Software for Modeling Deliberative Argumentation: Requirements and Criteria

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Abstract

Methods of deliberative argumentation are widely employed for solving applied tasks in various fields of practical activities, where choosing of a line of behavior in a certain situation or making decisions is at stake. These methods enjoy permanent attention in the contemporary education with respect to teaching argumentation and training the critical thinking skills. In the last three decades, the progress in the information and communication technologies has led to the development of software designed for visualization and modeling of deliberative intellectual activity for solving various kinds of practical tasks and for supporting the relevant education. We propose the five (groups of) criteria for developing the software designed to model and represent deliberative argumentation, which have to be observed both in the development software and in its classification. We suggest four ontologies for such software, which will enhance implementing functions for evaluating arguments and finding solutions in such software.

Keywords

deliberative reasoning, conceptual bases, software, modeling, representation

1. Introduction

In contemporary society, deliberative argumentation is widely used in various areas of human activity, where the results are achieved in the process or with the help of substantiating actions and justifying decisions. Such areas include law and jurisprudence, politics, public administration, social interaction, science, etc. The deliberative, or practical, argumentation, is distinct from the theoretical, or discursive, argumentation. The former focuses on justifying claims about the line of behavior in different circumstances – how to act in certain situation or what should we do with respect to certain goals and intentions. The latter pursues the justification of claims' truthfulness, and the discursive arguments are put forward to support or criticize the claims. The discursive arguments as well as the claims themselves are descriptive propositions which can be true or false. The deliberative arguments consist of descriptive and non-descriptive sentences expressing norms, values or intentions playing key role in justifying or refuting their conclusions expressing intentions to act [1]. These formal and semantic differences of discursive and deliberative arguments is connected to the properties of intellectual agents participating in the argumentation of those two kinds and entail differences in how the arguments are evaluated. On one hand, the deductive arguments, mostly regarded the strongest in the discursive argumentation, are seldom applicable in the deliberative argumentation. On the other hand, the non-deductive plausible arguments, the most persuasive in the deliberative argumentation, which include such widely used schemes of reasoning as appeals to expert opinion, to consequences, negative or positive, to popular opinion or behavior, etc., are often considered fallacious in the discursive argumentation.

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The structure of intellectual agents in the discursive argumentation presupposes exclusively descriptive elements, such as knowledge and opinions (beliefs), and in the deliberative argumentation it also includes their opinions about norms, values, as well as desires, goals and intentions. Accordingly, there are special requirements for the agentive properties that are imposed on the agents with respect to evaluation of deliberative arguments, for example, whether an agent is a reliable source of information when the argument at question appeals to his or her authority, whether he or she is an expert in the issue under consideration when it appeals to his or her expert opinion, whether he or she is it trustworthy in assessing the consequences, etc. Deliberations often involve many people, and therefore it is necessary to take into account many individual and group parameters in justifying decisions by means of the arguments [2].

To enhance intellectual activity, many approaches based on the implementation of elements of argumentation and deliberation in software have been proposed, developed and applied. They aim at supporting the deliberation in decision-making in various areas of human activity, for example, medicine [3], public policy and e-democracy [4, 5], law [6, 7], scientific argumentation [8, 9, 10], business and other areas.

Our present study is one of the stages of a comprehensive research project conceived to assess the adequacy of modeling of argumentation by means of appropriate software and information systems. The project aims to bridge the theoretical gap between the concepts of argumentation, implemented in the software, and the concepts of argumentation, yielded by academic studies of argumentation. At the previous stages of our research project, we 1) studied the capabilities of the software for modeling argumentation [11], 2) identified the key characteristics of the software designed for modeling argumentation, deliberative reasoning and mind mapping [12], 3) formulated the conceptual foundations, or criteria, for assesing the software, by which we divided it into two groups - on the basis of its descriptiveness / normativity and on the modifiability of reasoning [12, 13].

As part of our previous research, we have selected and assessed the software and information systems aimed at supporting the representation of reasoning and critical thinking. The development of such systems and their applications started in the mid-90s of the XX century; and their active development and updating continues up to this day with the top intensity of the development in the first decade of the XXI century.

A characteristic feature of the development of the software is that the ideas of its development are born inside interdisciplinary academic communities, whereas the conceptual projects for its creation are realized mainly by the representatives of the logical community including logicians and specialists in logic programming and artificial intelligence. Here is a list of the most widely used software products for modelling argumentation and reasoning:

- OVA – developed by the Centre for Argument Technology of Dundee University (Scotland), incorporates D. Walton's ideas of 'new dialectic';
- Carneades – developed by T. Gordon (Potsdam University) and D. Walton;
- Rationale – initially developed by T. van Gelder's team in Melbourne University; today is a commercial software https://www.rationaleonline.com/;
- bCisive – elaboration of Rationale for representation of argumentative support of decision-making (https://www.bcisiveonline.com);
- Belvedere – initially developed by A. Lesgold and D. Suthers team in the University of Pittsburgh, later elaborated by D. Suthers's team in Hawaii University.

The existing software is used mostly in teaching critical thinking and argumentation skills, for example, Belvedere [10], LARGO [7], ARGUNAUT. Some systems are initially designed to teach critical thinking and argumentation skills in jurisprudence - Carneades, ArguMed, LARGO, QuestMap, others - in research or all-purpose argumentation in general, for example, Belvedere [14], SenseMaker, Convince Me [15]. Some software products have been developed to implement the IBIS (Issue-Based Information System) methodology [16] for joint planning and design in various subject areas. The earliest implementation of this methodology is gIBIS [17], followed by QuestMap and Compendium [18]. Some software products are used independently of specific subject areas for training general skills related to critical thinking and practical argumentation, for example, Rationale and bCisive [19], Hermes [20].

Carneades, OVA and some other software abstract from the distinction between defeasible argumentation, which is based on plausible arguments mostly used in deliberative argumentation, and indefeasible argumentation, which includes deductive and inductive arguments [21, 22]. The abstraction allows modelling both the discursive and the deliberative argumentation, but at the cost of a vague mechanisms of its assessment.

With respect to its practical purpose and regardless of its subject area, the software can be divided into the following groups:

- for modeling of argumentation;
- for visualization of the discursive and deliberative reasoning;
- for mind mapping.

This division is arbitrary as some software systems fall into more than one group. Nevertheless, its criteria put as the groups’ titles provides us with a preliminary clue for sorting the software.

The diversity of available software is rooted in the manifold approaches to its creation. However, most of the software systems have some common characteristic features which have been observed in recent review papers appeared as a output of its comprehensive comparative studies. One of such studies is the LASAD project carried in 2008-2013 [23], in the framework of which its team examined 45 systems available to the time and designed for supporting the representation of argumentation and critical thinking. The project team compared the software in relation to the goal of using these systems for teaching reasoning and critical thinking skills and identified the key functional characteristics implemented in them.

2. Implements of elements and functions of the deliberative argumentation in the software

We limit our study of the software to the products designed for modeling argumentative dialogues (disputes) and represents the argumentation in the form of graphs and protocols. The software designed to visualize argumentative dialogues offer no tools for scoring assessments of arguments and establishing solutions to disputes, which means that with respect to the analysis of argumentation, it has descriptive character even in those cases where it implements the concepts regarded normative by their developers, as in cases of Rationale and bCisive which are said to imply the code of critical discussion in pragma dialectics [19], or OVA and Carneades, which involve evaluation of arguments by means of the critical questions [24]. The developers of the software do not explicitly suggest using it for intellectual support of deliberative reasoning, but it is applicable for visualizing some aspects of public deliberations.

Deliberative public opinion plays an essential role in political decision-making and formulating of the political and social agendas in the deliberative democracy with its evolving contemporary feature of disagreement and polarization about many issues. Special software systems and platforms are developed (DemocracyOS, Democracy 2.1, Loomio, OpaVote, Delib, Decidim and others) for supporting of the deliberative democracy. Most of them are social platforms for polls, exchange of views, debates and discussions, they aim at supporting decision-making in state and municipal management, which remain human-oriented. These systems implement technologies for collecting and processing Big Data by statistical methods and imply no function of solving the discussed problems.

