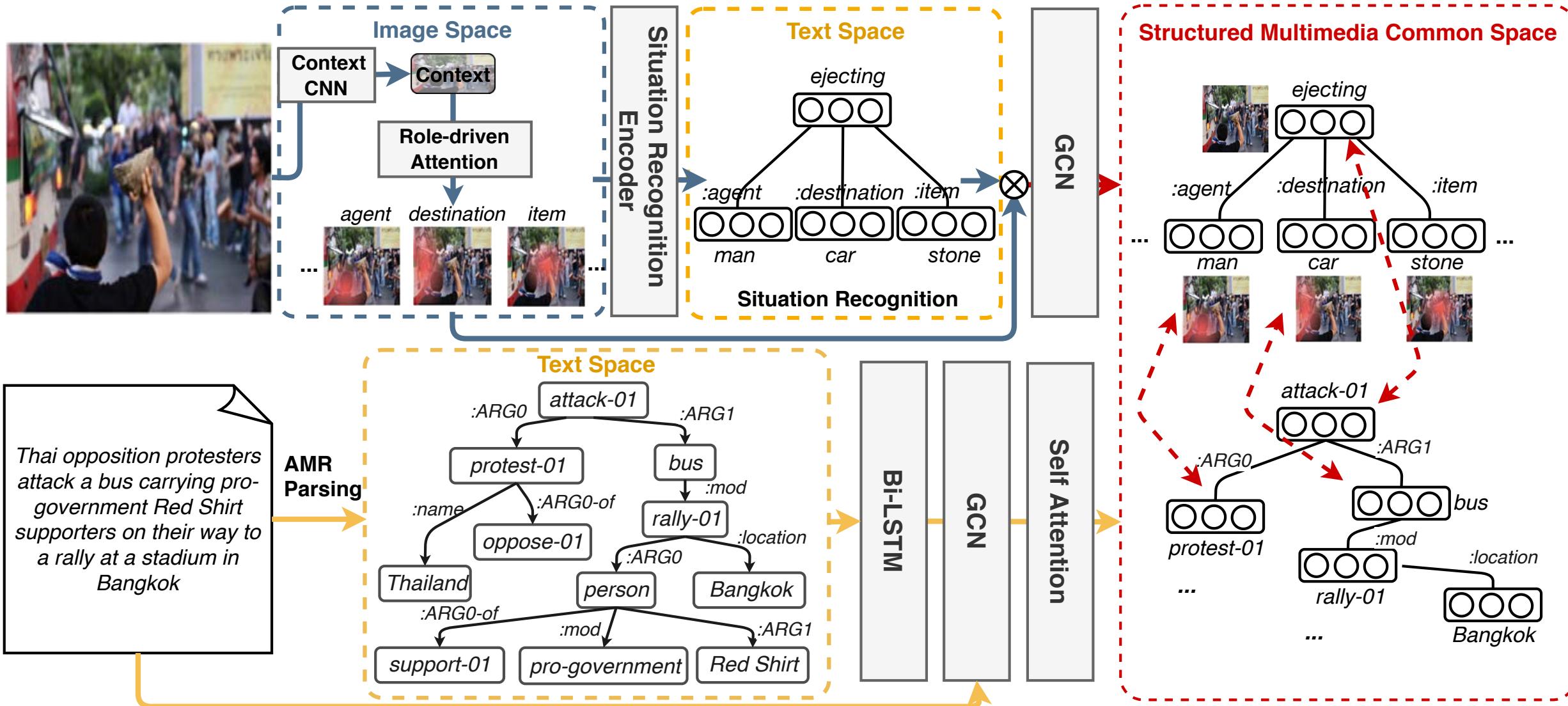


ejecting	
agent	man
destination	bus
item	stone



# Weakly Aligned Structured Embedding (WASE)

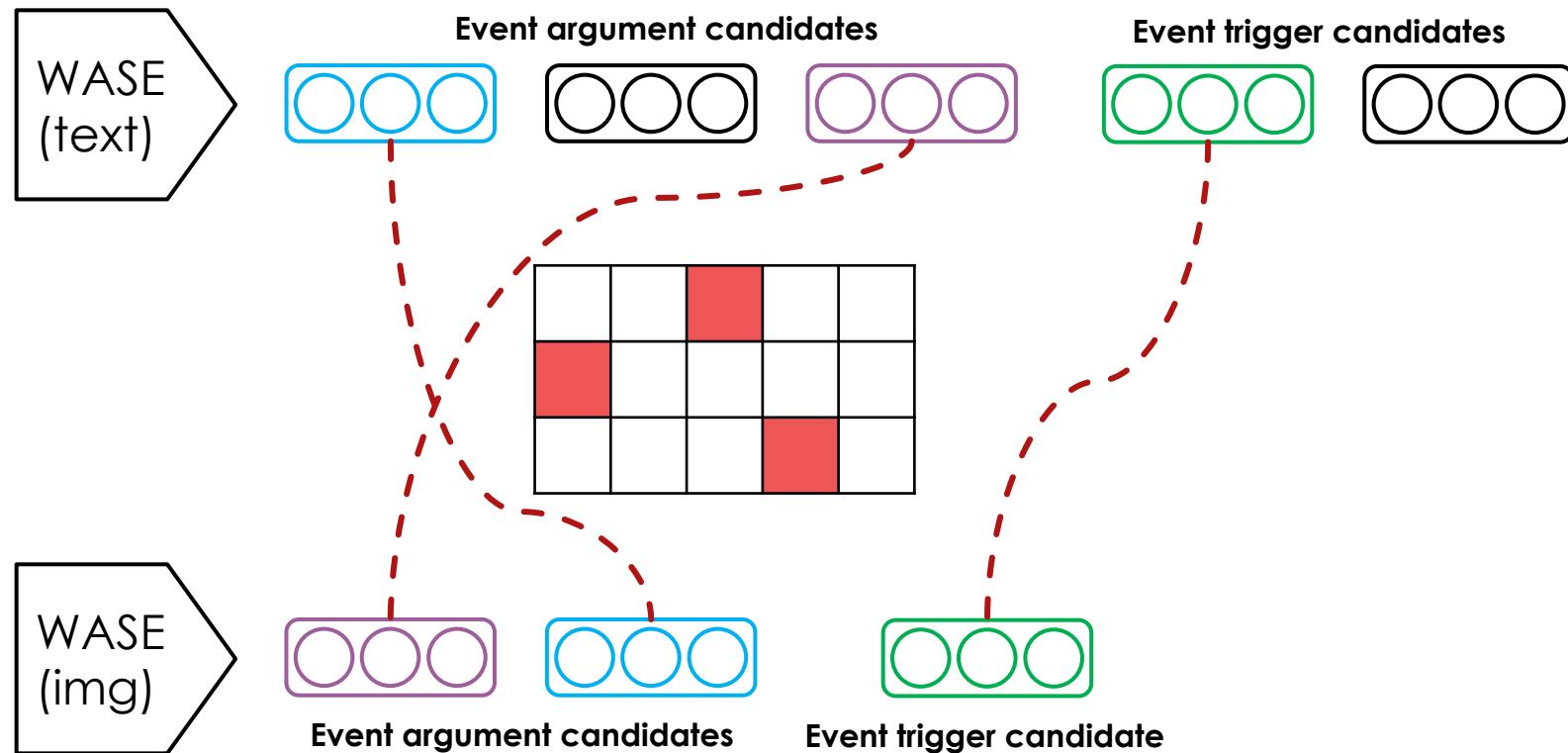
-- Training Phase (Common Space Construction)



