

# Providing Informational Support For Argumentation: The ISA Project

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## Abstract

This paper briefly presents the ISA project that addresses the issue of how argumentation processes can be supported by providing textual information from document databases. The conceptual integration of data- and knowledge-based technologies with discussion forums is illustrated, and the preliminary works for indexing documents as well as for providing search mechanism are presented.

## 1 Introduction

As a consequence of global network technologies, human communication issues keep on moving into the center of research attention and add a new aspect to the previous informational, presentational and transactional perspective, that is finding consensus concerning important issues from discourses [Kuhlen 1999]. The claim "firms need to shift their attention from documents to discussions" [Davenport and Prusak 1998, 106] emphasizes the importance of discourses for the practice of information and knowledge management. In that, since they facilitate the organizing and recording of discussions, discussion forums play a very particular part. Methodologically, they are based on structured models of verbal argumentation. Projects of research in this area have mainly concentrated on how to use argumentation models for the archiving

and formal-structural presentation of discussion processes, as well as for extracting arguments [Conklin 1996], [Gordon and Karacapilidis 1999].

However, less attention had been paid to how informational support could be given to discussion processes, e.g. argumentation processes, in the course of which the supply of additional background information or facts might be appropriate. This requires a conceptual and technical integration of information retrieval and document management systems with web-based discussion forums. Further technologies of a document-oriented information and knowledge management have to be developed and applied, which do not only contribute to an "organizational" knowledge base by representing, extracting or distributing information from documents, but also make this information available during discussions. Consider initiating a search for information in support of the current position, for example.

In this paper, the essential of the research project ISA is presented. The first steps have been made in the field of information organization and the conception of an argumentation-oriented search for information.

## 2 Related Work

Research on discussion processes has received growing interest in the Artificial Intelligence and Computer-supported Cooperative Work community during recent years. Computer tools to facilitate discussion processes vary from simple classical tools (e-mail, mailing lists, newsgroups, etc.) and web-based discussion forums, to more dedicated systems that meet a user's wish to interpret and reason about knowledge during a discourse. For example, the system QuestMap [Conklin 1996] captures the key issues and ideas during meetings, and creates shared understanding within a knowledge team by placing messages, documents, and reference material concerning a project onto the system's "whiteboard", where interrelations are displayed graphically. A "map" then shows the line of argumentation that lead to key decisions and plans.

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Another category of systems does not only provide a cognitive argumentation environment that monitors and structures discussion processes, but also offers support for decision-making. For instance, the HERMES system [Karacapilidis and Papadias 1998] is intended to act as an assistant who efficiently structures, and thus facilitates, communications. In particular, it acts as an advisor who recommends decisions by providing reasoning mechanisms. A system related to that is ZENO [Gordon and Karacapilidis 1999].

The corresponding argumentation frameworks are variants of the informal IBIS model of argumentation [Rittel and Webber 1973]. These systems are related to the discussion forum element in the architecture of the ISA system. They monitor issues, positions, alternatives, preferences, etc., and refer them to each other. Most systems even provide a significant automation of the decision-making process. However, they do not address the issue of how the current process of argumentation could get further informational support. As Ballim and Karacapilidis [1998] pointed out, the following further tools of automation would be desirable:

- an argument assistant that can follow and advice on the detailed content of an argument, and not just on its form;
- an argument support tool that can peruse a document collection, in order to find relevant information units that promote the agent's assessment of a given argument.

Of course, a prerequisite to such tools would be the capability of the computer system not only to understand (at least partially) dialogs between human agents, being involved in decision-oriented argumentation processes, but also to assess the inherent structure and informational content of documents. As a prototype tool, the ISA system is designed to represent documents in a way that allows human agents to find the pieces of information that are relevant to their current position in an argumentation process.

### 3 Architecture of the System

In its architectural design, the ISA system integrates a forum where contributions to the discussion are handled, with two sub-systems providing informational support (fig. 1):

The data-based sub-system (DB system) serves as a stock of argument-supporting information units (texts). For that, (hyper)text bases are manually constructed, i.e. contents of texts are described, and inter-textual relations are explicitly defined. The purpose of the knowledge-based sub-system (KB system) is to deduce further implicit relations between information units, and in particular, to determine the (explicit and/or implicit) relations that are relevant to the current position in an argumentation process.

Both sub-systems are still in the development stage. The DB system is being developed under *Visual-Basic* and *MS-Access*. For the KB system *GoldWorks III* is being used, an expert system developing environment, which

supports hybrid (both frame- and rule-based) knowledge representation methods. A database interface allows informational exchanges between the two sub-systems, for example, the picking of explicit relations between information units by the KB system in order to deduce implicit relations and their transcription to the DB system.

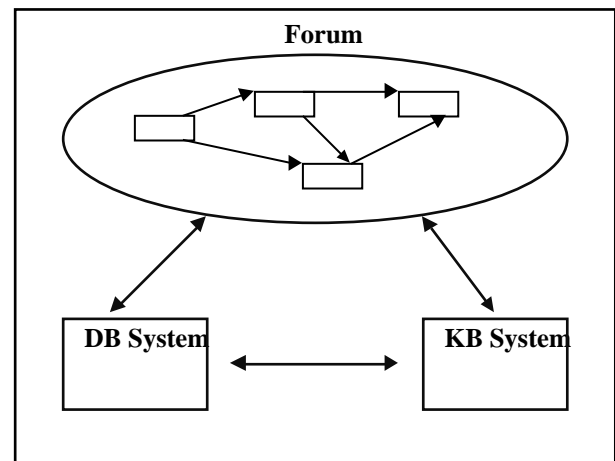


Figure 1: The ISA System

In the following sections, the components of these sub-systems, and the applied methods are described in more detail.