There are several levels of implementation of deliberation elements in the software:

- multi-user synchronous (on-line) and asynchronous (off-line) mode for collective argumentation mapping in teaching argumentation skills - Belvedere, OVA, Hermes;
- dialogue modes through feedback toolkits for controlling students’ activities and progress (Digalo, ARGUNAUT) or for playing dialogues in teaching critical thinking skills (AcademicTalk, InterLoc), which can be used for group deliberations, too;
- web-oriented systems for wide disputes, which allow an unlimited number of participants to interact in the debates (DebateGraph (http://www.debategraph.org) or Collaboratorium [5]);
- constructing arguments, in which users can themselves pick and assemble argument components (Digalo, Athena), which allow modeling their deliberations, too;

- evaluating justification of statements by weighing single pro and contra arguments with the help of special assignments (Carneades, ArguMed), which support determining the solutions [25].

Recently the Critical Thinking Skills BV, the developers of Rationale, have proposed a new software for modeling decision making bCisive (https://www.bcisiveonline.com), which is based on the concept of deliberative protocol [26]. They suggest bCisive for visualization of deliberative reasoning and decision support and consciously avoid differentiating between those two otherwise distinct modes of practical argumentation.

In other approaches some developers propose to supplement the ontology of argumentation with "means that allow modeling the audience to which the arguments are directed, and means that allow representing the content of the statements included in the arguments" [8], which open a possibility of taking into account the parameters relevant for the tasks of discovering arguments with special focus on deliberative argumentation.

As regards the modelling of the deliberative argumentation, most of these developments towards creating the software are capable for modelling it either as a side result of their modelling of argumentation and reasoning, in general, or are adjustable for that with subsequent reservations. At the present, there is no software comprehensively aimed at supporting the deliberative argumentation with functions of evaluating arguments and finding solutions.

3. Guidelines for the software for modeling and representation of deliberative argumentation with a resolution function

There are diverse approaches and methods to the development of the software designed to model and represent argumentation. The developers seldom clearly indicate the requirements and criteria by which they were guided when creating their software. We examined the software toolkits [23, 27, 28] along with the conceptual approaches to their design [8, 29, 30] and found a number of problems that, on the one hand, restrict the comprehensive use of the software for modeling argumentation and deliberative reasoning, and, on the other hand, resist development of a unified general approach to designing of the software for both representation of argumentation and deliberative reasoning and implementing algorithms for searching solutions:

- unavailability of systems' technical documentation, which prevents implementation of the successful solutions in further developments and creating of the integrative solutions based on using the advantages found in different systems. The documentation for the system installation as well as in the user manuals, which is available in many cases, is of little help for solving those tasks;

- low flexibility in the system settings, which prevents configuring it for specific use. For example, the preset argumentation schemes or types of visualization presuppose no modifications;

- implementation of specific conceptual foundations restricts application of the software for solving a wide range of tasks in modeling argumentation.

There are two other obstacles to exploring and approbation of the software: some products are no longer supported by their developers; others are described only in research papers (ProGraph, ConArg2) which contain no links to the software itself. In general, most projects in the field explore just some of the special aspects of the software design, and very few of them comprehensively focus on its design and development. The special properties of the software for modelling of the deliberative argumentation are left outside the research scope of those projects.

One of the notable achievements in the examination of the software is the LASAD (Learning to Argue - Generalized Support Across Domains) software platform [3, 30, 31, 32] developed with the support from the German Research Foundation (DFG) (https: // www. dfki.de/en/web/research/projects-and-publications/projects-overview/projekt/lasad/) by the German Research Center for Artificial Intelligence in cooperation with Clausthal University of Technology in 2008-2010. The LASAD team explored the existing software and approaches its creation [23], compared them to the platform developed by themselves and proposed a concept for the creating of a software platform which would consider the challenges and shortcomings in existing systems identified by the team. One of the LASAD goals was to simplify the creation of the formal argumentation systems by means of a flexible configuration mechanism [27], for which the team formulated the special requirements and implemented them in developing of their platform:

1) general properties – special conditions for installation, maintenance and use;
2) cooperation (joint work) – toolkits supporting joint work;
3) analysis and feedback implementing machine learning in the libraries of samples and templates;
4) ontology, based on definite conceptual foundations (Tulmin [33] or Wigmore [34]) and providing the possibility of employing the system for solving various tasks belonging to diverse subject areas;
5) diversification of the options for visualization and representation in the data sets including argument maps;
6) journaling for the discovering, modelling and restoration of the argumentation processes and output in full-fledge explicit forms for spotting fallacies. This requirement ensures the entry of new participants into the already running joint activities including the argument mapping.

