More Meaningful Language

AI, NLP and FrameNet

ICSI / 30th Anniversary

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The Case for Case

Speculation on language universals has always and continues to be viewed as a fully respectable pastime for the scientific linguist. This recalls a Linguistic Institute lecture of not many summers ago where it was announced that the only really secure generalization on language is that some members of communities have been observed to interact by means of vocal symbols. It has now changed, it is a pleasure to report, and this is partly because some linguists are willing to risk the danger of being dead wrong.
Neural Theory of Language

✱ How can the human brain learn, use, and understand language?

✱ How are language and thought related to perception, motor control, social cognition, and other neural systems?

A lexical database linking meaning to form, based on frame semantics

MetaNet Metaphor Wiki

Language Communication with Autonomous Systems
The Embodiment Hypothesis

- Basic concepts and words derive their meaning from *embodied experience*.

- Abstract and theoretical concepts derive their meaning from *metaphorical maps* to more basic embodied concepts.

The economy is *moving* at the *pace of a Clinton jog*. 
Simulation hypothesis

- Simulation exploits some of the **same neural structures** activated during performance, perception, imagining, memory...

- Linguistic structure **parameterizes** the simulation

5 levels of the Neural Theory of Language

Cognition and Language

Computation

Structured Connectionism

Computational Neurobiology

Biology

Image Schemas
Event Structure
Grammar
Frames
Metaphor
Mental Spaces

Embodied Construction Grammar
X-schemas

Philosophy, Anthropology, Linguistics, Econ

Computer science, Psychology, Neural networks

Computational neuroscience, Neuroscience, Neurobiology

abstraction
Chuck bought a car from Jerry for $1000.

Jerry sold a car to Chuck for $1000.
Chuck bought a car from Jerry for $1000.
Chuck paid Jerry $1000 for a car.
Chuck spent $1000 on a car.
The car cost Chuck $1000.
The price of the car was $1000.

\[
\begin{align*}
\text{Frame-annotated data} & : & \text{lexicographic} & 8180 \\
& : & \text{full-text} & 4046
\end{align*}
\]

- Meaning is relativized to scenes
- Structured networks of frames represent complex events and capture conceptual generalizations
- computational models of learning & understanding (Embodied Construction Grammar, metaphor understanding)
- psycholinguistics & neuroscience empirical results
- robotics applications

- semantic role labeling, info extraction
  - PropBank, crowdsourced annotation
  - 10+ multilingual FrameNets
  - Many alumni in academia and industry...
From ICSI...

Come to Google

Are you working on language?

No... we’re a search company!

(1998-2008)

‘Sem - an - tics’?

(2008)

...via Paris...

Sony CSL

U. Sorbonne Nouvelle

...to “Semantics” @ Google

Conversational search

(2012-2013)

Research & Machine Intelligence

(2014-2016)

The Assistant

(2016 - present)
Scaling frame annotation via crowdsourcing

*(Chang, Paritosh, Huynh & Baker, 2015)*
FrameNet-Google collaboration, based on Google Faculty Research Award

Longer-term NL efforts: grounding & embodiment

More collaboration with academia
Data release planned
Multiple workshops & grants

**SLING:** Frame Semantic Parser
*(Ringgaard, Gupta & Pereira. 2017)*

graph-based frame semantic representation
Life of a Conversation

Hey Google, who won the World Cup this year?

2018 World Cup was won by The France national football team

Who’s their best player?

According to Wikipedia: La Liga’s top goalscorer is Lionel Messi.

How many goals has he scored?

On the website fcbarcelona.com, they say: The Argentine has scored 365 goals and has provided 144 assists.
Natural Language Understanding

set alarm for 6 am
wake me up at 6
6 am alarm
I need to wake up at 6
alarm at 6 in the morning

wake me up one hour before my first meeting
Actions & intents featured at Google I/O 2018 (developer conference)

“Language is hard. I work with a team of expert linguists to define intents that capture all of these natural variations...”
Ok Google, start calming activities

Ok Google, I want to start breathing exercises to chill out about my interview

Ok Google, I want to meditate for 10 minutes

Ok Google, help me get rid of stress with yoga

Built-intent: start_calming_activity

calming activity: type of activity
duration: time period for activity
stressor: reason for stress
Ideas (and people) incubated at ICSI are increasingly influential on industry NL efforts.

- Emphasis on thinking **long-term**
- Truly **interdisciplinary** environment for rich collaborations & conversations
Thank you!

Question(s)?