# Weakly Aligned Structured Embedding (WASE)

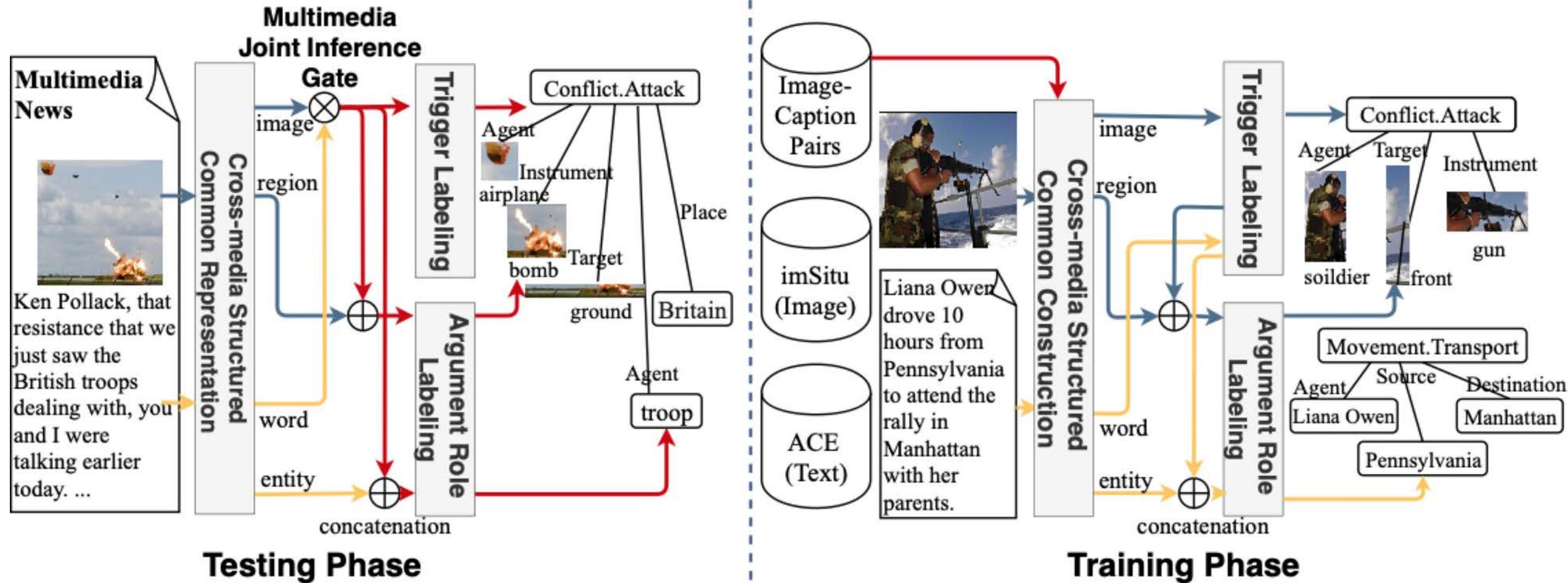
## -- Training Phase (Common Space Construction)

Thai opposition protesters attack a bus carrying pro-government Red Shirt supporters on their way to a rally at a stadium in Bangkok



# Weakly Aligned Structured Embedding (WASE)

-- Testing & Training Phase



# Experimental Results

- Compare with text-only extraction (ACE) and image-only extraction (Situation Recognition)

Method	Text Event Trigger Labeling			Visual Argument Role Labeling		
	P(%)	R(%)	F <sub>1</sub> (%)	P(%)	R(%)	F <sub>1</sub> (%)
JMEE (Text-only) [1]	49.12	72.64	58.61	-	-	-
FC_Graph(Vision-only) [2]	-	-	-	19.15	19.15	19.15
Multimedia Flat Embedding	56.08	62.03	58.91	32.48	34.24	33.34
WASE	59.55	66.43	62.80	32.51	34.29	33.36

[1] Xiao Liu, Zhunchen Luo, and Heyan Huang. 2018a. Jointly multiple events extraction via attention-based graph information aggregation. EMNLP 2018

[2] Ruiyu Li, Makarand Tapaswi, Renjie Liao, Jiaya Jia, Raquel Urtasun, and Sanja Fidler. 2017. Situation recognition with graph neural networks. ICCV 2017

# Compare to State-of-the-art Cross-media Flat Representation



- ▶ Baseline:
  - ▶ Event: Justice:Arrest-Jail
  - ▶ Roles:
    - ▶ None
- ▶ Our Approach:
  - ▶ Event: Conflict.Attack
  - ▶ Roles:
    - ▶ Instrument = weapon



- ▶ Baseline:
  - ▶ Event: Justice:Arrest-Jail
  - ▶ Roles:
    - ▶ Entity = man
- ▶ Our Approach:
  - ▶ Event: Conflict:Demonstrate
  - ▶ Roles:
    - ▶ Entity = man



- ▶ Baseline:
  - ▶ Event: Justice:Arrest-Jail
  - ▶ Roles:
    - ▶ Agent = man
- ▶ Our Approach:
  - ▶ Event: Justice:Arrest-Jail
  - ▶ Roles:
    - ▶ Person = man

# Promising Progress

		2015	2019
Portability	# Languages for EDL and Event Extraction	1-3	300
	# Entity types	5	16,000
	# Relation types (English)	41	2,000
	# Event types (English)	33	1,000
Quality (Low-resource Languages without gold standard annotations)	Name Tagging	0%	Up to 76% F-score
	Cross-lingual Entity Linking	Up to 16% absolute improvement in accuracy	
Development Time		Half a year	1-10 hours
Cost		Supervised models based on 500 fully annotated documents	No manual annotation required for new language/domain

# Remaining Challenges: Acquire background knowledge

- The final Perahera of the **Ruhunu Kataragama Maha Devalaya** will be held today.
- In the communiqué the education ministry has cited as a cases in point several instances like the application by a doctor transferred to Bemmulla in Gampaha for admission of his child to the Colombo **D . S . Senanayake Vidyalaya**.
- The navy media unit stated that they suspect that the **Kerala Ganja Cannabis** was brought from India via the mainland
- When we come back media speculation run amuck over possible indictments at **sixteen hundred Pennsylvania** and the President 's scripted session with troops in Iraq .

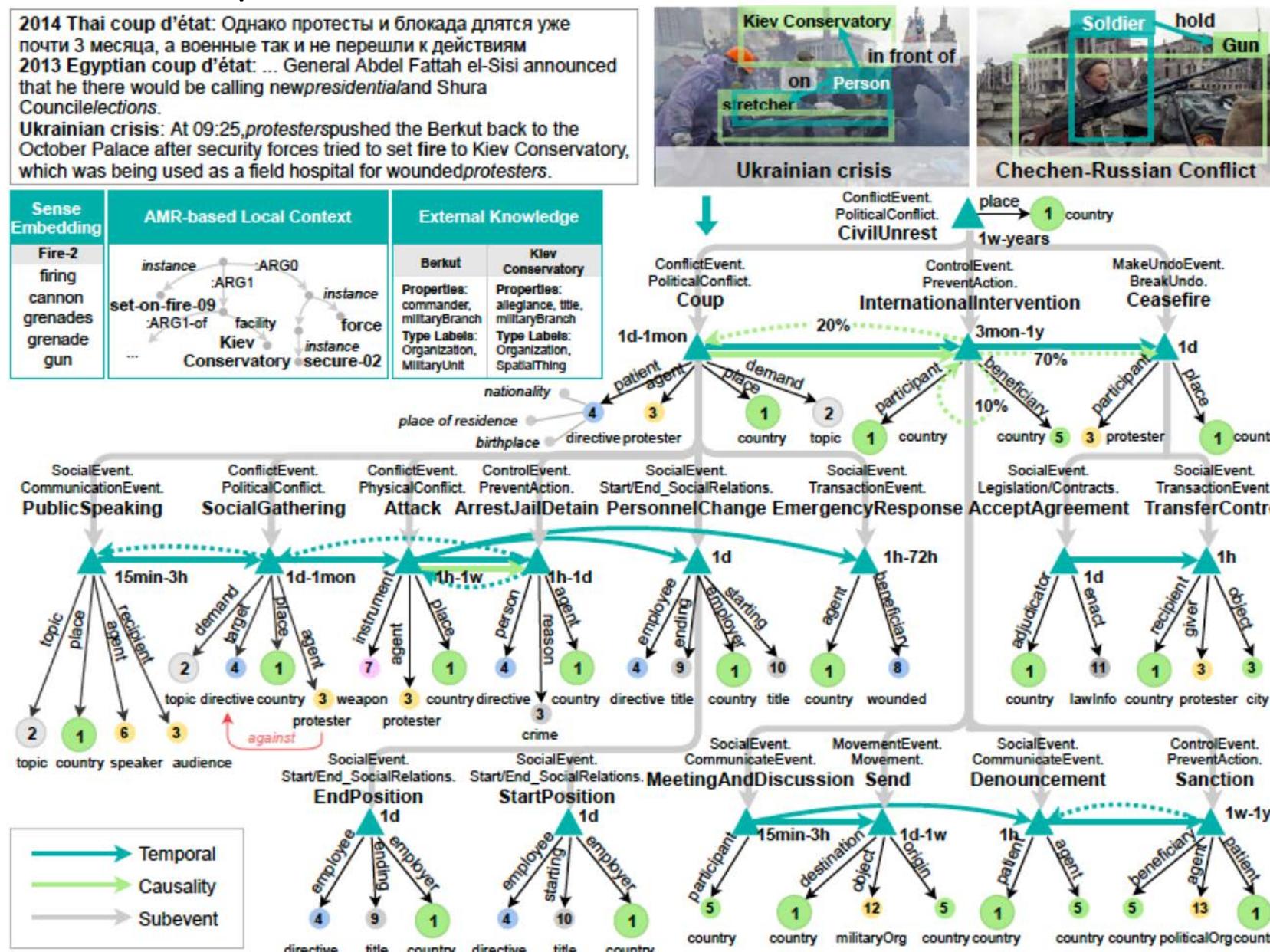


D. S. Senanayake College



# Remaining Challenges: Cross-scenario Transfer through Complex Event Schema Induction

**2014 Thai coup d'état:** Однако протесты и блокада делятся уже почти 3 месяца, а военные так и не перешли к действиям  
**2013 Egyptian coup d'état:** ... General Abdel Fattah el-Sisi announced that he there would be calling new presidential and Shura Council elections.  
**Ukrainian crisis:** At 09:25, protesters pushed the Berkut back to the October Palace after security forces tried to set fire to Kiev Conservatory which was being used as a field hospital for wounded protesters.