These groups of requirements clearly aim at creating of a software system that can be effectively used in education for training of practical argumentation and critical thinking skills relevant in many subject areas. Modular approach of the software designed according to the LASAD requirements presupposes flexibility and extensibility, which allows creating, updating, and applying of the special modules with additional functional potential for solving specific tasks. The architecture of the designed platform reflects the modular approach.

The LASAD system of requirements includes no special guidelines for modelling of the deliberative argumentation, although it contains some elements adjustable to support the deliberative reasoning. Another restriction is that it lacks explicit criteria which would allow implementation of the function for identifying the solutions. Yet another restriction is that the platform is available only in the form of source codes (https://sourceforge.net/projects/lasad/) and is impossible to properly testify its work, as it is available in its beta-version, and its demo version is blocked by an empty link to (http://lasad-demo.cses.informatik.hu-berlin.de).

The developers of another kind of the software suggest employing of an ontological approach with an extensible ontology [8]. The proposed extension is justified by the tasks of modelling of argumentation in popular scientific discourse, where it is necessary to consider the reliability of the sources of scientific information or the characteristic properties of the audience. They rely on the AIF ontology (Argument Interchange Format) [35] which represents arguments as graphs. The software has the following functions [29]:

- storage of argumentative markup of texts, as well as of the information about the source of argumentation (storage of annotated text corpora);
- genre-, subject area- and linguistic-sensitiveness to the style of the discourse, where the argumentation at question is found;
- a comprehensive analysis of the created argumentation graphs (argumentation maps).

The software can verify the argumentation graphs as an option of the general assessment of the argumentation. The automatic verification algorithms of the software can search for the cycles, analyze the connections, consider the textual indicators of argumentation, compare the obtained maps. For the automated analysis of argumentation, the software proposes the following functions: search in the corpus of experts' output in the system; preparatory processing of texts with marking out the indicators of argumentation; assessment of the arguments' persuasiveness.

The developers certified their software and registered it according to the legal rules of the Russian Federation [36]. Although the software is thoroughly described and screenshotted in the academic papers, nevertheless its unavailability for regular testifying and use limits its assessment to purely theoretical. According to the papers, the key advantages of the software include the possibility of extending the ontology with deliberation elements (value attitudes, weights of arguments, etc.), as well as a special algorithm that "calculates the weights of conclusions by carrying out calculations along a chain, in which the conclusion inferred out of an argument serves as a premise for the next argument, including the pieces of reasoning in which the chain mapped in one and the same graph involves not only supporting claims but the conflicting claims as well as [29] ". For the calculations, the system is operated by a truth values algebra based on fuzzy logic. Alternatively, it contains the algorithm for weighing of premises and conclusions by user manual assignments. Judging by these properties, the software can be classified as proposing a mechanism for solving argumentative tasks and can be applied for automated decision-making in the deliberative reasoning.

Its key restrictions amount to the risks of subjectiveness in the manual assessment of the premises and in its non-flexibility of varying the modes of evaluating arguments in relation to different types of dialogues. Plausible arguments can be acceptable in deliberations as well as in other types of dialogues, in which they can be assigned with positive weights. However, such arguments can be fallacious in the discursive argumentation, for example in formal or critical discussions which instantiate what we call scientific discussions, and in those dialogues the same plausible arguments have to be assigned with negative weights. Other restrictions of the software include the following:

- visualization is limited to graph representation;
- the system is limited to the analysis of argumentation in popular science discourse, although the developers promise to further elaborate the software for making it applicable in broader subject areas;
- there are no functions of joint activity, feedback and restoration of argumentation.

In general, the descriptions of the key functions of the software and its general functional properties can be taken as requirements for the design and development of that kind of software.

The above considered approaches to designing and creating of the software for modeling and representation of argumentation point to two essential shortcomings. Either there are no requirements or criteria that are explicitly put as those that should be or are taken into account in its development with respect to solving broad or specific tasks related to the deliberative argumentation, or the software or approach to creating it exhibit sensitive functional limitations for its use, which are generated by overly broad or narrow criterial toolkit.

