

Formalizing Practical
Argumentation
Lecture 5:
Formalizing Adversarial
Reasoning with Precedents

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Bahia Blanca, June 1998

Introduction

Prakken & Sartor (1998)

- *Aim*: formalize HYPO-style reasoning with the tools of argumentation systems.
- *Ideas*:
 - Model dialectical setting with dialectical proof theory
 - Regard analogy and distinguishing as heuristics for premise introduction
- Main difference with HYPO: ‘normative’ instead of ‘descriptive’ dialectics:
Aim of game is testing a claim, not to produce realistic disputes.
 \Rightarrow
Dialectical asymmetry.
- Related work: Loui et al. (1993), Loui & Norman (1995, 1997)

Aspects:

1. Represent precedents as argument structures
2. Distinguish premises from ‘background’ information on precedents.
3. Define analogizing and distinguishing as premise-introducing dialogue moves
4. Define the notion of an actual dialogue
5. Define ‘winning’ relative to a stage in a dialogue.

1 Representing precedents

- Precedents in HYPO: factors pro and con a decision
- Formalization in Prakken & Sartor:

$$r_1: PRO_1 \wedge \dots PRO_n \Rightarrow DEC$$

$$r_1: CON_1 \wedge \dots CON_m \Rightarrow \neg DEC$$

$$p_1: \Rightarrow r_2 \prec r_1$$

- Problem: complex argumentation in precedents cannot be represented
 \Rightarrow
- Generalization (Loui & Norman 1995): A dialectical structure of arguments pro and con the decision (summarized by the premises used)

Example precedent:

$domestic-property \Rightarrow domestic-company,$
 $r_1: \neg domestic-headquarters \wedge \neg domestic-president \Rightarrow$
 $domestic-company,$
 $r_4: domestic-company \wedge short-duration \wedge$
 $domestic-citizenship \Rightarrow \neg change,$
 $r_6: \neg kept-house \wedge \neg domestic-job-prospects \Rightarrow change,$
 $r_{2/13} \prec r_{3/5/14},$
 $r_{10/12} \prec r_7,$
 $r_7: kept-house, f_7: domestic-property, f_5: short-duration,$
 $r_{11}: domestic-headquarters, f_{12}: \neg domestic-president,$
 $r_{14}: domestic-job-prospects, f_{14}: domestic-citizenship\}$

Intermediate decision: $\neg domestic-company$
 Final decision: $change$

2 Premises, background information

- A *Background Information theory (BI)* is a triple $(Cases, CFS, CSRules)$, where
 - *Cases* is a set of precedents;
 - *CFS* is a set of strict rules, the current fact situation;
 - *CSRules* is a set of rules, the ‘common sense’ knowledge.
- Any dialogue begins with

$$\Gamma_0 = CFS \cup CSRules$$
- During a dialogue, new premises can be introduced when ‘introducible’ from *BI*.

3 Premise introduction

$r_{3/5/14}$: $\text{domestic-company} \wedge \text{short-duration} \wedge$
 $\text{domestic-citizenship} \Rightarrow \neg \text{change}$

denying: $r_{3/5}$: $\text{domestic-company} \wedge \text{short-duration} \Rightarrow \neg \text{change}$

function: $r_{d_{14}}$: $\sim \neg \text{domestic-citizenship} \Rightarrow \neg \text{appl}(r_{3/5})$

ducible rules:

$\text{ducibles}_{BI} \supseteq \text{Broadenings}_{BI} \cup \text{Distinctions}_{BI}$.

4 Actual dialogues

Definition 0.1 (*actual dialogues*) For any BI an actual dialogue based on BI is a sequence of moves $\text{move}_i = (\text{Player}_i, \text{Arg}_i)$ ($i > 0$), such that

1. Arg_i contains only rules from $\text{CFS} \cup \text{CSRules} \cup \text{Introducibles}_{BI}$
2. $\text{Player}_i = P$ iff i is odd; and $\text{Player}_i = O$ iff i is even;
3. If $\text{Player}_i = \text{Player}_j = P$ and $i \neq j$, then $\text{Arg}_i \neq \text{Arg}_j$;
4. If $i \neq 1$, then move_i is for some $j < i$ a valid reply to move_j in a priority dialogue.

Remark: An actual dialogue is a tree of priority dialogues.

5 Winning an actual dialogue

- The premises at stage i , with tree T_i :

$$\Gamma_i = \text{CFS} \cup \text{CSRules} \cup (\text{Introducibles}_{BI} \cap \text{Rules}_{T_i})$$
- Branch B of actual dialogue T is a P -alternative to branch B' of T iff B and B' split at a move by O .

Definition 0.2 (*actually winning*) *Player _{i} wins an actual dialogue T_i iff*

1. *Player _{$i+1$} cannot move with arguments containing only rules from Γ_i ;*
2. *If Player = P then all branches of T won by O have a P -alternative won by P ;*
3. *If Player = O then not all branches of T won by O have a P -alternative won by P .*

Summary

- HYPO:
 - Reconstructed as normative dialectics
 - Extended with multi-step precedents and multiple priority sources
- Computational dialectics:
 - Actual dialogues, linked with argument-based semantics.