

# ARGUMENTUM – Towards Computer-Supported Analysis, Retrieval and Synthesis of Argumentation Structures in Humanities Using the Example of Jurisprudence

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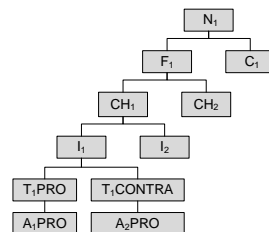
**Abstract.** Argumentation represents a fundamental intellectual activity and is, furthermore, one of the central tasks in the context of every scientific discipline. Developing new arguments and analyzing existing argumentation structures is of special importance for the field of humanities and, thus, for jurisprudence. The analysis of existing and the synthesis of new argumentation structures comprise sophisticated intellectual processes which are, nevertheless, bound to the natural limitations of the human information processing capacity. Against the background of the improving electronic availability of a growing corpus of jurisdiction, approaches and techniques from the field of artificial intelligence offer a considerable potential for an automated analysis, retrieval and synthesis of argumentation structures. The project ARGUMENTUM aims at exploring the potential and limitations of computer-supported methods for the analysis, retrieval and synthesis of argumentation structures using the example of law.

**Keywords:** Information Retrieval, Argumentation Analysis, Computer-Supported Argumentation, Argumentation Mining, eHumanities

## 1 Motivation

Argumentation is a fundamental intellectual activity and, moreover, a central task in the context of every scientific discipline. In this context, justifications as well as refutations of statements are developed by humans in order to convince other people of the trueness or falsity of these statements. Developing new and analyzing existing argumentation structures is of tremendous importance for every scientific discipline; especially for jurisprudence as one representative of the humanities. A central task of jurisprudence lies in the analysis of court decisions which represent aggregated and formalized argumentation structures. Argumentation structures are methodically well-investigated and generally accessible for intellectual analysis. They are characterized by the fact that certain theses are attacked or defended step-by-step by means of supporting or refuting arguments. In a basic structure for justification one thesis is supported by one or several justifications. In this regard, a justification is a set of sentences which are presented to justify the thesis.

For jurisprudence and for legal practice it is crucial to identify those justifications which support a thesis. However, basic justification structures can be embedded into more complex structures such as in the following example: given a *legal norm*  $N_1$ , the *fact*  $F_1$  and the *legal consequence*  $C_1$ . The fact consists of two conjunctively linked *characteristics*  $CH_1$  and  $CH_2$ . The interpretation of  $CH_1$  is controversial. Let us assume there are two opposite *interpretations* for  $CH_1$  viz.  $I_1(CH_1)$  and  $I_2(CH_1)$ . The *thesis*  $T_1PRO(I_1(CH_1))$  is submitted supporting the first interpretation  $I_1(CH_1)$ . Opposed to  $I_1(CH_1)$ , the thesis  $T_1CONTRA(I_1(CH_1))$  is submitted. Authority  $A_1$  argues for the thesis  $T_1PRO(I_1(CH_1))$ , hence  $A_1PRO(T_1PRO(I_1(CH_1)))$ . Authority  $A_2$  argues for the thesis  $T_1CONTRA(I_1(CH_1))$ , hence  $A_2PRO(T_1CONTRA(I_1(CH_1)))$ . Figure 1 gives a graphical representation of the described justification structure.



**Fig. 1.** Exemplary justification structure

Typically asked questions in jurisprudence which are highly relevant for daily work are e.g., *which authority supports the thesis saying that the characteristic  $CH_1$  should be interpreted in the sense of  $I_1$ ?* The concrete answer would be  $A_1$ . Jurists in every possible role need such information to be able to prepare their argumentation.