We propose our approach to the development of a body of criteria (requirements) that have to be considered in the development of the software for modeling the deliberative argumentation. The proposed criteria include the guidelines for implementation of a function of arguments' evaluating and finding solutions, and can be taken into account both in the applied and the conceptual agendas of designing of the software. Our proposal is based on the three following issues:

- exploration in the research approaches and publications relevant to designing and development of that kind of the software;
- the results of our own research;
- our experience of using the special software in research and teaching.

We propose the following five (groups of) criteria which take into account definite special properties of the deliberative argumentation as well as presuppose necessary functional options for arguments' evaluation and search for solutions (Table 1).

In the technical documentation of the software, it is preferable to explicitly reflect the cases when the developers consider some (group of) criteria relevant or irrelevant for the software they create.

The development and use of ontologies belong to the key logical and conceptual criteria determining the possibility of modeling of the deliberative argumentation. We propose to use four kinds of ontologies and to implement them as the corresponding libraries: arguments, relations (functions), dialogues (disputes), and agents. As a foundation for their construction, we suggest employing the Argument Interchange Format (AIF-Argument Interchange Format) proposed by an international team of argumentation researchers [35]. AIF covers the first three libraries, but includes no elements for agent profiling. At the present stage, AIF is a common platform for the following three different trends in the development of the software products for modelling argumentation:

- Argumentation protocols, for example, ASPIC+ with molecular arguments, [37],
- Software for visualization of argumentation, such as Rationale [38] or OVA [39],
- Descriptive logic matching tools of mathematical logic and IT-representation of knowledge [40, 41].

The AIF is a template for building ontologies, and it is a result of the collective efforts of the scientists in their development of those three directions and in creating it as a lingua franca of formal, or computational, argumentation analysis. Similar to how gadget users are divided into those who prefer either iPhones or android smartphones, AIF divided the software products and the formalisms for the analysis, modeling and visualization of argumentation into two groups, into those which employ that format as a basic ontology or those which are based on the specially constructed formats. This allows classifying the software products with respect to the ontology employed. Thus, the LACAD project employs not AIF, but a different specially created ontology. The developments of Russian scientists [1] and [8] are based on AIF.

Table 1
Necessary criteria for developing of the software for modeling the deliberative argumentation, evaluating arguments and finding solutions

Groups of criteria	Criteria	Explanation
logical	Syntactical and semantic aspects of arguments Dialogue graph representation Modifiable ontologies	The criteria consider the qualitative structure of arguments, requirements for ontologies and argumentation schemes. For example, argumentative marking involve examination of the semantic and syntactic aspects of the structural elements of the created schemes and diagrams, the compositional relations between atomic and molecular elements, etc.
Pragma-linguistic	Rhetorical text mapping Coding and decoding of messages	Considering and profiling of the speech actions by which arguments are put forward
Communicative	Multi-use options for joint work Support of collaboration in deliberation	These criteria ensure the possibility of using the software for deliberation both in the professional activity for collaboration and joint work of individual participants and groups, and in teaching and training of the corresponding skills.
Methodological	Modifiable argumentation Defeasible arguments Journaling deliberations (protocols)	Reflect the goals of the software and special features of its application
Digital-technological	Modular architecture Options for extending or modifying of the software Support of the user-friendly configuration by web- interface Support of cross-platform adaptability Exportation of the argumentative maps (schemes, diagrams) in the formats supported by other widely used software Journaling and profiling of the software design and work	Relate the aspects of the software application to its design and creation

The basic AIF ontology contains two key groups of elements which can be viewed as conceptual and formal. To express them, AIF provides two ontologies, an ontology (conceptual) of forms and a top-level ontology, respectively. The formal elements represented by the top-level ontology are a kind of syntax for representing arguments by means of graphs which consist of nodes and edges. The ontology of forms reflects the substantive elements of arguments, such as premises, conclusions, assumptions, exceptions, schemes of argumentation, criticisms, etc., which are designed for making the top-level ontology meaningful by representing individual arguments, for example, the deductive or the plausible, or representing the types of disputes. AIF and the visualization of arguments with the help of ontologies based on this format can be compared to Wigmore's argumentation and Toulmin's argumentation models, respectively.

In the top-level ontology, there are two types of nodes, information nodes (I-nodes) containing information about the elements of the molecular arguments - premises, conclusion, exclusions, etc., and circuits, or schematic nodes (S-nodes), representing the types of atomic arguments by their structure and forming the three following groups:

- RA (Rules of Arguments) nodes of inference rules,
- PA (Preferred Argument) preference nodes,
- CA (Conflict Argument) nodes (types) of conflicts of opinions.

