

# A Tool to Highlight Weaknesses and Strengthen Cases: CISpaces.org

Federico CERUTTI<sup>a</sup>, Timothy J. NORMAN<sup>b</sup> and Alice TONIOLO<sup>c</sup>

<sup>a</sup>*Cardiff University, UK*

<sup>b</sup>*University of Southampton, UK*

<sup>c</sup>*University of St Andrews, UK*

**Abstract.** We demonstrate CISpaces.org, a tool to support situational understanding in intelligence analysis that complements but not replaces human expertise, for the first time applied to a judicial context. The system combines argumentation-based reasoning and natural language generation to support the creation of analysis and summary reports, and to record the process of forming hypotheses from relationships among information.

**Keywords.** argumentation, case analysis, report generation

## 1. Introduction

We demonstrate the application of CISpaces.org [15,14,2], Collaborative Intelligence Spaces Online, in judicial context. CISpaces.org is a suite of tools and algorithms for the support of sense-making of complex situations, complementing human expertise, and for the dissemination of natural language reports. This web-based tool builds on top of argumentation-based systems, combining a structured graphical representation of the reasoning process with efficient algorithms for the automated identification of plausible hypotheses.

We demonstrate how CISpaces.org supports the data-to-decision process, from hypotheses formation, to report generation that can be used for briefings to inform legal practitioners, or even judges. CISpaces.org facilitates sensemaking in a declarative format. Differently from existing tools [7,6], CISpaces.org provides a method to record and support the process of forming hypotheses from the relationships among information which enables the analyst to highlight information or assumptions that may lead to interrelated as well as alternative hypotheses. CISpaces.org makes this core process of reasoning explicit, providing further support for structuring reasoning and mitigating biases. The reasoning mechanism identifies what evidence and claims together constitute a plausible interpretation of an analysis.

CISpaces.org is freely available for being used at <http://tiny.cc/CISpaces> (username: demo, password: demo), and it can be downloaded at GitHub, <https://github.com/CISpaces>, with MIT licence.

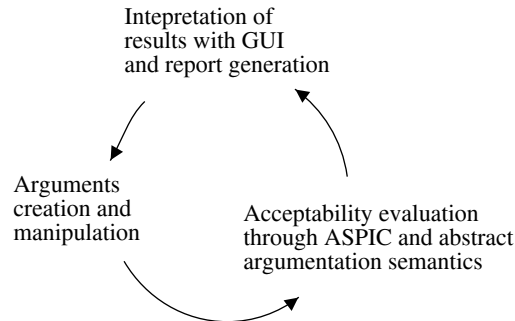


Figure 1. Overview of CISpaces.org functionalities.

## 2. Components

CISpaces.org builds on top of (1) argumentation schemes; (2) formal argumentation; and (3) natural language generation techniques (cf. Figure 1).

### 2.1. Argumentation Schemes

Argumentation schemes [16] are abstract reasoning patterns. Schemes have been derived from empirical studies of human argument and debate, and further adapted in this work from literature and experts [15]. Each scheme has a set of critical questions that represents standard ways of critically probing into an argument to find aspects of it that are open to criticism. For instance, the following is the argumentation scheme for argument from cause  $A$  to effect  $B$ :

**Major Premise:** Generally, if  $A$  occurs, then  $B$  might occur.

**Minor Premise:** In this case  $A$  might have occurred.

**Conclusion:** Therefore, in this case  $B$  might have occurred.

Critical questions are:

**CQ1:** Is there evidence for  $C$  to occur?

**CQ2:** Is there a general rule for  $C$  causing  $E$ ?

**CQ3:** Is the relationship between  $A$  and  $B$  causal?

**CQ4:** Is there any exception to the causal rule that prevents  $B$  from occurring?

**CQ5:** Has  $A$  happened before  $B$ ?

**CQ6:** Is there any other cause  $A'$  that might have caused  $B$ ?

The purpose of schemes in CISpaces.org is to guide analysts in drawing inferences, critical questions are available to analysts as a means to reflect on potential issues during the formation of hypotheses. Instantiated schemes can be mapped to the overall ASPIC+ framework following the approach proposed in [11].

### 2.2. ASPIC+ [10]

ASPIC+ [10] is a formal framework able to transform logical statements and logical rules into arguments. Due to space constraints, we refer an interested reader to the relevant literature.

ASPIC+ uses Dung's abstract argumentation framework [5] to compute the acceptability status of arguments and, consequently logical statements. CISpaces.org uses state-of-the-art algorithms for computing such acceptability statuses [4].

### 2.3. Natural Language Generation

The use of graphical models to represent arguments is the most common approach used in the formal argumentation community to capture argument structures [3,1]. This requires a significant level of training that cannot be assumed for the recipients of intelligence analysis, viz. decision makers such as group commanders. To this reason, CISpaces.org has been equipped with a Natural Language Generation system. A Natural Language Generation (NLG) system requires [12]: a knowledge source to be used; a communicative goal to be achieved; a user model; and a discourse history.

In CISpaces.org we followed a rather pragmatic approach. Indeed, as our main audience are legal practitioners and judges, we strictly obey to the principle of providing them with the important pieces of information in the most concise way. We implemented: (1) a template-based NLG system; (2) a greedy, heuristics-based approach for chaining together premises and conclusion of arguments; (3) an assert-justify writing style suitable for speed reading.

## 3. Applications to Intelligence and Legal Analysis

CISpaces.org is the result of a collaboration with the US Army research Lab in the NIS ITA programme and with the UK Defence Science and Technology Laboratory in both the NIS ITA programme and follow-on Defence and Security Accelerator (DASA) programme. CISpaces.org is available for use by professional analysts in both the US (Army Research Laboratory) and the UK (Joint Forces Intelligence Group). The first version of CISpaces [15] was one of three key research highlights in the NIS ITA programme [13]. The refinement of the CISpaces software to take it to Technology Readiness Level 4 (characterised as “validation in a laboratory environment”) was informed by evaluation conducted with professional analysts in the US and the UK as part of the NIS ITA programme, and enabled by the DASA programme. Development work funded by the DASA programme led to CISpaces being made available as an open-source project under a permissive (MIT) licence: <https://github.com/CISpaces>.

CISpaces.org supported an analysis to determine whether Karadžić possessed *mens rea*<sup>1</sup> for genocide in relation to the Srebrenica mass killing. The results of our analysis were submitted to the Mechanism for International Criminal Tribunals as an *amicus curiae*<sup>2</sup> brief [9] pursuant to Rule 83 of the MICT Rules of Procedure and Evidence. We based our analysis only on the judgement of Prosecutor v. Radovan Karadžić [8].

We have continued collaboration with the UKs NCA National Cyber Crime Unit, where there is considerable interest in the technologies underpinning CISpaces.org and Open Source Intelligence extraction.

## 4. Conclusion

CISpaces.org complements human expertise in sense-making activities. The system and its underpinning technologies have attracted positive interest by the UK Joint Forces In-

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<sup>1</sup>*Mens rea*: the intention or knowledge of wrongdoing that constitutes part of a crime.

<sup>2</sup>*Amicus curiae*: a non-party in a lawsuit who argues or presents information relevant to the lawsuit.

telligence Group as well as by the UK National Crime Agencies Dark Web Intelligence Unit and National Cybercrime Unit, in addition to triggering interest in the legal community due to its use for analysing whether Karadžić possessed *mens rea* for genocide in relation to the Srebrenica mass killing.

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