# Ongoing Research Project: Let's Write a History Book!

- History is written by the victors
- Entity-centric knowledge base is much easier to construct than event-centric one
  - Who is Barack Obama's wife?
- Requires exhaustive search and information aggregation
  - How many people died in 911? Who are they?
- Multi-view verification
  - What happened in 1989 Tiananmen Square?
  - What happened in Hong Kong Protest 2019?
- It's international human right to know what happened in the history
- We aim to create a history book automatically so it can be more complete and authentic than human created ones



Attacker = protesters



Attacker = protesters

vs.



Police use petrol bombs and water cannons against Hong Kong protesters

Attacker = police

vs.



Attacker = police

# What will such a History Book look like?

- Each chapter looks like a Wikipedia page
  - The description is organized by multimedia timeline with detailed source and evidence information, links to original news articles
  - Detailed participants (arguments) and their roles, and their connections and relations
  - Infobox shows event-event relations: temporal, causal and hierarchical
- Building blocks
  - Open-domain Multilingual Multimedia Event Extraction
  - Cross-document Event Coreference Resolution and Ranking
  - Event Schema Induction and Event-Event Relation Extraction
  - Cross-source Information Verification and Truth Finding
  - Abstract Summarization for Event Description
- Never-ending updated over time; put up to the wild for human editing and curation

## Protests against the government [edit]

### 4 December 2011 [edit]

On 4 November 2011, during the annual [Russian March](#) event, representatives of "The Russians" movement declared a protest action unapproved and took place on 4 December at 21:00 in Moscow. The statement of non-recognition of electoral results spread widely. It is said to have occurred during the elections. Alexander Belov declared the beginning of the "Putin, go away!" campaign.<sup>[37]</sup> The protest at [Alexander Belov](#), [Dmitry Dyomushkin](#), [George Borovikov](#) were arrested along with dozens of other nationalists. The head of the banned observer. Mass detentions of other public organizations occurred in Moscow. According to police some 258 persons have been detained.

### 5–7 December 2011 [edit]

On 5 December, around 5,000 opponents of the government began protesting in Moscow, denouncing [Vladimir Putin](#) and his government. Putin step down, whilst some demanded revolution.<sup>[15][39]</sup> [Alexey Navalny](#), a top blogger and anti-corruption activist who branded Putin's postings on his [LiveJournal](#) blog and Twitter account. Navalny's agitation was denounced by United Russia as "typical dirty self-promotion".<sup>[40][41]</sup>

Many pro-government supporters, including the pro-Putin youth group [Nashi](#), were mobilized on 6 December at the site of the planned [Nashi](#) on [Manezhnaya Square](#)<sup>[43]</sup> and an 8,000-strong rally of the [Young Guard](#) on [Revolution Square](#).<sup>[44]</sup> About 500 pro-United Russia expected anti-government protests. It emerged that 300 protesters had been arrested in Moscow the night before, along with 120 in St. Petersburg. Slogans against Putin,<sup>[15]</sup> whilst anti-government protesters at Revolution Square clashed with riot police and [interior ministry troops](#).<sup>[48]</sup> In Revolution Square and dozens of arrests were reported, including [Boris Nemtsov](#), an opposition leader and former deputy prime minister,<sup>[48]</sup> and [Anna Politkovskaya](#), a journalist.<sup>[50]</sup> Nemtsov was shot dead in Moscow's central [Tverskaya Street](#) and charged. At least one Russian journalist claimed he was beaten by police officers who stamped on him and hit his legs with batons.<sup>[50]</sup> The protest came to an end.<sup>[51]</sup>

Attempts to stage a large protest in Moscow on 7 December fizzled out due to a large police presence in the city.<sup>[13]</sup>

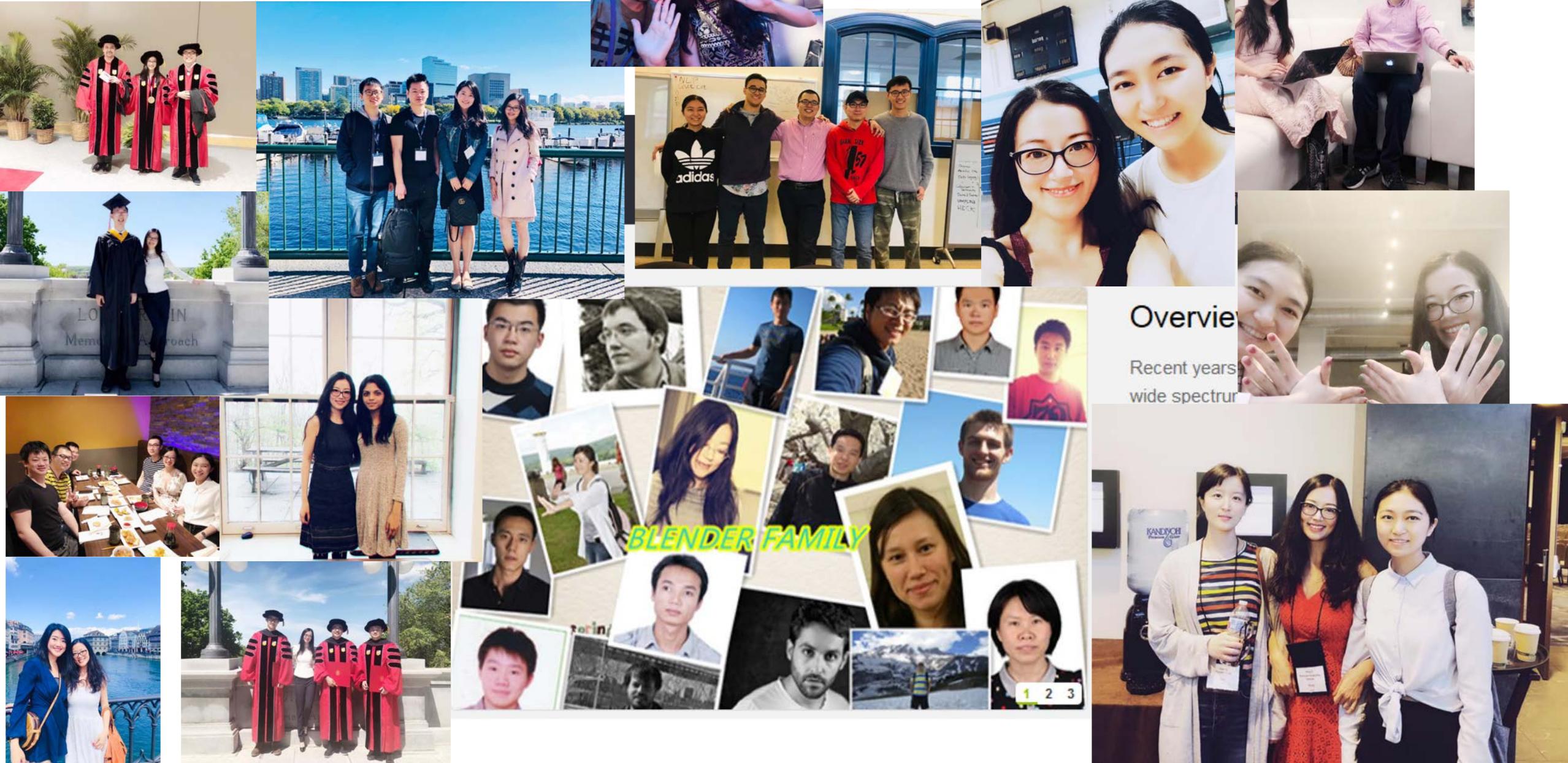
### 10 December 2011 [edit]