S-nodes act as nonspecific structural or functional schemes for I-nodes.

The nodes RA, CA and PA express the properties of argumentation at its three levels, respectively, on the level of individual arguments, of the relations between arguments in the framework of the sets of arguments presented by the agents of the dispute, and of the assessments of individual arguments relative to each other. In the three directions of the analysis of argumentation, in their formalisms, the nodes RA, CA and PA are used with different degrees of detailing.

At the present, RA nodes are the most developed, they imply two types of inference rules and divide arguments by the method of demonstration, the connection between premises and conclusions, into the deductive and defeasible arguments. We consider this division confusing and below propose a different one.

CA nodes are designed to express schemes of criticism and differentiate between its two types, symmetric, when in a pair of arguments one attacks the other and vice versa, and asymmetric, when in the pair one attacks the other, but not vice versa. With respect to the elements of argumentation, between which the relation of criticism is established, the CA nodes mark two of its structural types, between the points of view of the parties and between the arguments the parties put forward for their defense or refutation. In relation to criticism and refutation, the CA-nodes contribute to distinguishing between the kinds of disputes depending on the type of disagreement in opinions and imply two types of disputes: asymmetric dispute-disagreement, when one agent defends his or her point of view from doubts or criticisms of another agent who have no point of view other than the opposite to the first one; and a symmetrical dispute-conflict, when each agent defends his or her point and criticizes the opposite point of view. The dispute-conflict can be viewed as two corresponding disputes-disagreements. The varieties of asymmetrical CA nodes are used to express refutation, by which one argument attacks another one in two ways: by undermine which questions the premise or undercut which doubts the demonstration. The undermine and the undercut can be refined by considering the relevant argumentation schemes.

The least developed are PA nodes, designed to express the ratio of assessments of the acceptability of arguments and to play an important role in the search and selection of dispute solutions.

AIF provides three types of relations between elements of the two ontologies: to be a subclass, to fulfil, and to include. For example, CA nodes are a subclass of S-nodes, they fulfil (functions of) criticism schemes and include two kinds of elements, the attackers and the attacked.

Ontologies generated by means of AIF model a dispute in the form of a directed graph, the nodes and edges of which model the arguments put forward in the dispute and forming up its network of arguments. Depending on the properties of the formalism created on the basis of AIF, the nodes express the necessary properties of arguments, such as inferential quality, acceptability, belonging to the position of an agent, etc., while the edges characterize the three types of connections between arguments or relations between their internal elements. The edges of information connecting I-nodes with S-nodes represent the structure of information at the level of individual arguments, for example, the function of an argument premise fulfilled by a proposition. The edges of inference connecting S-nodes to I-nodes express the kind of demonstration, or the kind of argument; and the edges of justification connecting different S-nodes to each other represent the structure of argumentation within an agent's position or on a (sub-) set of arguments in the dispute.

For modelling of the deliberative argumentation, we propose to supplement AIF (Fig. 1) to DelibAIF (Fig. 2) by means of the following three modifications.

