

# **TTIC 31230, Fundamentals of Deep Learning**

David McAllester, Autumn 2020

## **AGI: Natural Language**

# Natural Language for Knowledge Representation

President Donald Trump on Tuesday insisted he was serious when he revealed that he had directed his administration to slow coronavirus testing in the United States, shattering the defenses of senior White House aides who argued Trump's remarks were made in jest.

[the order] = [Trump] directed his administration to reduce [COVID testing].

[the revelation] = [Trump] revealed [the order].

[the claim] = [the order] was in jest.

[the assertion] = [the aides] made [the claim].

# Natural Language for Knowledge Representation

President Donald Trump on Tuesday insisted he was serious when he revealed that he had directed his administration to slow coronavirus testing in the United States, shattering the defenses of senior White House aides who argued Trump's remarks were made in jest.

[the aides] = Senior White House aides

[the defense] = [the assertion] defended [Trump].

[the insistence] = on Tuesday [Trump] insisted [the order] was serious.

[the shattering] = [the insistence] shattered [the defense].

# Natural Language for Knowledge Representation

Is natural language a reflection of a general learning or knowledge representation architecture?

Will some NLP-motivated memory-based Transformer-like architecture ultimately underly general intelligence?

# Natural Language Semantics

Thousands of civilians have fled advances by Syrian government forces in eastern Ghouta as ...



## Stanford Dependencies

```
root(ROOT-0, fled-5)
  aux(fled-5, have-4)
  nsubj(fled-5, Thousands-1)
    nmod(Thousands-1, civilians-3)
      case(civilians-3, of-2)
  dobj(fled-5, advances-6)
  nmod(fled-5, forces-10)
    case(forces-10, by-7)
    amod(forces-10, Syrian-8)
    compound(forces-10, government-9)
  nmod(forces-10, Ghouta-13)
    case(Ghouta-13, in-11)
    amod(Ghouta-13, eastern-12)
```

## Just Parantheses

(Thousands of civilians)

(have fled)

(advances (by (Syrian government forces))

(in eastern Ghouta))



## Reference (Entity Linking)

Thousands of civilians have fled advances by Syrian government forces in eastern Ghouta as Damascus makes rapid gains against the last major rebel enclave near the capital.

Damascus  $\Rightarrow$  Assad

Rapid Gains  $\Rightarrow$  advances-6

the last major rebel enclave ...  $\Rightarrow$  Ghouta

the capital  $\Rightarrow$  Damascus

## Reference vs. Composition

Functional programming is compositional

$$x = f(y, z)$$

The meaning of  $x$  is computed by  $f$  from the meaning of  $y$  and  $z$ .

But in language we typically have that  $f(y, z)$  is a mention and  $x$  is its referent.

(the last (major rebel enclave) (near (the capital)))

$$x = (\text{the last } Q \ P)$$

**END**