**Argumentation in Artificial Intelligence, With Applications in the Law**

Course at the Institute of Logic and Cognition, Sun Yat-Sen University

**Ia Introduction**

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**Legal argument: setting**

- There is a *conflict* between parties
- *Argumentation* is a tool to find a reasonable, practical, acceptable *solution*
- Parties are *normatively bound*

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**The law**
Artificial Intelligence

Maar edelachtbare, u drinkt toch ook wel eens een glaasje? But, Your Honour, you sometimes have a drink too, don’t you?

Artificial Intelligence and Law

Theoretical arguments

If $p$, then $q$

$\neg q$

Therefore: $\neg p$

<table>
<thead>
<tr>
<th>$p$</th>
<th>$q$</th>
<th>$p \rightarrow q$</th>
<th>$q \rightarrow (p \rightarrow q)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
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Natural arguments

Artificial arguments

```
theorem
  not m in m + f for m holds m \geq m
  proof
    assume not thesis;
    then consider n such that
    A1: for m holds m \geq m;
    set n = n + 2;
    n > m by KNEXL,1;31;
    then not for m holds m \geq m;
    hence contradiction by A1;
  end;
```

Computer understandable proof taken from a slide by Freek Wiedijk “Formal proof with the computer”, Johann Bernoulli Colloquium, University of Groningen, 2010-03-17, 16:15
This course

The course aims to provide an overview of argumentation as it is studied in Artificial Intelligence, led by applications in the field of law.

Goals:
- Acquire knowledge of the study of argumentation in Artificial Intelligence
- Acquire knowledge of the applications in the field of law
- Develop critical reflection about the subject matter and the state-of-the-art in the field

Lecture Ia: Introduction
Lecture Ib: Abstract Argumentation and Argument Structure
Lecture IIa: Argument Schemes and Argumentation Dialogues
Lecture IIb: Argumentation with Rules and with Cases
Lecture IIIa: Reasoning with Evidence
Lecture IIIb: Argument Strength and Probabilities

Warning

This course is about research

Loose ends
Confusing, differing terminology

Literature

Chapter 11 (draft) of
Handbook of Argumentation Theory
A Comprehensive Overview of the State of the Art
Frans H. van Eemeren, University of Amsterdam
Bart Dassan, University of Amsterdam
Erik C. W. Krabbe, University of Groningen
A. Francisca Snoeck Henkemans, University of Amsterdam
Bart Verheij, University of Groningen
Jean H. M. Wagemans, University of Amsterdam

To appear 2014
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IA Introduction

Topics:
- Argumentation in Artificial Intelligence
- Historical Background

Goals:
- Get an overview of the course and its subject matter
- Acquire insight about the historical background

Literature:

Historical background

Where did research on argumentation in Artificial Intelligence come from?

1. Nonmonotonic logic
2. Defeasible reasoning

Nonmonotonic logic

A logic is non-monotonic when a conclusion that, according to the logic, follows from certain premises need not always follow when premises are added.

In contrast, classical logic is monotonic:

IF
  P implies Q
THEN
  P, P' implies Q

Reiter’s logic for default reasoning

Birds fly
- BIRD(x) : M FLY(x) / FLY(x)

A penguin does not fly
- PENGUIN(x) → ¬FLY(x)

FLY(t) follows from BIRD(t)

FLY(t) does not follow from BIRD(t), PENGUIN(t)

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Logic programming

parent(pam, bob)
parent(tom, bob)

?- parent(pam, bob).
YES
?- parent(may, bob)
NO

Closed world assumption
Negation as failure

Impact of the study of non-monotonic logic

- Very successful as a research enterprise
- Innovations in computer programming
- Not all expectations fulfilled

Ginsberg 1994:
The field put itself "in a position where it is almost impossible for our work to be validated by anyone other than a member of our small subcommunity of Artificial Intelligence as a whole"

Defeasible reasoning

In 1987, John Pollock published the paper ‘Defeasible reasoning’ in the *Cognitive Science* journal.

What in AI is called “non-monotonic reasoning” coincides with the philosophical notion of “defeasible reasoning”.

Pollock’s red light example

- The object is red
- The object is illuminated by a red light
- The object looks red

Undercutting defeat

Theory of warrant

A proposition is warranted in an epistemic situation if and only if an ideal reasoner starting in that situation would be justified in believing the proposition.

Here justification is based on the existence of an undefeated argument with the proposition as conclusion.
Classes of specific reasons

(1) Deductive reasons
(2) Perception
(3) Memory
(4) Statistical syllogism
(5) Induction

Pollock 1995, *Cognitive Carpentry*

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**H. L. A. Hart 1948**

[... the accusations and claims upon which law courts adjudicate can usually be challenged or opposed in two ways. First, by a denial of the facts upon which they are based [...]) and secondly by something quite different, namely a plea that although all the circumstances on which a claim could succeed are present, yet in the particular case, the claim or accusation should not succeed because other circumstances are present which brings the case under some recognized head of exception, the effect of which is either to defeat the claim or accusation altogether, or to "reduce" it so that only a weaker claim can be sustained (Hart, 1951, pp. 147-148; also quoted by Loui, 1995, p. 22).

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**Main themes of Toulmin (1958)**

1. Argument analysis involves half a dozen distinct elements, not just two.
2. Many, if not most, arguments are substantial, hence defeasible.
3. Standards of good reasoning and argument assessment are non-universal.
4. Logic is to be regarded as generalised jurisprudence.

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**Toulmin’s model**

- **D**
  - Since W
  - Unless R
  - On account of B

- **So, Q, C**

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**Toulmin’s model**

- Harry was born in Bermuda
  - Since
  - Unless
  - On account of

- So, presumably
  - Harry is a British subject

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**The uses of argument through time: Toulmin’s model**

- Harry is a British subject
  - Since
  - Unless
  - On account of

- The following statutes and other legal provisions:

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**Datum and claim**

Harry was born in Bermuda → Harry is a British subject

**Datum and claim**

D: Harry was born in Bermuda.
C: Harry is a British subject.
D -> C: If Harry was born in Bermuda, he is a British subject.

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**On arguments and Modus ponens**

1. Harry was born in Bermuda. Therefore, he is a British subject.
2. Harry was born in Bermuda. If Harry was born in Bermuda, he is a British subject. Therefore, he is a British subject.

In the present setting, Modus ponens is not a representation of an argument, but specifies how evaluation values are transferred.

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**Attack I (no warrants)**

Harry was born in Bermuda → Harry is a British subject
Attack I (no warrants)

Harry was born in Bermuda

Harry is a British subject

Harry has become a naturalized American

Reinstatement

Break a window

Obligation to pay for the damages

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**Literature:**
For more information on Toulmin & argumentation in Artificial Intelligence, see:
