

Argument Technology in Intelligence Analysis

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www.arg.tech

Centre for Argument Technology

20-year track record, 200
research papers, 100,000 users



Interdisciplinary team covering philosophy, AI, software engineering, linguistics, NLP, deep learning.

\$13m research funding (of which 1/3 in the intelligence sector), largest research group in the area

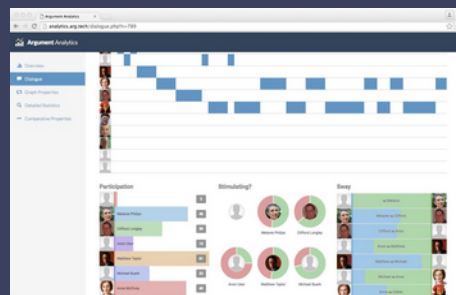
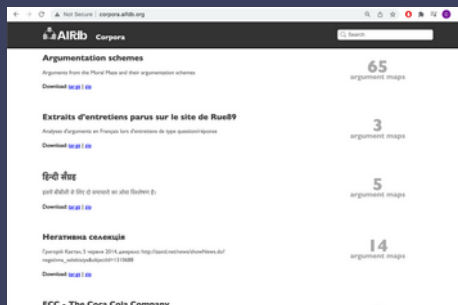
Work with Ministry of Defence, IARPA, & governments; partners including IBM, the BBC & the UN

Understanding IC product



Argument analysis & visualisation tools:
OVA, Analysis Wall,
ArgNav, ACHNav

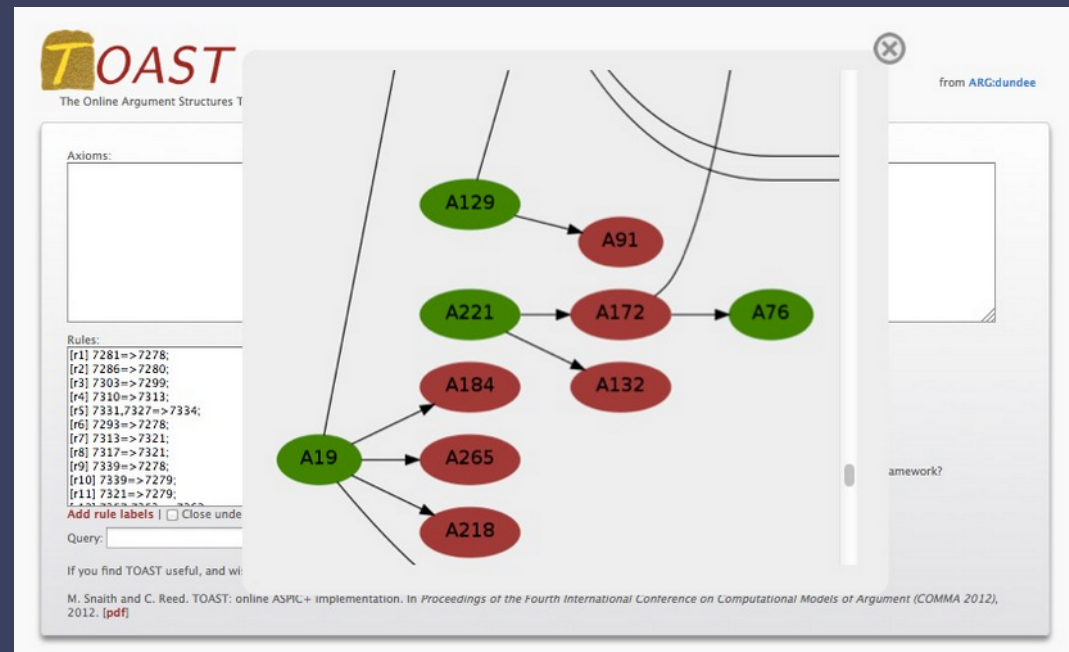
Representational standards:
AIF (AIF+, xAIF)



Data curation:
AIFdb, largest extant
datasets of analysed
argumentation

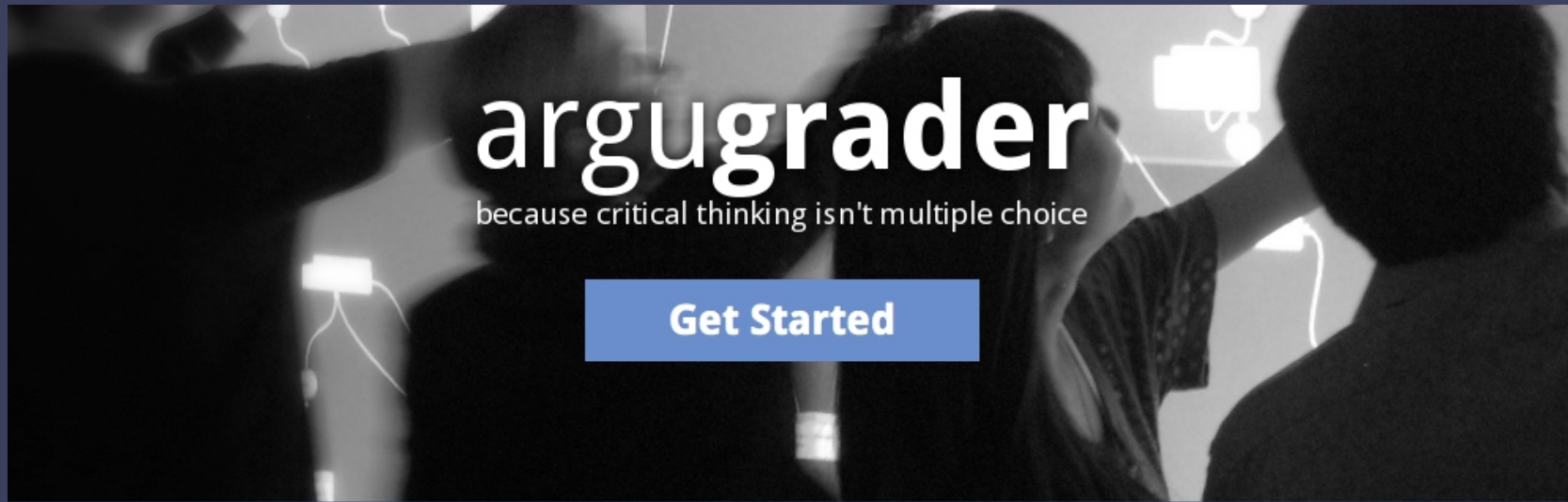
Evaluating Coherence in Reasoning

From
Natural language
arguments
to
Structured networks
to
Abstract frameworks



which can then be evaluated using one of a library of argumentation semantics (first implemented in our TOAST web service)

Evaluating Structure of Reasoning



How it works



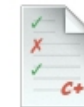
Analysis

Students use any Argument Web tool for conducting analysis (OVA, iLogos, Rationale, etc.)



Grading

Student work submitted to argugrader.com. Comparison initiated between student analysis and tutor's model answer. Individual units compared (within tutor-specified tolerance). Structural connections compared (with charitable matching).



Feedback

Marks entered into spreadsheet or student management system. Feedback generated for students.

Evaluating Structure of Reasoning

argugrader

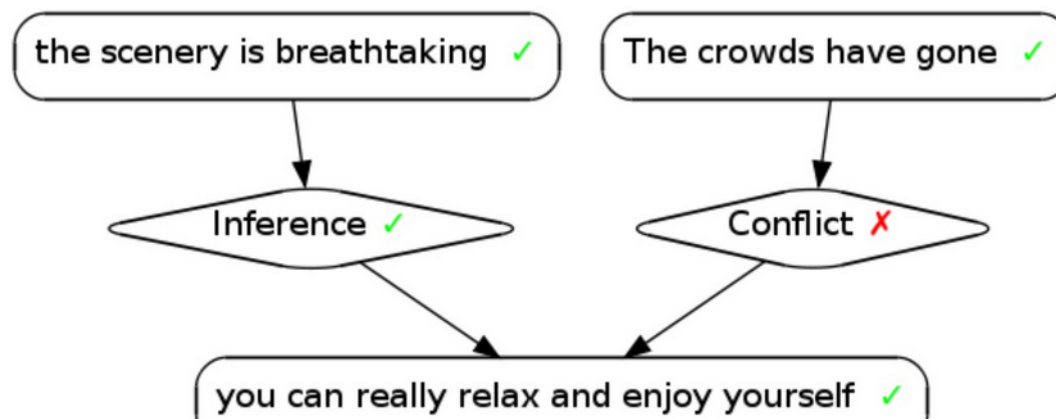
Assignment 1

05 Jun 2014

Overall grade: 72%

Feedback:

- The claim 'weather is cooler' isn't in your answer
- You used an incorrect scheme from the claim 'The crowds have gone', to the claim 'you can really relax and enjoy yourself' (conflict instead of inference)



