Interoperable semantic annotation for language resources

Volha (Olga) Petukhova
Spoken Language Systems Group
Saarland University
Outline

Introduction

Semantic language resources | ISO standards

Annotation Theory

Abstract & Concrete Syntax | Annotation Structure

ISO 26417-2 dialogue act standard

Elements | Examples | Metamodel

Resources

Dialogue corpora | DialogBank

Annotation Tool

ANVIL
Semantically annotated corpora tend to have corpus-specific ways of analyzing and annotating the data, with lack of theoretical underpinning, domain dependence, lack of generality, lack of interoperability across approaches and domains.

Dialogue corpora (HCRC Map Task, AMI, TRAINS, ICSI-MRDA,...) mostly rather coarse-grained annotations of communicative functions of utterances and/or disfluencies

**ISO:**

- Lexical Markup Framework (LMF) for lexical resources
- Support for annotating corpus data in a way that is domain-independent and *interoperable* (and theoretically and empirically well-founded).
ISO 24617 Semantic Annotation Framework

- Part 2: Dialogue acts (Bunt et al., 2012)
- Part 4: Semantic roles (Palmer et al., 2014)
- Part 6: Principles of semantic annotation (Bunt, 2016)
- Part 8: Semantic relations in discourse (‘DR-Core’, Prasad & Bunt, 2016)
- Part 10: Co-reference (Romary, proposed November 2018)
- Part 12: Quantification (Bunt, proposed December 2018)
Example: ISO-TimeML (24617-1) Annotation of time and events

“John drove to Boston on Friday”

m1                           m2

<event xml:id="e1" target="#m1" pred="drive"/>
<timex3 xml:id="t1" target="#m2" pred="friday"/>
<tLink eventID="#e1" timex3ID="#t1" relType="during"/>

Semantics:

Ee Et drive(x) ∧ friday(t) ∧ during(e,t)
“John drove to Boston on Friday”

\[ \text{m1} \quad \text{m2} \quad \text{m3} \]

\[
\begin{align*}
<\text{event xml:id="e1" target="#m2" pred="drive" } /> \\
<\text{entity xml:id="x1" target="#m1" pred="john" } />\\
<\text{entity xml:id="x2" target="#m3" pred="boston" } />\\
<\text{srLink eventID="#e1" participant="#x1" semRole="agent" } />\\
<\text{srLink eventID="#e1" participant="#x2" semRole="final-loc" } >
\end{align*}
\]

**Semantics:**

\[ Ee \; Ex \; Ey \; \text{drive}(e) \land \text{john}(x) \land \text{boston}(y) \land \text{agent}(e,x) \land \text{final-loc}(e,y) \]

As a **DRS:**

\[ <e,x,y \mid \text{drive}(e), \text{john}(x), \text{boston}(y), \text{agent}(e,x), \text{final-loc}(e,y)> \]
Example: ISO-TimeML (24617-1) and ISO 24617-4 combined

“John drove to Boston on Friday”

\[
\begin{align*}
m1 & \quad m2 & \quad m3 & \quad m4 & \rightarrow \text{ISO 24617-2 + ISO 24617-4} \\
\end{align*}
\]

<event xml:id="e1" target="#m2" pred="drive"/>
<entity xml:id="x1" target="#m1" pred="john"/>
<entity xml:id="x2" target="#m3" pred="boston"/>
<timex3 xml:id="t1" target="#m2" pred="friday"/>
<srLink eventID="#e1" participant="#x1" semRole="agent"/>
<srLink eventID="#e1" participant="#x2" semRole="final-loc"/>
<tLink eventID="#e1" timex3ID="#t1" reltype="during"/>

\[
\begin{align*}
&e,x,y,t \mid \text{drive(e), john(x), boston(y), friday(t), agent(e,x), final-loc(e,y), during(e,t)} \\
&\rightarrow \text{Representation of sentence semantics!}
\end{align*}
\]
Dialogue Act Annotation Frameworks

Speech Act Theory (Austin, Searle)

Communication as Cooperation (Grice)

Communicative Activity Analysis (Allwood)

HCRC TRAINS MRDA … GBG-IM DIT

DAMSL + der.