Rally in Bolotnaya Square in Moscow on 10 December 2011

Via a Facebook group "Суббота на Болотной площади" (Saturday at Bolotnaya Square),<sup>[52]</sup> the rally was organized on 10 December.<sup>[53][54]</sup> Prior to the demonstration newspapers commented that tens of thousands of people would participate in the rally. In Moscow,<sup>[55][56]</sup> and, similarly, over 5,000 in St. Petersburg.<sup>[57]</sup> A permit had originally been issued for the rally in St. Petersburg, but it was denied. By 8 December, more than 30,000<sup>[52]</sup> had accepted the Facebook invitation to attend the rally. The rally was authorized by the Moscow government for the demonstration which took place on 10 December. The rally was organized by Putins supporters. It was made by Putins supporters that police and security forces would be deployed to deal with anyone participating in the rally. The rally was peaceful and without attempts by the state to prevent or disrupt it.<sup>[59][60]</sup> Rapper [Noize MC](#) performed at the rally, and [Femen](#) activists demonstrated in front of the Russian Parliament. The rally was also attended by [Guerrilla theater](#) from Paris for the occasion.<sup>[61]</sup> Guerrilla theater by FEMEN and the circulation of a pamphlet were organized by the activists.<sup>[62][63]</sup>

# Thank You



## Overview

Recent years  
wide spectrum

# Some IE Demos

# Cross-lingual Entity Discovery and Linking for 287 Languages

▪ (Pan et al., ACL2017)

**Language List**

Choose a language: Abkhazian / Browse

Three examples are provided. You could also enter you example 1 example 2 example 3 enter

# REDIRECT Атыхәемеңда  
''' Рашибүж '''' ( ''' ) Полша ақалакъ .  
''' Лос-Анцелес '''' ( "Los Angeles" ) - Гедоута араион .  
\* Монтевидео ( проектируется )  
\* Лыхны  
''' Владимир '''' - Урыстәйла ақалакъ .  
# Очамчыра араион

Abkhazian	Achinese	Adyghe	Afrikaans	Akan	Albanian
Alemannisch	Amharic	Arabic	Aragonese	Aramaic	Armenian
Aromanian	Arpitan	Assamese	Asturian	Avaric	Aymara
Azerbaijani	Bambara	Bangla	Banjar	Basa Banyumasan	Bashkir
Basque	Bavarian	Belarusian	Belarusian (Tara...)	Bihari	Bikol Central
Bishnupriya	Bislama	Bosnian	Breton	Buginese	Bulgarian
Burmese	Catalan	Cebuano	Central Kurdish	Chamorro	Chavacano de Za...
Chechen	Cherokee	Cheyenne	Chinese	Chinese (Min Nan)	Church Slavic

**Extracted Name**

Mention ID: Boliang\_NE\_tagger\_00010  
Mention Str: Stephane Dujarric 601:617  
Reference KB: St%C3%A9phane\_Dujarric  
Entity Type: PER  
Mention Type: NAM  
Confidence Value: 1.0  
Images:

**Wikipedia Entry**



**GeoNames**

Bentiu ca. 395 m  
Bentiu, Bentiu, Bentiu, بنتيو, బెంతియు, బెంతియు, బెంతియు,班提烏  
P PPLA seat of a first-order administrative division  
South Sudan SS » Northern Liech 11550578  
population : 7653  
9.25722, 29.79833 N 9°15'26" E 29°47'54"  
geotree .kml .rdf

**Retrieved Image**

# Cross-document Event Tracking

Timeline Home Examples System

Entity Name: All Event Type: All Event SubType: All Argument Role: All Start Date: End Date: Search

Legend: Argument Trigger Time Timeline Scale: Year Month

March 2011

## Life.Die

Independent groups say 113 men and 24 women have set **themselves** on fire since **March 2011** and **most** have **died** of **their** burns.

- Victim= {their , themselves , most }

Source Doc: **HC0007FAT**

← Justice.Release.Parole → Conflict.Attack

Timeline JS

[https://blender04.cs.rpi.edu/~lim22/gaia/GAIA\\_arg.html](https://blender04.cs.rpi.edu/~lim22/gaia/GAIA_arg.html)

# Cross-document Entity Relation Tracking

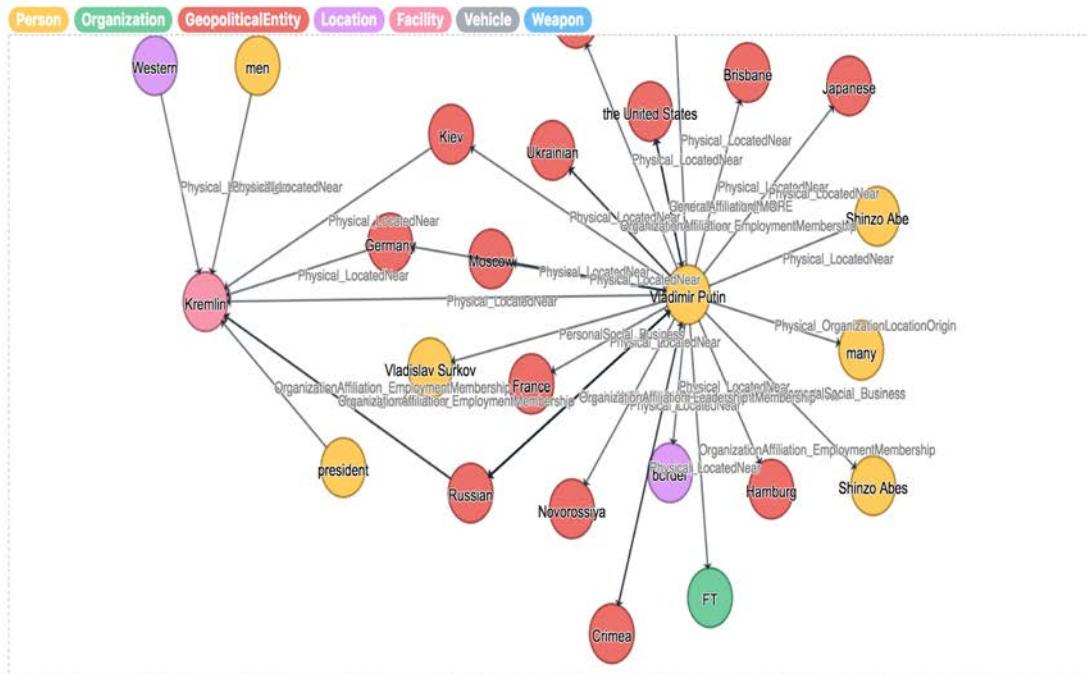
Entity-Relation Graph Home Examples System

Putin

✓ Search

Name Search Cypher Query Example Cypher Queries

Graph Visualization: Double Click a node to see its relations, Click a node and then the CROSS icon to remove it from visualization. Zoom in and out by mouse wheel.



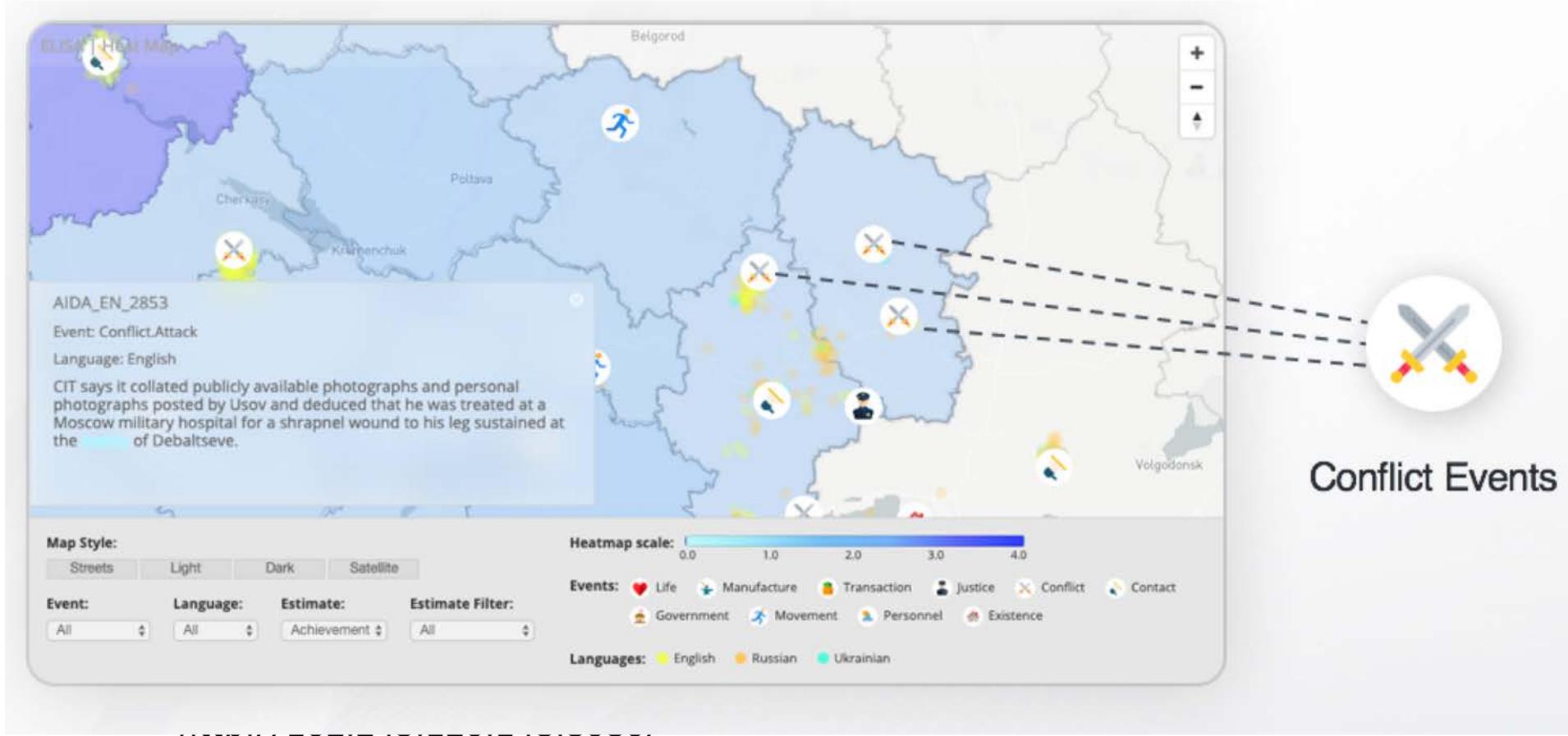
Properties: Hover over nodes and edges to see their properties here.

