

Argumentation in AI

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What's new in Argumentation in AI?

- In 2004 and 2005 tutorials were offered at ECAI and IJCAI on argumentation and dialogue in AI.
- Significant expansion and development since 2005.
- Books and articles providing introductions and research overviews.
- Number of specialist arenas for dissemination of argumentation related research.
- Considerable changes in focus of research.

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Books, survey articles etc.

- a. P. Besnard and A. Hunter, *Elements of Argumentation*, MIT Press, 2008
- b. I. Rahwan and G. Simari (eds), *Argumentation in AI*, Springer, 2009
- c. T. Bench-Capon and P.E. Dunne, *Argumentation in AI* (intro. to special issue of AIJ, 171:619-641, 2007)
- d. I. Rahwan and P. McBurney, *Argumentation Technology*, (intro. to special issue of IEEE Intell. Systems, 22:21-23, 2007)

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Dissemination

- Argumentation now features as a keyword at all major AI and agent related conferences: IJCAI, ECAI, AAAI, AAMAS.
- To complement existing workshops (ArgMas, CMNA) a dedicated international biennial conference – COMMA – started in 2006 (Liverpool) and was held subsequently in 2008 (Toulouse). The 2010 conference will be hosted by Univ. of Brescia.
- Specialist journal – *Argument and Computation* – has recently (2009) been launched by Taylor & Francis.
- A number of journals, e.g. JLC, have specific argumentation related “corners”.
- Argumentation related research accounts for a significant number of published articles in archival journals such as Artificial Intelligence Journal.

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Research directions

- a. New material refining “*set of justified arguments*”: Caminada(2006), Baroni et al. (2005,2006); Dung et al.(2007); Coste-Marquis et al.(2005); Cayrol et al.(2005).
- b. Activity expanding the concept of “*argument p attacks argument q*” in Amgoud and Cayrol(2002), Bench-Capon(2003). Treatments of Modgil(2009), Modgil & Bench-Capon (2009); Simari et al (2008), Baroni et al. (2008,2010), Dunne et al. (2009).
- c. (a) and (b) have seen treatments of *algorithms and complexity*: Dunne (2007, 2008, 2009, 2010); Dvorak & Woltran (2010); Baroni et al. (2009, 2010); Simari et al. (2010), Szeider et al. (2010); Dunne, Modgil & Bench-Capon (ECAI 2010).

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Introduction

- Overview – Argumentation vs. Proof
- Modelling Arguments
- Semantics – sets of arguments.
- Refining concepts of “attack”.
- Algorithms and Complexity .
- Research Issues and Conclusion.

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Argumentation

The study of processes

“concerned with how assertions are *proposed, discussed, and resolved* in the context of issues upon which several *diverging opinions* may be held”

(Bench-Capon and Dunne, *Argumentation in AI*, AIJ, 171:619-641, 2007)

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Applications

- Agent-based negotiation
- Decision explanation support
- Legal Reasoning

*“I can see no logical, practical or moral justification for a claim for expenses being covered by privilege, and I can see no **legal** justification for it either.”*
(Mr. Justice Saunders, over-ruling attempts by former MPs to avoid criminal trial for expenses fraud; Southwark Crown Court, 11th June 2010)

Argument and Proof

“Which do you want to know; what happened or the truth? What do you mean they’re the same? Of course they’re not! I can believe something happened but that doesn’t make it true –”

David Peace, *Occupied City*

“That sounds pretty far-fetched.”

“Facts can be bent to conform to any thesis.”
James Ellroy, *American Tabloid*

Argumentation vs. (Mathematical) Proof

- **Mathematical Proof**

*Closed world, Objective, Final,
Symbolic, Demonstrative*

- **Argumentation**

*Open world, Subjective, Defeasible,
“multi-media”, Persuasive*

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Closed vs Open worlds

- **Mathematical Proof**

Uses logical and axiomatic frameworks whose
fundamental assumptions (axioms) within a theory *do
not change*.

e.g. ZF basis in set theory; Euclidean geometry;
Huntingdon's postulates in Boolean algebra.

- **Argumentation**

Conclusions and conduct of debate subject to change
given *new information, evolving social attitudes*, etc.
e.g. slavery no longer defensible but considered so
150 years ago; views on alcohol and tobacco use.

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Objectivity vs Subjectivity

- **Mathematical proof**

No (rational) basis for debate as to whether a proof is
correct. Notions of results as “inconvenient” or
“counter-intuitive” do not provide an accepted
rationale for rejecting a proof.

e.g. Gödel's Incompleteness Theorems; status of the
Continuum hypothesis.

- **Argumentation**

May use “fallacious” reasoning. While there may be a
common background understood for discussion
subjective judgements colour interpretations and
weight placed on particular debate stages.

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Examples

- **Inappropriate appeal to authority**
"FIFA should introduce goal-line technology to help referees because David Cameron says so."
- **Statistical chicanery**
 - a. 10% of serious traffic accidents are caused by drivers under the age of 14.
 - b. Hence, 90% of serious traffic accidents are caused by drivers aged 14 or more.
 - c. Therefore, in order to make roads safer, it should be illegal to drive a car after the age of 14.

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Final vs Defeasible

- **Mathematical Proof**
The status of a mathematical theorem (once proven) is not subject to future challenge let alone reversal.
e.g. " $p^2+q^2=r^2$ iff (p,q,r) are the lengths of the sides of a right-angled triangle with hypotenuse r"
- **Argumentation**
Conclusions are neither final nor definitive but always open to the possibility of being over-turned.

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Examples

- Appeal processes in law even with nominal final appeal court, e.g.
USSC contradictory rulings in *Penry v. Lynaugh* (1989) and *Atkins v. Virginia* (2002)
- 18th and 21st Amendments.
- (Potential) changes to English status quo arising from UK ruling coalition, e.g.
fox-hunting (currently banned, Conservatives promise free vote on re-introduction)
student tuition fees (introduced by Blair govt.; abolition by 2016 promised in LibDem manifesto).

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Symbolic v. “multi-media”

- **Mathematical Proof**

At its most basic level is ultimately concerned with the construction of sequences of symbols by applying allowed manipulation rules.

e.g. axioms and inference rules in symbolic logic.

- **Argumentation**

Arguments may be expressed through means other than verbal and symbolic communication.

Examples

- Visual methods, e.g. montage in Eisenstein's propaganda films.
- Aural methods, e.g. use of leitmotiven for character and emotional association in Wagner's late works.
- Combination of these: many cinematic examples where argument is effected by integrating image, script, background score.

Demonstrative vs. Persuasive I

- **Mathematical Proof**

The goal of a “mathematical proof” is to demonstrate that a particular assertion is valid.

- **Argumentation**

The goal of “argumentation process” is to persuade: of the “truth” of some claim; to perform some action, etc.

Demonstrative vs. Persuasive II

- **Mathematical Proof**

The sole requirement of a proof is that it be *correct*, i.e. be constructed by *legitimate application* of rules to *accepted facts*. Proofs need not "*persuade*".

e.g. Haken-Appel, Fermat-Wiles

- **Argumentation**

The only aim of argumentation is to *persuade* its audience. Arguments do not have to be "*correct*".
e.g. outcome of most political processes.