However, the analysis of argumentation structures is a complex intellectual process which is bound to the natural limitations of the human information processing capacity. This means that the preparation of argumentation structures is only based on those legal cases a person is familiar with, and commonly requires a considerable

amount of time. Against the background of the improving electronic availability of an ever growing corpus of jurisdiction, it is remarkable that, so far, no comprehensive support for detailed information retrieval in legal argumentation structures and – in preparation for this – adequate approaches for their analysis and synthesis have been established. The major legal databases in Germany do not support an argumentation structure-oriented information retrieval, but only simple keyword searches. Some of the elements in the justification structure represented in figure 1 are accessible, e.g.  $F_1$  or  $CH_1$ . However, all the other elements are not retrievable and the considerable potential of computer support using approaches from the field of artificial intelligence is not realized in practice. Nevertheless, realizing this potential can support the identification of significant new knowledge for jurisprudence. In the following section, the project ARGUMENTUM which investigates these aspects is presented.

## 2 The ARGUMENTUM Project

The project ARGUMENTUM which has been funded by the German Federal Ministry of Education and Research (BMBF) in the context of the *eHumanities* initiative since June 2012 deals with the investigation of the potential and the boundaries of computer-supported analysis, retrieval and synthesis of argumentation structures from different perspectives using the example of jurisprudence.<sup>1</sup> The project aims at exploring the potential and opportunities of methods and techniques from computer science and artificial intelligence for new and innovative applications supporting research methods in the humanities, especially argumentation. The identified potential shall, furthermore, be realized by means of an innovative software prototype which will be developed during the project. Innovative methods for computer-supported analysis, retrieval and synthesis of argumentation structures based on large corpora of documented court decisions can support jurisprudence in several ways:

1. The possibility of an electronic search in existing argumentation structures can significantly accelerate the daily work of scientists and practical jurists because relevant issues could be investigated independent of the availability and the organisation of printed sources.
2. The analysis of argumentation structures in larger repositories can also support the identification of interesting and significant patterns of argumentation in the domain of jurisprudence. Based on these patterns, an information system could recommend “successful” patterns of argumentation to a jurist who is interested in a similar problem or issue.

In addition to the disclosure and presentation of such argumentation structures by the planned software prototype, ARGUMENTUM also aims at checking whether the developed insights and findings concerning the analysis, retrieval and synthesis of argumentation structures can also be transferred and fruitfully applied in other fields of the humanities besides jurisprudence.

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<sup>1</sup> The ARGUMENTUM consortium consists of the *Institute for Law and Informatics (IFRI)* and the *Chair of Theoretical Philosophy*, both Saarland University, as well as the *Institute for Information Systems (IW<sub>i</sub>)* at the *German Research Center for Artificial Intelligence (DFKI)* and the *European Academy of eJustice (EEAR)*.

The prospective of developing new and combining existing approaches for a partly automated analysis, retrieval and synthesis of argumentation structures is based on several preparatory studies conducted regarding the jurisdiction of the German Federal Constitutional Court (*Bundesverfassungsgericht*) which has been available in the internet since 1998 ([www.bundesverfassungsgericht.de/entscheidungen.html](http://www.bundesverfassungsgericht.de/entscheidungen.html)).

### 3 Related work

In the context of computer-supported argumentation [1] and especially argumentation mining [2], a certain amount of interesting work related to ARGUMENTUM exists which shall be further developed and integrated, e.g. first approaches for the analysis and retrieval of argumentation structures in legal dossiers [3], the retrieval of certain elements of argumentation structures based on linguistic patterns depending on certain domains of interest or text types, e.g. in [4] for scientific articles.

### 4 Conclusion and outlook

This contribution gives an overview of the recently started research project ARGUMENTUM which aims at exploring the potential and limitations of computer-supported methods for analysis, retrieval and synthesis of argumentation structures. Based on the improving electronic availability of growing corpora of jurisprudence, approaches from the field of artificial intelligence offer a considerable potential for supporting these tasks. In the upcoming project phases, the project team will develop a software prototype supporting the analysis, retrieval and synthesis of argumentation structures and, furthermore, explore the potential and the boundaries of used approaches and techniques.

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