Type	ID	Name	Link	Mention
Person	:Entity_EDL_ENG_0153461	Vladimir	LDC2015E42:m.08193	liberals,#Putin,Putin,own,President,gunmen,Mr,he,Vladimir Putin,Vladimir Putin,Putins,companies,murderers,victims,that,He,putin's,them,himself,group,Administration,surging,unrest,terrorism,dilemma,leadership,anti

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- [https://blender04.cs.rpi.edu/~lim22/entity\\_demo/aida\\_index.html](https://blender04.cs.rpi.edu/~lim22/entity_demo/aida_index.html)

# Ukraine Event and Moral Value Map



- Achievement, Benevolence, Conformity, Hedonism, Power, Security, Self-direction, Simulation, Tradition and Universalism (Schwartz, 2012)  
<http://162.243.120.148:8080/>

# Event Recommendation

Violence subsided in northern Indian cities on Tuesday as troops patrolled streets and a curfew remained in place after riots broke out a day earlier over the killing of a Sikh cleric in Austria.



explosion fire, anchorperson, demonstration or protest, person on street, fighting on street

Punjab

Date	Location	Target of Protest	Protesters	Type of Protest	Demands of Protest
20090526	India	Unknown	Unknown	Riot	Religious

Similar Events | Dissimilar Events

Sugges



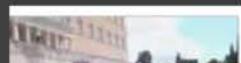
Date	20091231
Location	Bauchi,Nigeria
Target of Protest	Nigeria government
Protesters	Unknown
Type of Protest	Riot
Demands of Protest	Religious



Date	20100911
Location	Afghanistan
Target of Protest	United States government
Protesters	Unknown
Type of Protest	Riot
Demands of Protest	Religious



Date	20090706
Location	Xinjiang,China
Target of Protest	Unknown
Protesters	Exiled Uighurs
Type of Protest	Riot
Demands of Protest	Race

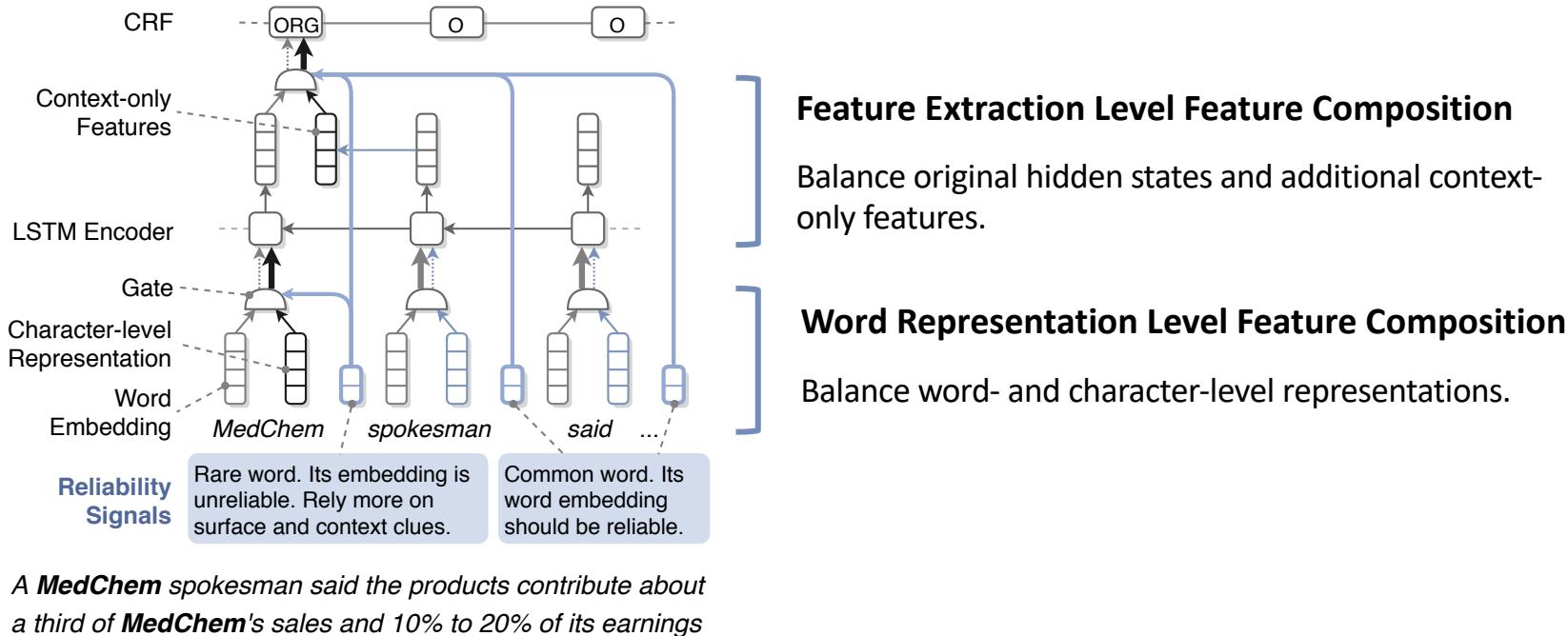


Date	20100305
Location	Athens,Greece

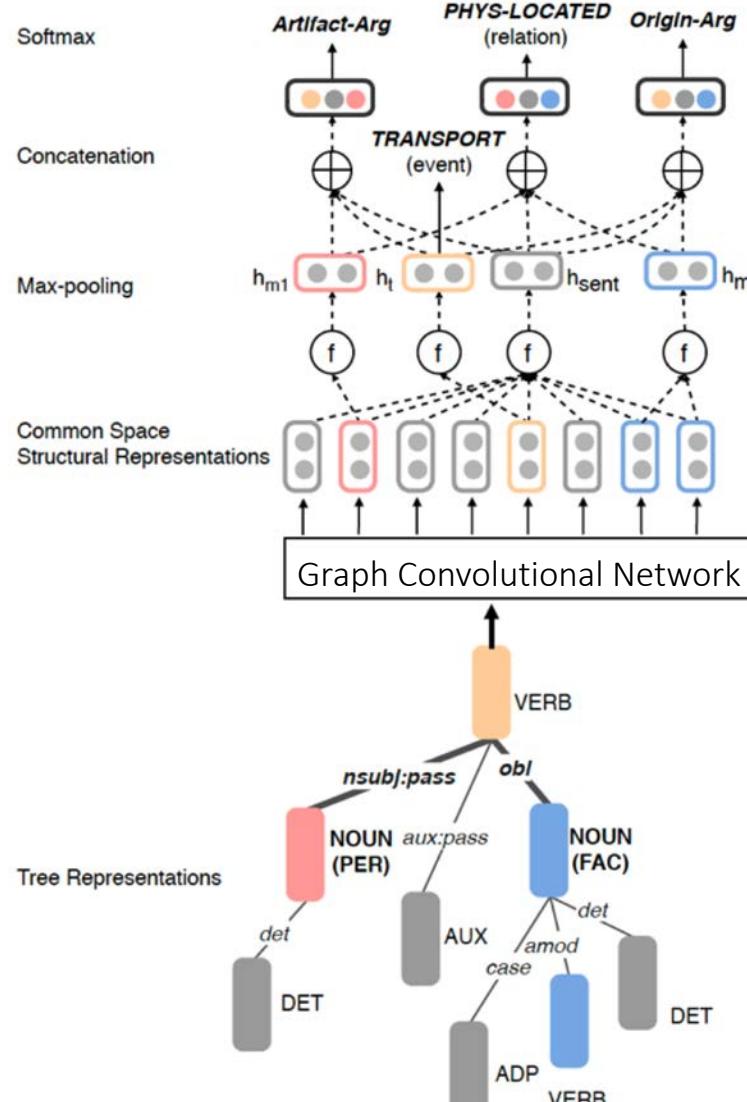
Cross-media coreference and inference

[https://blender04.cs.rpi.edu/~lud2/video\\_recommendation\\_demo2019/navigation\\_dark.html](https://blender04.cs.rpi.edu/~lud2/video_recommendation_demo2019/navigation_dark.html)