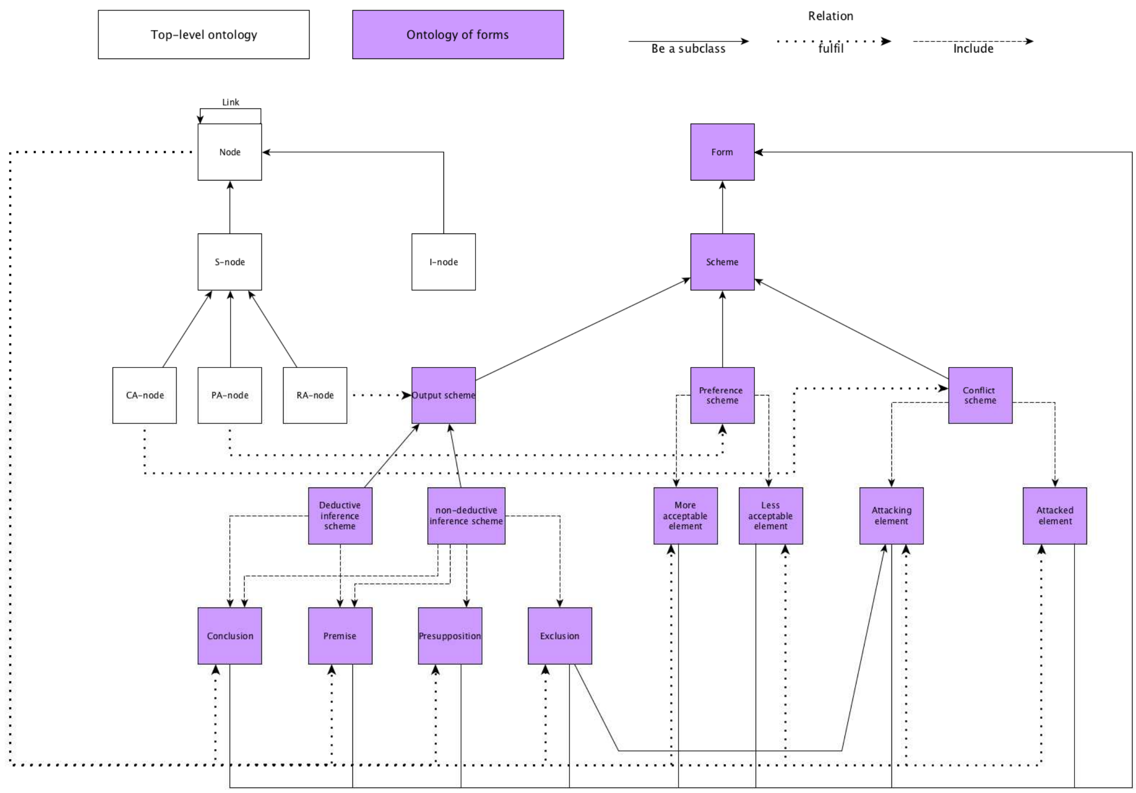

Figure 1: Standard AIF

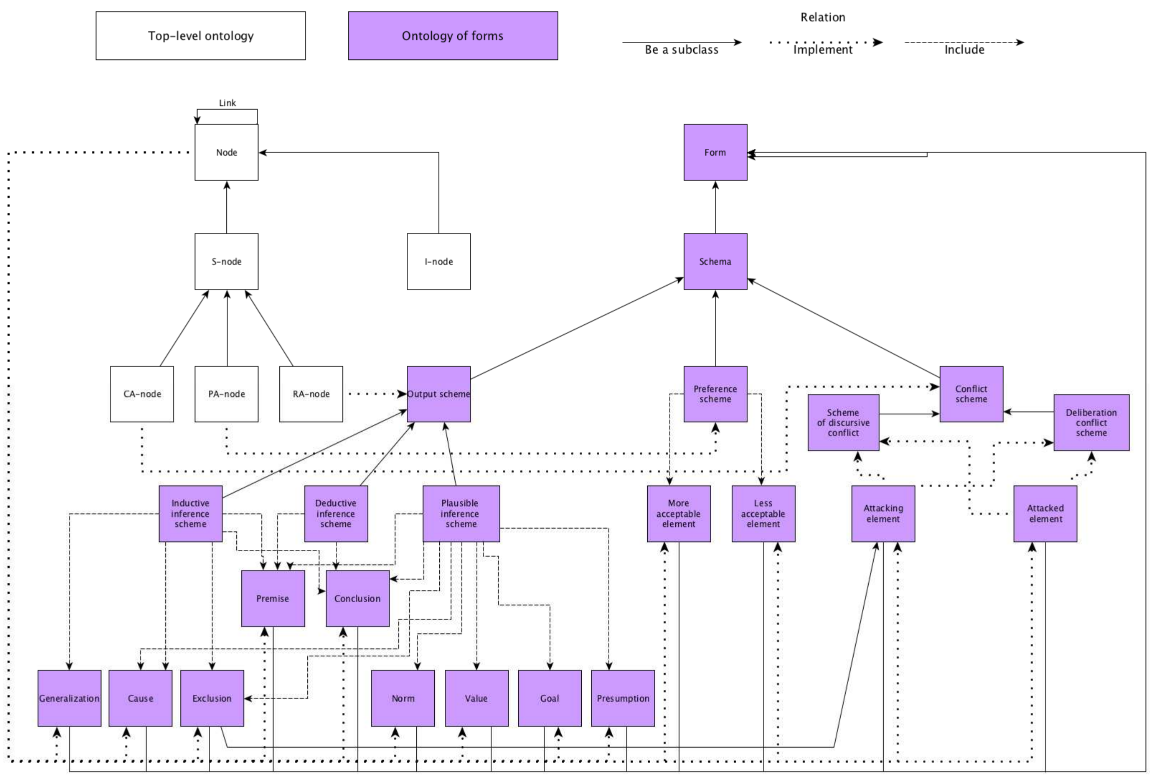

Figure 2: Modified AIF (DelibAIF) for modelling of the deliberative argumentation

First, in RA nodes of inference schemes, we propose to abandon the vague division of schemes into the deductive and the defeasible and to replace it with a division into three classes: deductive, inductive and plausible schemes. Then, indefeasible schemes will consist of the first two classes of the deductive and the inductive schemes; and the second and the third classes, i.e. the inductive and the plausible schemes, together with make up the class of the non-deductive schemes. There is no need of adding elements such as indefeasible or non- deductive schemas to DelibAIF as separate subclasses of the *Inference Schemes* class.

Secondly, to the four structural elements already present in the AIF - *premise*, *conclusion*, *assumption* and *exclusion* we propose to add the following five: *generalization*, *cause*, *goal*, *value*, *norm*. The elements *premise* and *conclusion* are necessary in any argument, so they are necessary elements of each of the three schemes. The rest of the elements are required for expressing of the properties of the premises of the inductive or plausible arguments: *generalization*, *cause*, *assumption* and *exclusion* - for the inductive arguments; and *cause*, *admission* and *exclusion*, and the rest of the elements - for the plausible arguments. The elements *goal*, *value*, *norm* are necessary for modeling the deliberative arguments which are a part of the class of plausible arguments. These elements mark out the specific premises of the practical arguments and reflect the properties of reasoning about actions that are not characteristic of other plausible arguments.

Thirdly, we propose to treat the two subclasses *Scheme of discursive conflict* and *Scheme of deliberative conflict* as the subclasses of the element of the ontology of forms *Scheme of Conflict* and to establish the relation *to fulfil* between the elements *Attacker* (Attacking element) and *Attacked* element and those two *Schemes.* This allows to distinguish between the deliberative, or practical, argumentation from the discursive, or theoretical.