### 4 Organization of Information Units

Providing informational support for discussions requires an adequate method for the organization and the retrieval of documents. Like a discourse, most (scientific) documents are argumentative, containing a series of arguments that support or criticize a specific position. Therefore, an argumentation-based method for the indexing of documents - as proposed by Sillince [1992] in the context of information retrieval - seems appropriate for the support of discourses as well.

The design of the DB sub-system includes the manual indexing of documents and document units, facilitating the search for informational support. There are the following components:

- *Component for the construction of the vocabulary:* This allows the input of terms (concepts) and of relations between terms (*inter*, *intra* as well as *extra linking*).
- *Component for the construction of the text base:* Documents are indexed formally by the name of the author(s), the title, etc., contents are described by terms from the vocabulary and by argumentation relations (e.g., *describes*, *criticizes*, *supports*, etc.). The additional assignment of terms and relations to document sections allows an indexing of the inherent line of argumentation, for example, capturing the addressed problem or position, the solution to the

problem, the points of criticism or support of the position, etc. (e.g., 'doc-1-section-1 describes information-management', 'doc-1-section-2 criticizes knowledge-management').

- *Component for the definition of hyper-textual relations:* This allows to define term-document relations (e.g., 'doc-1 describes information-management') and document-document relations (e.g., 'doc-1 criticizes doc-2'), both referring to documents as a whole (unlike the sectional references by the text base component). These relations will be used by the KB sub-system for generating further relations.
- *Component for the integration of user models:* Three general user types (student, lecturer, and librarian) have been considered with respect to differences in languages and presentation preferences.
- *Component for the search of texts in the text base:* This allows the finding of documents or document sections by using search terms and argument patterns ('pro and contra'), or text connectors (e.g., 'either ... or ...').

## 5 Knowledge-Based Support

The knowledge-based support for retrieving relevant documents to an argument is provided by the KB sub-system. This includes the determination of the explicit and implicit relations that are related to the current argument type (pro or contra argument), and thus have to be taken into account for the searching the DB system.

The method for determining explicit relations between texts is based on the modified version of the argumentation grammar proposed by Sillince [1992], where an argument is considered as a relation between terms X and Y (e.g., X criticizes Y). This grammar has been modified to the effect that relations are grouped into contra, pro, and neutral arguments, as shown in the following.

<i>Argument:</i>	<i>Term Pro-argument Term / Term Contra-argument Term/ Term Neutral-argument Term</i>
<i>Pro-argument:</i>	<i>supports / ...</i>
<i>Contra-argument:</i>	<i>criticizes / ...</i>
<i>Neutral-argument:</i>	<i>mentions / ...</i>

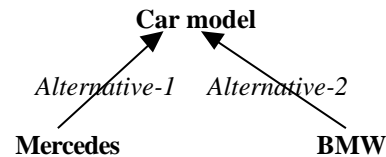
In addition, logical rules have been implemented to enable the KB system to find out implicit relations between documents, which have not explicitly been defined in the DB system during the manual indexing process, but could hypothetically be assumed as valid. Various types of rules are conceivable. Giving a simple example, the support relation between two documents X and Y may be valid, if in X another document Z, and in Z the document Y is criticized.

### Example:

```
IF (?Dokument_X criticizes ?Dokument_Z) AND
   (?Dokument_Z criticizes ?Dokument_Y)
THEN
   (?Dokument_X supports ?Dokument_Y)
```

## 6 A Dialog Example

A dialog is intended to promote the decision on the car model that will be bought by an agent. There are various decision alternatives to discuss, e.g. the one of the alternatives may be Mercedes, the other one BMW, etc. For each alternative, there are pro and con arguments to take into account.



If informational support in favor of Mercedes is required, the following query may be raised:

*(Pro-argument Mercedes)*

First, the KB system determines:

- the explicit relations that belong to the group of pro arguments; and
- the combinations of explicit relations that have to be considered to find implicit relations involving pro arguments.

Then, the search for documents containing pro arguments is performed on two levels. The system searches for:

- document sections, whose descriptions include the topic (Mercedes) and explicit relations of the current argument type (pro argument); and
- documents, which are related to documents that describe the topic (Mercedes), whereas the corresponding (implicit or explicit) relation has to be of the current argument type (pro argument)

The amount of information units that is found during this search can be reduced in a further step by identifying similar argument patterns or rhetorical elements. For example, documents could be considered as more relevant, if they contain topics identified by the pattern 'in this paper' and/or criticism identified by 'however', etc. Some of these patterns are implemented in the present version of the DB sub-system as search options of a separate search component.

## 7 Conclusion

The ISA system thus far presented in this paper is still in the stage of development. The conception and construction of the database (the DB sub-system) and some of the definition of logical rules for the deduction of implicit relations (in the KB sub-system) is implemented. The technical integration of the DB and KB sub-systems with the discussion forum has not been addressed yet.

Further issues that remain to be addressed are the following: adaptive visualization and ranking of search results, integration of inference mechanisms for an automated identification of user preferences, extension of

search patterns to three languages (English, German, and Turkish). Finally, it is also important to address the practical issues, such as how long it takes to index a document in the level of detail needed, and whether the indexing process requires sophisticated personnel so that a partially automation of the process has to be considered.

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