# Node (Entity) Extraction: Token Labeling with Sequence as Context



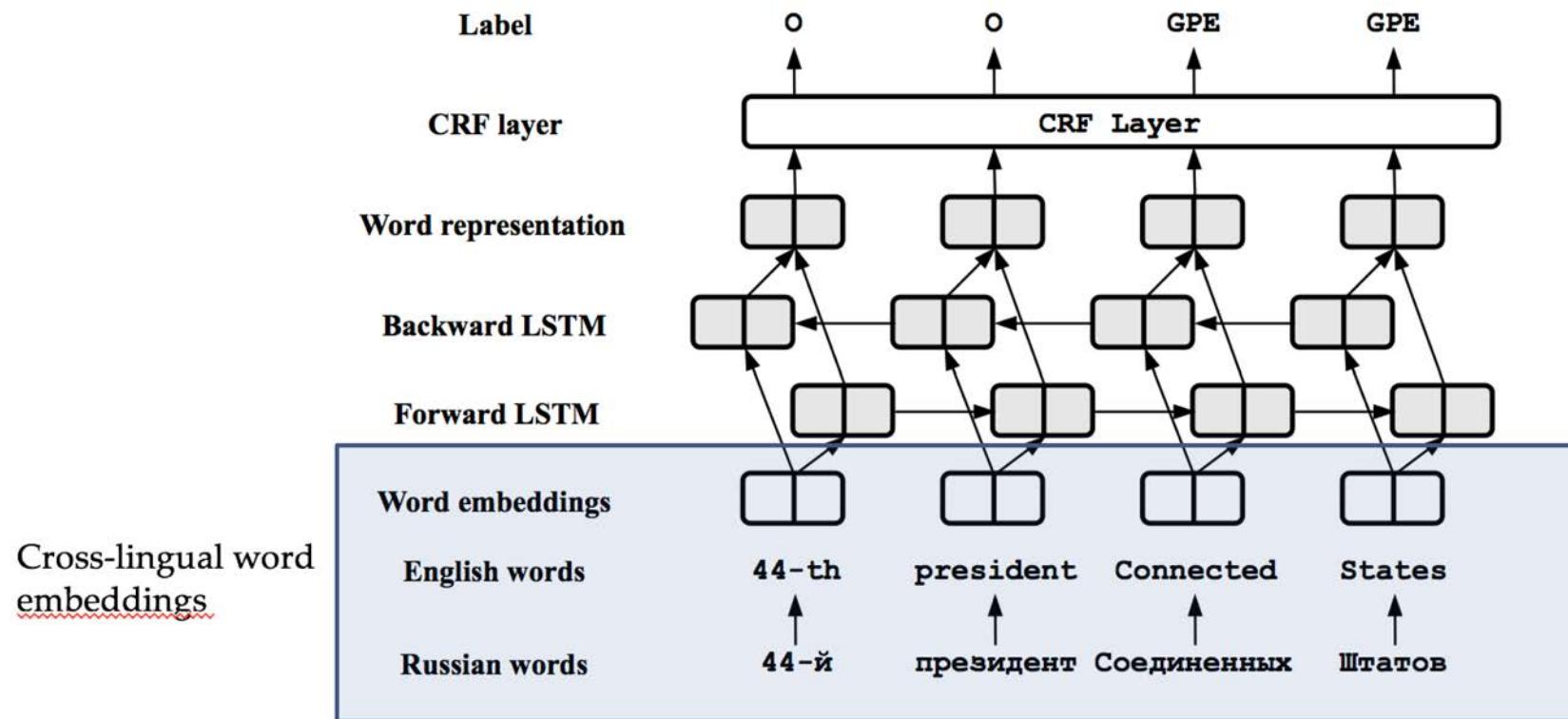
# Edge (Relation and Event) Extraction: Node Pair Classification with Graph Context



The **detainees** were **taken** to the **processing center**

# Previous Work

- Multilingual common space construction makes use of linear mappings (Mikolov et al., 2013; Rothe et al., 2016; Zhang et al., 2016; Baroni et al., 2015; Xing et al., 2015; Smith et al., 2017) or canonical correlation analysis (CCA) (Ammar et al., 2016; Faruqui and Dyer, 2014; Lu et al., 2015) to transfer surface features across languages
- Cross-lingual IE work mainly focuses on sequence labeling (name tagging) (Mayhew et al., 2017; Lin et al., 2018; Huang et al., 2019) which is not significantly influenced by word order



# Applications: Event Tracking

Timeline Home Examples System

Entity Name: All Event Type: All Event SubType: All Argument Role: All Start Date: End Date: Search

Legend: Argument Trigger Time Timeline Scale: Year Month

March 2011

## Life.Die

Independent groups say 113 men and 24 women have set **themselves** on fire since **March 2011** and **most** have **died** of **their** burns.

- Victim= {their , themselves , most }

Source Doc: **HC0007FAT**

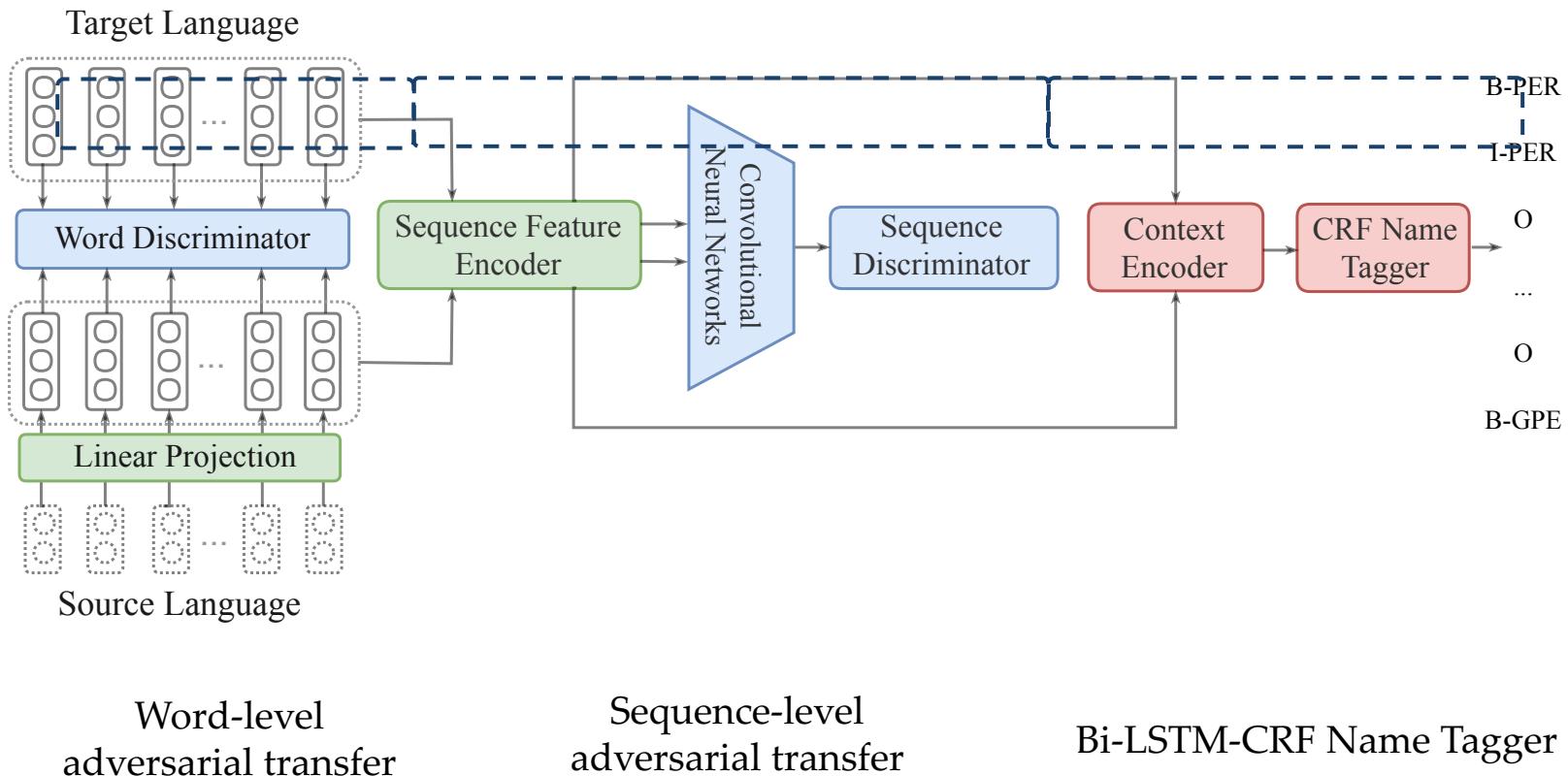
← Justice.ReleaseParole → Conflict.Attack