The proposed modifications open the possibility of completing of the library of arguments with the plausible arguments about actions, the library of disputes - with the disputes about actions, and the library of relations – with the relations between special elements of the practical arguments inside the structure of those arguments, at the level of the agent's position in the dispute and at the level of the whole dispute. For modelling of the agents of argumentation, be it discursive or deliberative argumentation, the corresponding library of agents has to be generated separately, since AIF lacks expressive abilities for providing agent profiles and reduces the cognitive diversity of agents to the information diversity expressed by I-nodes.

4. Conclusion

We proposed a preliminary approach to the formulation of criteria that have to be considered when developing the software for modeling and representation of the deliberative argumentation with the function of evaluating arguments and finding solutions. However, already at the initial stage, we propose grouping the criteria for reflecting the key properties of that kind of the software. We suggest a modified DelibAIF scheme which allows modeling the deliberative argumentation.

Since for modelling of argumentation, in Russia we have neither domestic, nor localized software, we propose the corpus of (the groups of) the criteria for providing the methodological support in generating guidelines and recommendations for the creation of the software and applications for modeling and representation of argumentation, deliberative reasoning, which will support decision-making, teaching argumentation and training the critical thinking skills. The development of the corpus of criteria aims at methodological support of the academic, research and educational communities and at providing them with the effective selection tools for using the software in their research and teaching activities related to the deliberative argumentation.

In our further research we intend to classify the properties of the software according to the five (groups of) the criteria given in Tab.1., to testify both the criteria and their grouping against the existing and newly developed software, and to update the body of the criteria, if needed. Its another application will be a comprehensive classification of the software and systems for modeling and representation of argumentation, the deliberative reasoning, support of decision-making processes and training of argumentation and critical thinking skills. The classification will enhance the quality of users' decisions regarding the choice of the software and applications for solving their practical tasks.

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