DS-TTR: An incremental, semantic, contextual parser for dialogue

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Abstract

We describe a demo to be given at the conference, of the DS-TTR dialogue parser[1]. We will show how the DS-TTR semantic context is updated in real time as dialogues are parsed incrementally, covering a variety of contextual phenomena.

1 Introduction

Language processing in dialogue is incremental and highly contextual. Dialogue is replete with fragments, ellipsis, incomplete sentences, add-ons, barge-ins, false starts, and repair (see dialogues in Fig. 1). This has had the consequence that traditional models of syntax and semantics, based strictly around the notion of a sentence have had very little success in handling dialogue phenomena, and often just put them to one side as instances of defective performance or disfluency. Although in the last decade or so, various researchers have attempted to come up with general, scalable models of semantic/contextual processing in dialogue (pioneered by the work of the likes of Ginzburg, Cooper, Traum and others (Ginzburg, 2012; Traum and Larsson, 2003)), they are hardly ever used in working, end-to-end, dialogue systems. In these existing systems, the Natural Language Understanding and Generation components are almost invariably shallow, based on pattern-matching, statistical methods, or templates, and they are highly domain-specific, thus rendering them of little or no use in a new dialogue domain. Apart from the highly domain-specific nature of meaning in general, this status quo seems to be due the apparent messiness of dialogue, as noted above, leading dialogue systems developers to use shallow statistical methods to achieve some degree of robustness in their end-to-end systems: the existing dialogue processing models alluded to above are too restrictive.

What is needed is a semantic parser/generator that is wide-coverage, capable of processing natural dialogue with all its seeming messiness; and producing domain-general, deep, re-usable semantic and contextual representations of dialogue. In what follows, we describe a working dialogue parser which is close to satisfying these properties. This is an implementation of Dynamic Syntax and Type Theory with Records (DS-TTR, (Kempson et al., 2001; Eshghi et al., 2012)), which has been in development over the past 10 or so years, showing its applicability to modelling a wide range of dialogue phenomena, including self-repair (SR) (Hough, 2015), ellipsis (Kempson et al., 2015), short-answers (SA), clarification interaction (CR), corrections (COR), split-utterances (SU) and backchannels (ACK) (see Fig. 1 for examples). It is this parser that we aim to demo at the SemDial conference, showing examples of how it handles various dialogue phenomena in real time.

2 The DS-TTR parser/generator

DS-TTR is an action-based parser/generator, based around the Dynamic Syntax (DS) grammar framework (Kempson et al., 2001) and Type Theory with Records (TTR, Cooper (2005)) which models the word-by-word incremental, *semantic* processing of linguistic input without recognising an independent level of syntactic representation. In DS, dialogue is modelled as the interactive and incremental construction of contextual and semantic representations. In DS-TTR, words are seen as contextual updates with context being based on the parsed search graph, a Directed-Acyclic Graph (DAG), encoding not only the fine-grained semantic contents that is jointly constructed, but also the steps (actions/words) that go on to build them

[1] Downloadable from: http://sourceforge.net/projects/dylan/. Soon to be ported to: https://bitbucket.org/dylandialoguesystem

(1)	(2)	(3)
A: Who did you meet yesterday? B: Arash [SA] A: The guy from your group? [CR] B: no, my cousin [COR] A: right [ACC]. I think I have met him.	A: Yesterday, I finally cooked uhh B: What? [CR,SU] A: Stew, uhh, Beef Stew [SR,SU] B: with carrots? [SU] A: yeah [ACC]	A: Bill arrives tonight B: Really? A: Yeah B: From London? [SU] A: no, Paris [Cor] B: uhh okay. [Ack]

Figure 1: To be demoed: Example dialogues parsable by DS-TTR

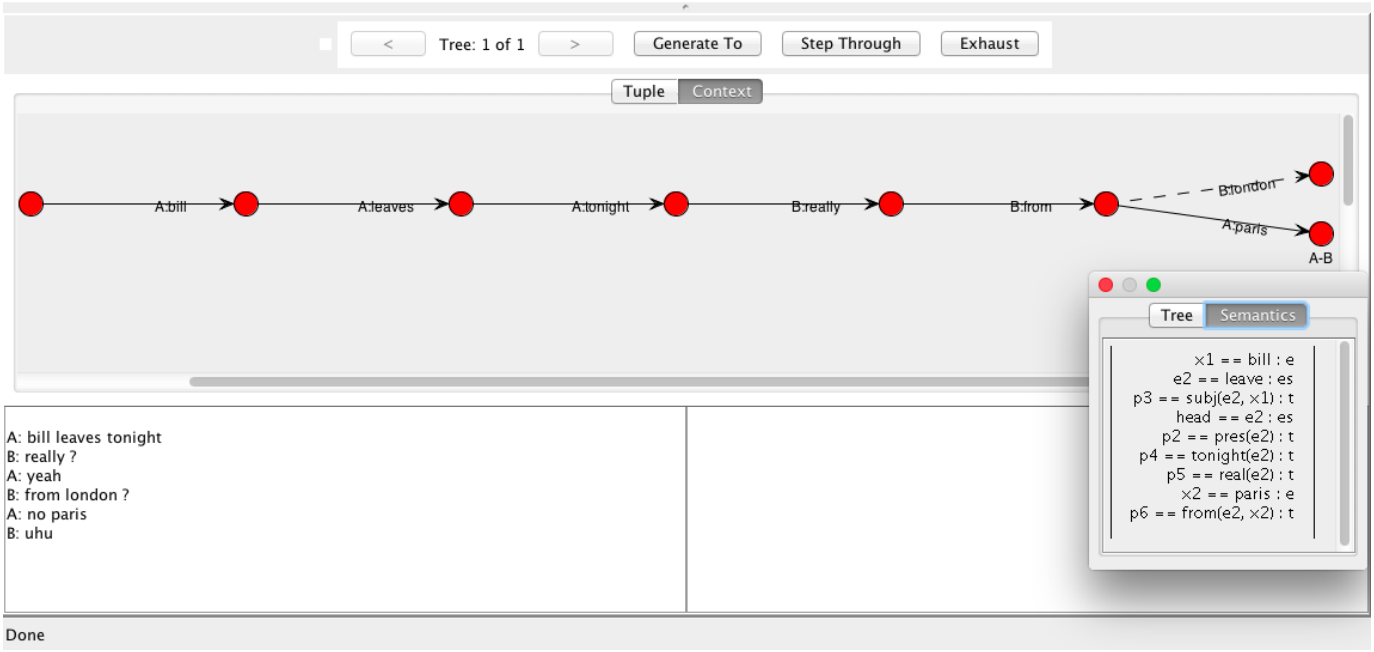

Figure 2: Parser Screen Shot: Parsing dialogue (3), Fig. 1

(see Fig 2). Eshghi et al. (2015) show how this word-by-word contextual update process can be achieved using only the existing core mechanisms of the grammar, and capturing updates arising from feedback/grounding phenomena (backchannels and CRs) without recourse to higher level pragmatic inference, or dialogue acts.

Nodes on the context DAG are semantic representations; and edges, words indexed to speaker, i.e. semantic updates (see Fig. 2) - note that only the currently active edges and nodes are shown here: the underlying parse search DAG is much bigger than this with many more branches corresponding to parsing ambiguity. Pointers on the DAG mark nodes where each participant has given evidence of acceptance for reaching (see Eshghi et al. (2015) for details): the A-B below the final node in Fig. 2 means pointers for speakers A and B are both convergent on that node, and thus that the semantic content at that node - the TTR record type below it in the small separate window - is grounded. The branching at the end is the result of the rejection+correction ("no Paris").

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