Timeline JS

[https://blender04.cs.rpi.edu/~lim22/gaia/GAIA\\_arg.html](https://blender04.cs.rpi.edu/~lim22/gaia/GAIA_arg.html)

# Transfer: Unsupervised Adversarial Training

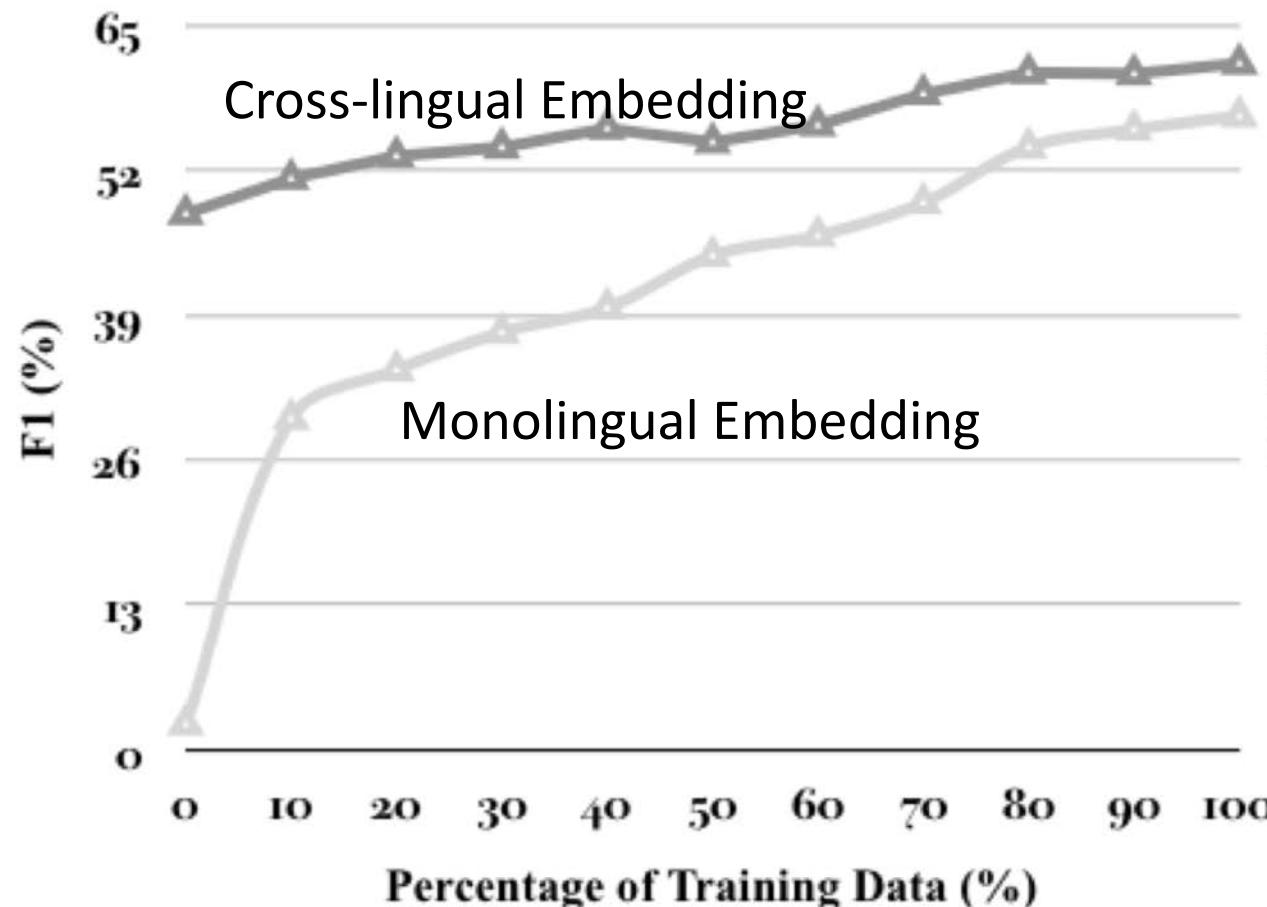
**Solution:** apply unsupervised adversarial training to extract language-agnostic features



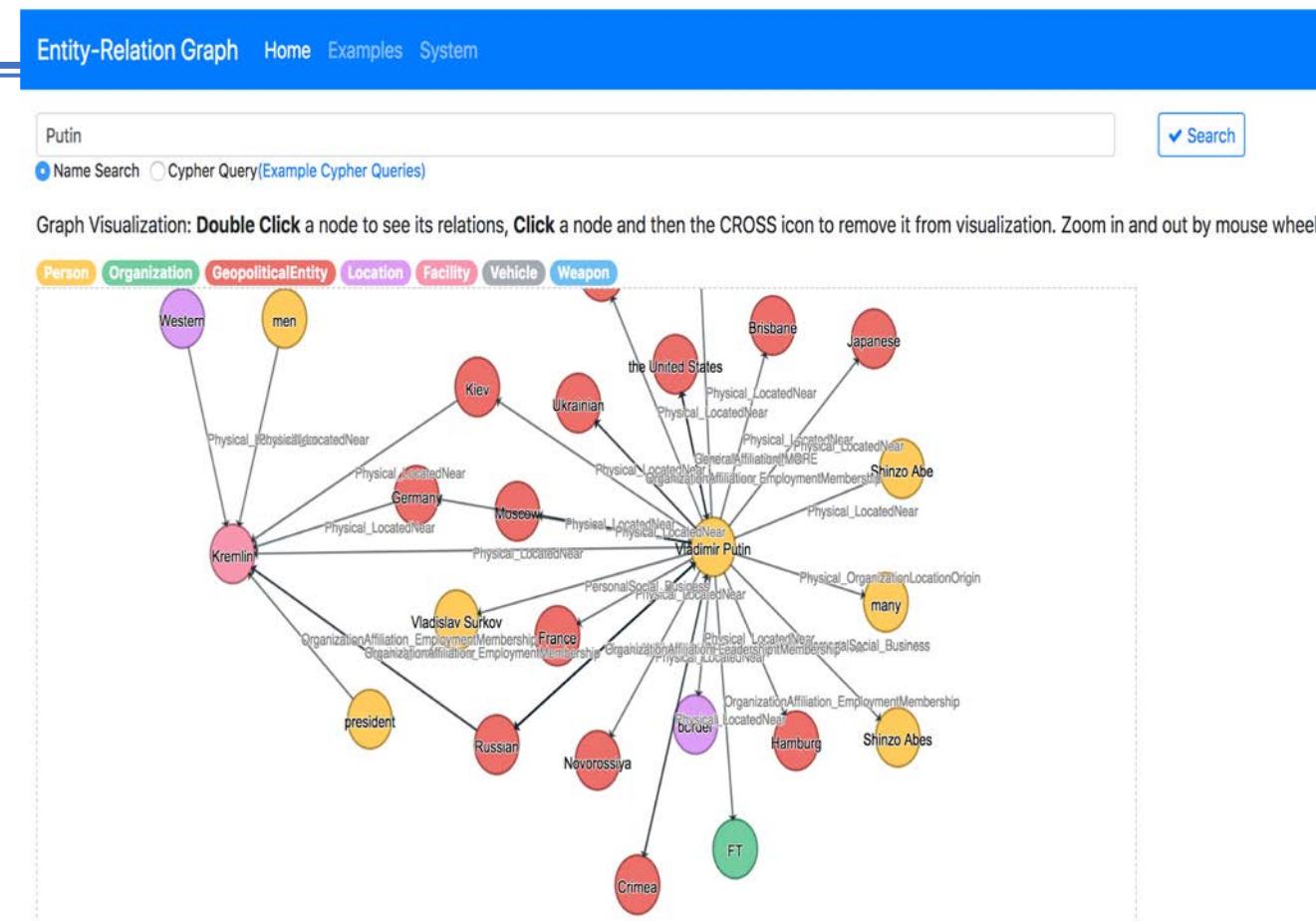
- (Huang et al., NAACL2019)

