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Context-dependent Parsing for Time Expressions
Error Analysis

Background

- Paper:

  K. Lee, Y. Artzi, J. Dodge, and L. Zettlemoyer. 2014. Context-dependent semantic parsing for time expressions. In ACL(1).

- Introduces UWTime: A framework for parsing time expressions and resolving them to a TIMEX3 value

- Temporal semantics modeled using Combinatory Categorial Grammar (CCG)

- Authors' error analysis suggests that majority of errors stem from misused context operators

CCG with context operators

$$
\begin{array}{ccc}
\underline{\text{one}} & \underline{\text{week}} & \underline{\text{ago}} \\
\dfrac{C}{1} & \dfrac{N}{week} & \dfrac{NP\backslash NP}{\lambda x.shift(ref\_time, -1 \times x)} \\
\end{array}
$$

$$
\dfrac{N/N}{\lambda x.1 \times x}
$$

$$
\xrightarrow{\quad}{>}
$$

$$
\dfrac{N}{1 \times week}
$$

$$
\dfrac{NP}{1 \times week}
$$

$$
\xleftarrow{\quad}{<}
$$

$$
\dfrac{NP}{shift(ref\_time, -1 \times 1 \times week)}
$$

ref_time could refer to the document creation time, or the most recently mentioned range
(e.g. a previously mentioned date)

Context-Dependent Operations

- Reference Time Resolution
  - Document Creation Time vs. last_range

$$\text{this} \vdash NP/N : \lambda x.this(x, ref\_time)$$

- Directionality Resolution
  - nearest_forward vs. nearest_backward

$$nearest\_forward_{\langle s, \langle r, r \rangle \rangle}$$
$$nearest\_backward_{\langle s, \langle r, r \rangle \rangle}$$

- Shifting Granularity
  - Resolve temp_d to delta vs. anchor granularity

$$\text{before} \vdash N \backslash NP/NP :$$
$$\lambda x.\lambda y.shift(x, -1 \times y, temp\_d)$$

The Plan

- Replicate the base experiments using the freely available UWTime software ✓
- Replicate the authors' error analysis ✓
  - Manual categorization of all resolution errors in the TempEval Dev data set gold mentions
- Perform similar manual categorization of errors on the WikiWars corpus results **(underway)**
  - Not exactly the same as the other analysis
- Identify underlying causes of major sources of error, propose avenues for improvement
- Stretch goal: Update model to to prevent an identified error

Authors' vs. My Categorization

Error description	%
Wrong directionality context operator	34.6
Wrong reference time context operator	15.7
Wrong shifting granularity context operator	14.4
Requires joint reasoning with events	9.2
Cascading error due to wrong detection	7.8
CCG parse error	2.0
Other error	16.3

Error Description	
Wrong directionality context operator	27.4%
Wrong reference time context operator	13.7%
Wrong shifting granularity context operator	2.6%
Requires joint reasoning with events	12.1%
Cascading error due to wrong detection	16.3%
CCG parse error	4.7%
Other error	23.2%