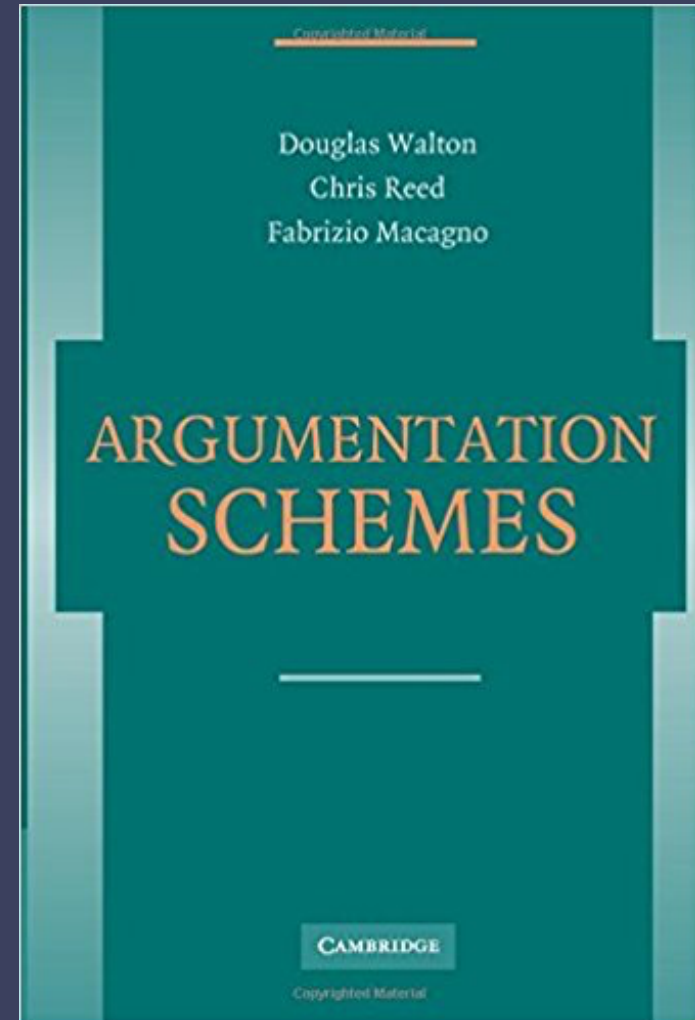
Formulating questions

Argumentation schemes capture stereotypical patterns of reasoning

They are associated with critical questions that point to critiques and to assumptions

Identify the scheme, identify the questions

Engineered in a web service:
Skeptic



Automating Critique

The screenshot displays the 'The Evidence Toolkit' interface. At the top, it says 'Tools for getting from news to truth'. The main content area shows a BBC article titled 'Air pollution: Are diesel cars always the biggest health hazard?' by Theo Leggett. The article text includes: 'Sales of diesel-powered cars fell dramatically last year, declining more than 17% compared with 2016. People within the industry blame anti-diesel rhetoric from the government, local authorities and clean air campaigners for eroding consumer confidence. They insist that modern diesel engines are actually very clean and the health risks have been overstated. They also say that they can play a vital role in helping to cut carbon dioxide emissions, in order to meet climate change targets. So have modern diesels just been getting a bad press, or do they represent a serious health hazard? The reality is not as black and white as you might think. It's true that some diesel engines produce fewer toxic emissions than some petrol engines, but by and large petrol remains the cleaner option. A diesel engine should, in principle, use less fuel and produce less carbon dioxide than a petrol engine with the same power output. However, this superior efficiency comes at a price. Diesel engines produce higher levels of particulates, microscopic bits of soot left over from the combustion process. Other These can penetrate deep into the lungs, causing irritation and potentially triggering asthma attacks. Particulate filters The greatest danger lies with the smallest, so-called "ultrafine" particles, according to Dr Matthew Loxham, a research fellow in air pollution toxicology at the University of Southampton. They get so deep into the lungs, they get to the surfaces where oxygen enters our blood, and the particles themselves almost certainly can enter the blood, he says. They can cause increased stroke rates and increase heart attacks in people who are most susceptible, who have underlying health conditions. However, modern diesels actually emit very few particulates - because they are equipped with special filters. Counter

On the left, there is a 'HELP' section and a 'TRUST TOOLBAR' with links to 'Diesel Toxicological overview [www.gov.uk]' and 'History of the diesel car [en.wikipedia.org]'. On the right, a 'CRITIQUE TEMPLATE' box contains the text: 'You've identified this as expert evidence. Do you think that:' followed by four questions, each with a smiley face and a red circle icon: 'the source actually made the attributed statement?', 'the source is a credible expert on this subject?', 'the source is duly impartial and not profiting from lending their support?', and 'other experts agree with the source?'.