# Name Tagging Performance

- Russian name tagging F-score; English to help Russian



# Applications: Entity Relation Tracking



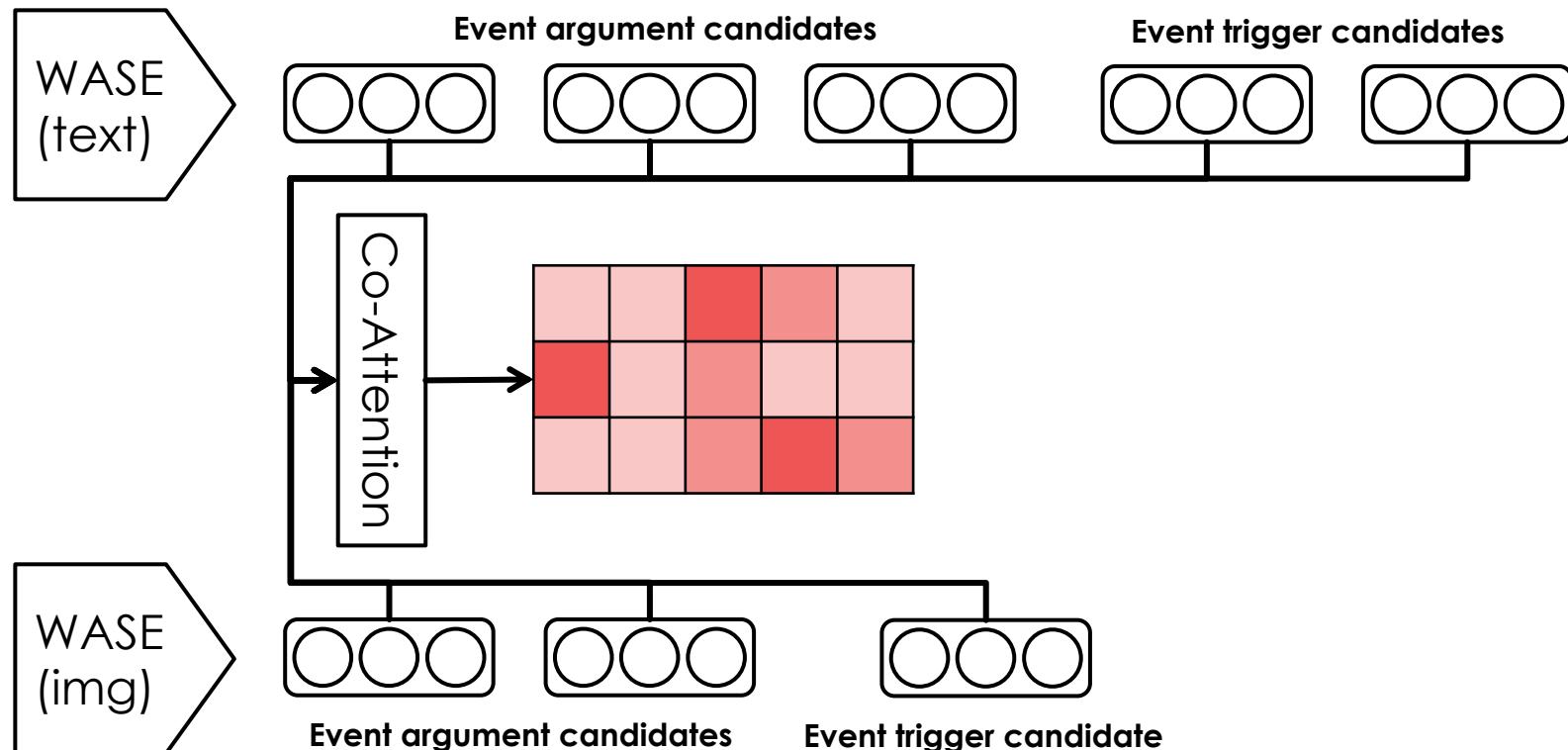
Properties: Hover over nodes and edges to see their properties here.

Type	ID	Name	Link	Mention
Person	:Entity_EDL_ENG_0153461	Vladimir Putin	LDC2015E42:m.08193	liberals,#Putin,Putin,own,President,gunmen,Mr,he,Vladimir Putin,Vladimir Putins,companies,murderers,victims,that,He,putin's,them,himself,grou
				Minister,faction,runisce,supportare,Terrorists,diplomata,leaders,wh

# Weakly Aligned Structured Embedding (WASE)

## -- Training Phase (Common Space Construction)

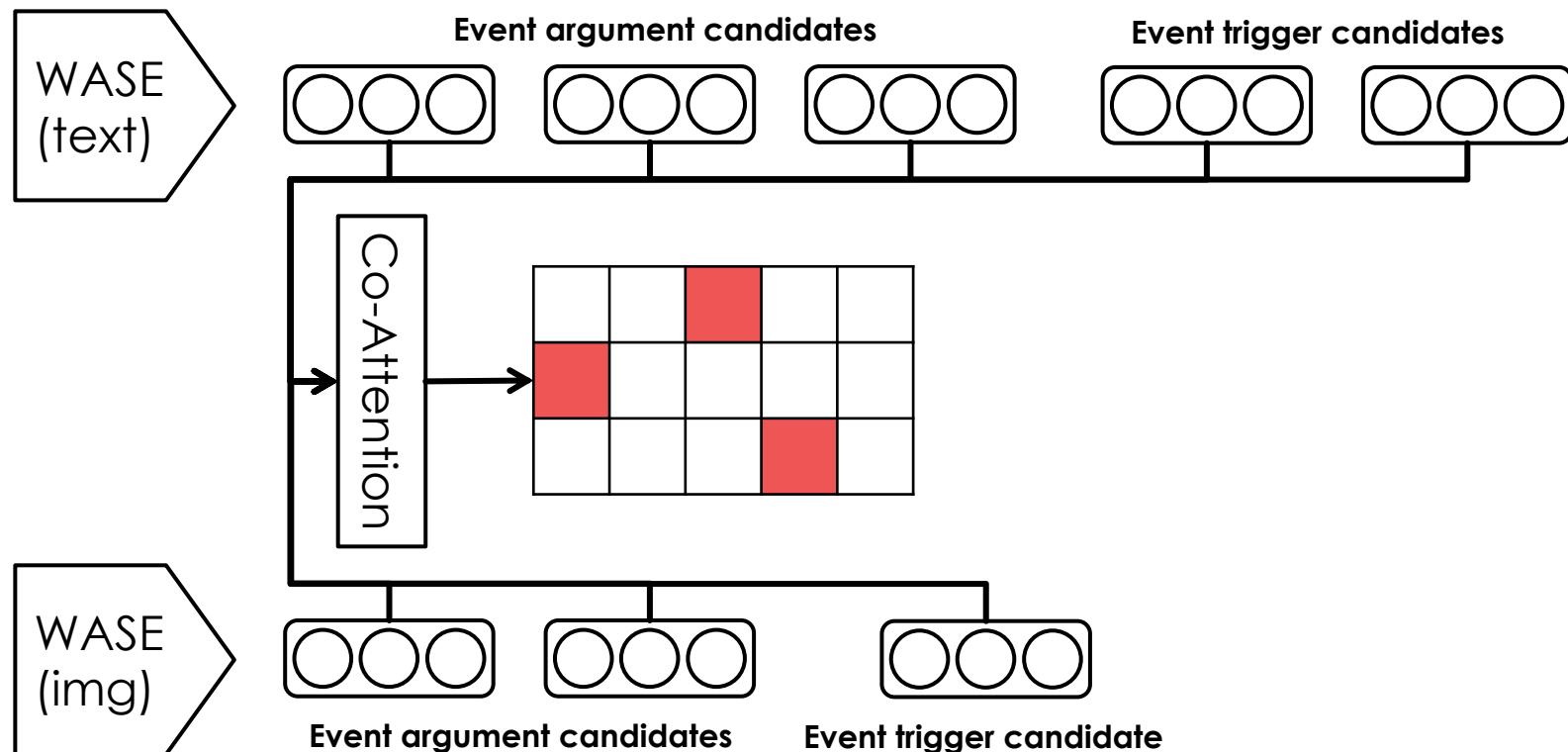
Thai opposition protesters attack a bus carrying pro-government Red Shirt supporters on their way to a rally at a stadium in Bangkok



# Weakly Aligned Structured Embedding (WASE)

## -- Training Phase (Common Space Construction)

Thai opposition protesters attack a bus carrying pro-government Red Shirt supporters on their way to a rally at a stadium in Bangkok



# Applications: County-Level Moral Concerns

- (Mooijman et al., Nature Human Behavior 2018, June Cover)

