Learning Objectives

• Recognize what each knowledge representation can be used for and when to apply them
• Note where to find the knowledge databases, how to access them, and call their APIs
• Manipulate data from knowledge representations to form schemas
History of Knowledge Bases

From slides for the [ACL 2020 Commonsense Tutorial](#) by Yejin Choi, Vered Shwartz, Maarten Sap, Antoine Bosselut, and Dan Roth
A mental representation/reference for something grounded in the real world
• Can be explained via a set of features (e.g. a CAT is a carnivore with fur, sharp claws, long tail, …)
• Can be abstract (e.g. UNICORN)
• Can be composed to create more complex concepts (e.g. black cat = BLACK + CAT)

Lexical concepts
• Words to refer to ideas

ConceptNet 5.5

https://conceptnet.io/

Data Source: crowdsourced + other sources like Wikis, OpenCyc
(Core) Languages: English, French, Italian, German, Spanish, Russian, Portuguese, Japanese, Dutch, Chinese
Use: python package, AWS, raw data

NELL

http://rtw.ml.cmu.edu/rtw/

Data Source: web crawling
Languages: English
Use: raw data

WordNet 3.1

https://wordnet.princeton.edu/

**Use:** hierarchical dictionary of “cognitive synonyms”

**Data Source:** hand-crafted

**Languages:** English, but other have made similar efforts: [http://globalwordnet.org/](http://globalwordnet.org/)

**Use:** nltk, raw data

**Demo:** [http://wordnetweb.princeton.edu/perl/webwn](http://wordnetweb.princeton.edu/perl/webwn)

SEMANTIC FRAMES & PROPOSITIONS
What is a semantic frame?

“people understand the meaning of words largely by virtue of the frames which they evoke”

• Understanding words in context
• Based on recurring experiences
SemLink/Unified Verb Index 2.0

https://github.com/cu-clear/semlink

Combines 4 systems: VerbNet, PropBank, FrameNet, WordNet and OntoNotes

Use: above link
FrameNet II

https://framenet.icsi.berkeley.edu/fndrupal/

**Data Source:** British National Corpus, US newswire, American National Corpus; annotated

**Languages:** English, global initiative: [https://www.globalframenet.org/](https://www.globalframenet.org/)

**Use:** Open-SESAME; Raw data needs to be requested
VerbNet v3.4

https://verbs.colorado.edu/verbnet/

Verb classes based on Beth Levin (1993)

**Data Source:** hand-crafted

**Languages:** English

**Use:** raw data, my code (will be provided in upcoming homework), semparse

**Demo:** [https://uvi.colorado.edu/uvi_search](https://uvi.colorado.edu/uvi_search)


Unified* PropBank

http://propbank.github.io/

Proposition → true/false statement

Data Source: hand-crafted; added to PennTreebank

Languages: English, Hindi, Chinese, Arabic, Finnish, Portuguese, Basque, Turkish (Plus a way to map English to different languages)

Use: raw data

*semantic propositions regardless of part of speech (e.g. create & creation)


OntoNotes 5.0

https://catalog.ldc.upenn.edu/LDC2013T19

**Data Source:** news, telephone conversations, blogs, talk shows, etc.

**Languages:** English, Chinese, Arabic

**Use:** raw data (same link)

CAUSAL ORDERINGS
Causal Reasoning
- CIDER (2021)
- GLUCOSE (2020)
- Causal Bank (2020)

Conceptual Knowledge
- ATOMIC (2019)
- Concept Net 5.5 (2017)

SemLink 2.0 (2021)
- Frame Net II (2016)
- Onto Notes 5 (2013)

Temporal Reasoning
- ECONET (model)
- Time Bank-Dense (2014)
- TORQUE (2020)

Semantic Frames
- NELL (2015)
- Verb Net 3.4
- Unified PropBank (2014)

ATOMIC 20 (model)
- Conceptual Knowledge

ECONET (model)
- Temporal Reasoning

ATOMIC 20 (model)
- Causal Reasoning
**RECAP: CAUSAL VS PROBABILISTIC ORDERINGS**

<table>
<thead>
<tr>
<th><strong>CAUSAL</strong></th>
<th><strong>PROBABILISTIC</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Occur because of one another</td>
<td>Occur frequently together (not necessarily because they had to)</td>
</tr>
<tr>
<td>Example: I pour dog food in my dog’s bowl. My dog eats dog food.</td>
<td>Example: I pour dog food in my dog’s bowl. I pet my dog.</td>
</tr>
</tbody>
</table>
**GPT-3 COMET With ConceptNet + ATOMIC**

**Data Source:** crowdsourcing  
**Languages:** English  
**Use:** above link  
**Demo:** [https://mosaickg.apps.allenai.org/kg_atomic2020](https://mosaickg.apps.allenai.org/kg_atomic2020)

GLUCOSE

https://github.com/ElementalCognition/glucose

Causal relations within ROCStories

Data Source: crowdsourcing
Languages: English
Use: above link

CausalBank

https://nlp.jhu.edu/causalbank/

Large, graph-based cause & effect

Data Source: Common Crawl Corpus
Languages: English
Use: raw data, COD3S

CIDER

https://cider-task.github.io/cider/

Data Source: annotated dyadic (2-person) dialogues
Languages: English
Use: repo

TEMPORAL ORDERINGS
TimeBank-Dense

https://www.usna.edu/Users/cs/nchamber/caevo/

Data Source: re-annotated TimeBank (news articles annotated)
Languages: English
Use: CAEVO, ECONET

"a representation of a plan or theory in the form of an outline or model." (from www.lexico.com/)

- Holds a set of facts/information (extracted from input text using knowledge representation)
- Can be used to capture the state of a fictional world and be updated when the fictional world changes (can be changed over time)
Jen sent the book to Remy from Atlanta.

**ROLES**
- **Agent**: Jen
- **Theme**: book
- **Destination**: Remy
- **Initial_Location**: Atlanta

**PREDICATES**
- has_location(e1, book, Atlanta)
- do(e2, Jen)
- cause(e2, e3)
- motion(e3, book)
- !has_location(e3, book, Atlanta)
- has_location(e4, book, Remy)

**SELECTIONAL RESTRICTIONS**
- Initial_Location: location
- Theme: concrete
- Agent: animate or organization
Pre-Conditions and Effects

**Jen** sent the book to **Remy** from **Atlanta**.

Pre-Conditions

- `has_location(e1, book, Atlanta)`
- `do(e2, Jen)`
- `cause(e2, e3)`
- `motion(e3, book)`
- `!has_location(e3, book, Atlanta)`
- `has_location(e4, book, Remy)`

Effects

- **Atlanta**: location
- **book**: concrete
- **Jen**: animate or organization
Jen sent the book to Remy from Atlanta.

Pre-Conditions

- has_location(book, Atlanta)
- Atlanta: location
- book: concrete
- Jen: animate or organization

Effects

- !has_location(book, Atlanta)
- has_location(book, Remy)
Resulting State Representation

**Jen** sent the **book** to **Remy** from **Atlanta**.

- **Atlanta**: location
- **book**: concrete
- **Jen**: animate or organization
- !has_location(book, Atlanta)
- has_location(book, Remy)
What’s the difference between a schema and a concept?
What’s the difference between a schema and a concept?
IN-CLASS ACTIVITY

https://interactive-fiction-class.org/in_class_activities/schemas/schemas.html
Please fill out this mid-semester survey

https://forms.gle/bQXZz3y8xzrU7wJ68

Have a good spring break!