MATE DIT++

Verbmobil-2

DIT++ (Release 5)

LIRICS

ISO 24617-2
Comprehensive, domain-independent taxonomy of dialogue acts

- Dialogue acts defined semantically as *update operators* applied to participants’ *information states*

- Dialogue utterances may be *multifunctional*, due to multiplicity of tasks in communicating

- Dialogue annotation is *multidimensional*, assigning multiple dialogue acts to segments of dialogue in multiple ‘dimensions’

- Taxonomy organized according to *orthogonal* DIT++ *dimensions* of communication
Example

- A: Ehm, okay that's fine with me.

  *Stalling*  *Feedback*  *Inform*

  *Take Turn*

- sequential multifunctionality
- simultaneous multifunctionality

  (Allwood, 1994)
Definition:

- **Functional segments** are *minimal* stretches of communicative behaviour that have one a communicative function.
- Minimal: no material that does not contribute to the expression of a communicative function or semantic content.
- Fine-grained segmentation supports high-accurate annotation.
A1: We're aiming a fairly young market

Task

B1: Do you think then we should really consider voice recognition

Propositional Question

Auto-F.

B2: What do you think Craig

Set Question

TurnM Assign to A

C1: Well did you not say it was the adults that we're going for

Propositional Question to A1

Auto-F.

Pos. exe B2 Neg. exe A1

Accept Assign A
Dialogue Act Annotations

- **Qualifiers**, e.g. for sentiment and certainty, for making fine-grained distinctions.
- **Functional dependence relations** (e.g. Answer à Question, Confirmation à Check Question) between dialogue acts
- **Feedback dependence relations** between a feedback act and its ‘antecedent’ dialogue act
- **Rhetorical relations** between dialogue acts or their semantic contents
- Annotation language **DiAML (Dialogue Act Markup Language)** with
  - Abstract syntax (annotation structures as pairs, triples,...)
  - Concrete syntax defining XML-representations
  - Semantics of annotation structures as information-state update operators
ISO 24617-2 dialogue acts

Scope:

Indication of functional meaning of dialogue utterances in terms of dialogue acts.

Full characterization of dialogue acts:

- Sender, addressee(s), other participants
- Communicative function and dimension
- Qualifications (sentiment, certainty, conditionality)
- Semantic relations to other dialogue acts
- Semantic content

Semantic content left out of consideration.
ISO 24617-2 dialogue acts: metamodel
The representation of annotations in the ISO Dialogue Act Markup Language (DiAML) relies on a three-level architecture:

1. a primary source, which may correspond to a speech recording, textual transcription or any low-level annotation thereof, e.g. a tokenisation;
2. the marking of functional segments from the primary source;
3. the actual dialogue act annotation associated with a functional segment.

XML element <dialogueAct> has the following attributes:

- @target, whose value is a functional segment identified at the second level;
- @sender, @addressee, @otherParticipant;
- @communicativeFunction, @dimension;
- @certainty, @conditionality, and
- @sentiment qualifiers;
- @functionalDependence and @feedbackDependence, which have <dialogueAct> elements and functional segments as values.
DiAML example

P1: What time is the first train on Sunday to the Airport?
P2: The first train on Sunday is at 6.15, I believe.

<diaml xmlns="http://www.iso.org/diaml/">

<dialogueAct xml:id="da1" target="#fs1" sender="#p1" addressee="#p2" communicativeFunction="setQuestion" dimension="task" />

<dialogueAct xml:id="da2" target="#fs2.1" sender="#p2" addressee="#p1" communicativeFunction="autoPositive" dimension="autoFeedback" feedbackDependence="#fs1"/>

<dialogueAct xml:id="da3" target="#fs2" sender="#p2" addressee="#p1" communicativeFunction="answer" dimension="task" certainty="uncertain" functionalDependence="#da1"/>
</diaml>
Continuous Dialogue Corpus Creation

Instantiations of the ISO 24617-2 METAMODEL: initial | revised | tailored to application

Set-up

Collection

Modeling

Evaluation

Deployment

Implementation & Testing

Corpus
The DialogBank

Language resource built at Tilburg University (https://dialogbank.uvt.nl/)

Annotated dialogues:

- Using ISO 24617-2
- Gold standard
- Re-annotated dialogues from existing corpora
- Some with original annotations
- Some with annotations of previous DIT++ versions
- Newly annotated dialogues from existing corpora without annotation
- From newly collected corpora