Commissioned by the BBC to help schoolchildren identify fake news

Argument mining to identify argument structure in news

Argumentation schemes to pose critical questions to users

Deployed into every school in the UK

Iterative Improvement

The image displays two sequential screenshots of the Arvina web interface, illustrating an iterative improvement process in a dialogue system. The interface is divided into several sections: a 'Participants' list on the left, a 'Live Discussion Map' below it, and a central dialogue area on the right. The dialogue area shows a conversation between a human participant (Mary Test) and several AI agents (ConfBias Agent, InfCrit Agent, CausBias Agent, and David Test). The right screenshot shows a 'Go' button being clicked, indicating a transition or action in the dialogue.

Below the screenshots, three columns of system logs provide a detailed view of the agents' internal states and actions:

- Column 1 (InfCrit Agent):** Shows the agent listening to dialogue and then asking a question: "Could ask about vested interest; the evidence is the lynchpin of reasoning so **criticality score is high - asking question**".
- Column 2 (CausBias Agent):** Shows the agent listening to dialogue throughout the sequence.
- Column 3 (ConfBias Agent):** Shows the agent listening to dialogue and then asking a question: "Could ask about bias, however the **evidence lacks centrality**".

Discovering Evidence

Intertextuality is an exciting new frontier in NLP

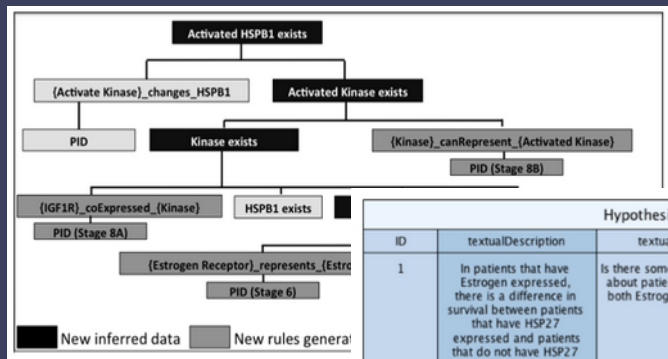
When might two documents be talking about the same thing?

Identifying *Intertextual Correspondence*

Early results from US2016

Formulating Hypotheses

From new evidence, new hypotheses can be formed



In cancer genetics, argument-based reasoning identified gaps in evidence

From which hypotheses were formed

Hypothesis				
ID	textualDescription	textualRational	canBeTested	test
1	In patients that have Estrogen expressed, there is a difference in survival between patients that have HSP27 expressed and patients that do not have HSP27 expressed	Is there something different about patients expressing both Estrogen and HSP27?	TRUE	1
2	There is a difference in survival between patients that have both HSP27 and Estrogen expressed and all other patients	Does it make any difference if patients which have expressed Estrogen also have HSP27 expressed?	TRUE	2
3	There is a difference in survival between patients that have HSP27 expressed and all other patients			
4	In patients that have Estrogen expressed, there is a difference in survival between patients that have HSP27 expressed and patients that do not have HSP27 expressed			

King et al. *Breast Cancer Research* 2012, 14:R40
<http://breast-cancer-research.com/content/14/2/R40>



RESEARCH ARTICLE

Open Access

Immunohistochemical detection of Polo-like kinase-1 (PLK1) in primary breast cancer is associated with *TP53* mutation and poor clinical outcome

Sharon I King, Colin A Purdie, Susan E Bray, Philip R Quinlan, Lee B Jordan, Alastair M Thompson and David W Meek*

and tested

and published

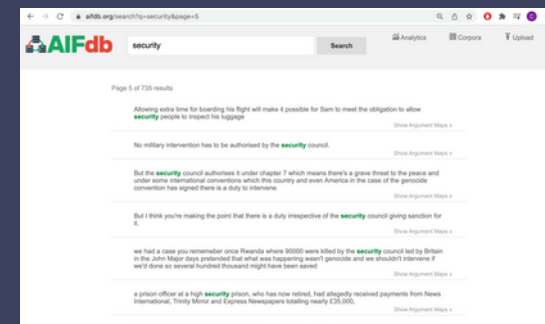
Concluding Remarks



Find out more at
www.arg.tech



Stephen Fry explains
argument technology
arg.tech/fry



Explore our datasets
at aifdb.org

chris@arg.tech



ARG_tech



ARGtechOrg



ARG_tech



ARG-tech



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