# Syncretic Argumentation by Lattice Homomorphism and Fusion

# (Extended Abstract)

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## ABSTRACT

In this paper, we attempt to formalize a novel approach to the syncretic argumentation, which allows agents with different epistemology to engage in argumentation, taking into account the Golden Rule in the ethics of reciprocity and Confucius' Golden Rule. We address this new argumentation framework in two ways. One is by introducing the lattice homomorphism on truth-values (epistemic states) of propositions, and the new definitions of arguments justified under syncretized knowledge base. For the other, we devise the lattice fusion, which is induced through the lattice product.

## Categories and Subject Descriptors

I.2.11 [**Distributed Artificial Intelligence**]: Intelligent agents

## General Terms

Theory

## Keywords

Argumentation, Logic-based approaches and methods

## 1. SYNCRETIC ARGUMENTATION

In his influential work on the abstract argumentation framework [1], Dung introduced the notion of "acceptability" of arguments that has played the most significant role in specifying the various kinds of semantics for argumentation: admissible, stable, preferred, grounded, complete. An abstract argumentation framework is a tuple $< A, R >$, where $A$ is a set of arguments and $R$ is a binary relation on $A$ called an attack relation. In Dung's theory of argumentation, we are not concerned with the internal structure of arguments and why and how arguments attack others. Everything is abstracted away in this way. This abstraction, however, was a good starting point for developing the formal argumentation semantics that is to capture what acceptable or admissible arguments are and the whole of justified arguments. The notion of acceptability is a counterpart of the phenomenon observed in our daily argumentation and originates from an old saying, "The one who has the last word laughs best", as stated by Dung. It is an empirical social truth or wisdom that has been evolved in various cultural sphere over generations and considered useful by people. It is remarkable and suggestive that Dung's theory of argumentation had started from such a daily but philosophical observation. This might be because argumentation is humans' most normal but intelligent action for thought and communication by language.

We developed the Logic of Multiple-valued Argumentation (LMA) [2] that is a variant of Dung's abstract argumentation framework concretized in such a way that the arguments are represented in terms of the knowledge representation language, Extended Annotated Logic Programming (EALP) and the attack relation consists of various sorts of attack such as rebuttal, undercut, defeat, etc. with three kinds of negation: ontological negation ($\tilde{}$), default negation (**not** ), and epistemological negation ($\neg$) that play a role of momentum in argumentation. EALP is an extension of ELP (Extended Logic Programming), and a very expressive knowledge representation language in which agents can express their knowledge and belief with annotations as truth-values that allow to represent various kinds of uncertainty of information. In a word, LMA is an argumentation framework that allows agents to engage in uncertain argumentation under uncertain knowledge bases if once the common annotation is shared among agents. Put it differently, agents are assumed to have a homogeneous recognition for propositions with the same annotation as truth-values.

In this paper, we make a clean break with this assumption, directing to a more natural but complex settings of argumentation named "Syncretic Argumentation". By the term "syncretic argumentation", it is meant to be such an argumentation that each agent can have its own knowledge base, based on its own epistemology, and participate in argumentation with it. More specifically, each agent can engage in the argumentation in which arguments are represented in EALP and annotated with its own truth-values which are assumed to represent modes of truth or epistemic states of propositions [2]. The syncretic argumentation is a new framework that allows agents to argue about issues of mutual interest even when they have their own annotations, for example, agent A has two values $\mathcal{TWO} = \{f, t\}$ as an-

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notation (this is typical in the Occident), and agent B has 4-values $\mathcal{FOUR} = \{\bot, \mathbf{t}, \mathbf{f}, \top\}$ as annotation (this is called tetralemma in the early philosophical literature and text of Buddhism).This reflects an attitude against unilateralism, so that one agent world may not be forced to assimilate to another unilaterally. We realize the goal by means of the lattice homomorphism since the mathematical structure of annotations is a complete lattice and the homomorphism is a mathematical apparatus convenient to syncretize the difference of epistemic states of propositions.

EXAMPLE 1. *Let us consider two typical lattices: the two-valued complete lattice* $\mathcal{TWO} =< \{f, t\}, \vee, \wedge, \leq >$, *where* $f \leq t$ *and the four-valued one* $\mathcal{FOUR} =< \{\bot, \boldsymbol{t}, \boldsymbol{f}, \top\}, \vee, \wedge, \leq >$, *where* $\forall x, y \in \{\bot, \boldsymbol{t}, \boldsymbol{f}, \top\}$ $x \leq y \Leftrightarrow x = y \vee x = \bot \vee y = \top$. *For these lattices, we may have the two-way homomorphism as shown in 1.*

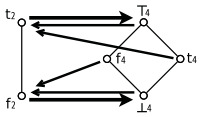


**Figure 1: Homomorphism:** $h1 : \mathcal{TWO} \rightarrow \mathcal{FOUR}$ **and** $h2 : \mathcal{FOUR} \rightarrow \mathcal{TWO}$

Through the two-way homomorphism, we can have two different sets of justified arguments: $Justified\_Args_{\mathcal{T}\rightarrow\mathcal{F}}$ and $Justified\_Args_{\mathcal{F}\rightarrow\mathcal{T}}$. Then, we are interested in defining a set of justified arguments as a "common good" that is acceptable for both agents. Actually, we may have four kinds of agent attitudes or criteria to chose it from among two different sets of justified arguments: bilaterally justified arguments, credulously justified arguments, self-centeredly justified arguments and creatively justified arguments.The following is the notion of bilaterally justified arguments.

DEFINITION 1 (BILATERALLY JUSTIFIED ARGUMENTS).

- *An argument a in* $Args_{K_A}$ *is bilaterally justified iff* $a \in Justified\_Args_{\mathcal{F}\rightarrow\mathcal{T}}$ *and h1(a)*$\in Justified\_Args_{\mathcal{T}\rightarrow\mathcal{F}}$.
- *An argument a in* $Args_{K_B}$ *is bilaterally justified iff* $a \in Justified\_Args_{\mathcal{T}\rightarrow\mathcal{F}}$ *and h2(a)* $\in Justified\_Args_{\mathcal{F}\rightarrow\mathcal{T}}$.

This is a fair and unbiased notion of justified arguments in the sense that the both sides can attain a perfect consensus by the two-way homomorphism. Morally, it reflects such a compassionate attitude that agents look from the other agents' viewpoint, or place themselves in the other agents' position.

The syncretic argumentation is obviously a radical departure from the past argumentation frameworks in the sense that they are basically frameworks using two-valued knowledge base, or simply a fixed multi-valued one. Here we should emphasize that our approach to the syncretic argumentation is not only technically new but also has a profound philosophy that underlies our syncretic argumentation. They are,

- Golden Rule in the ethics of reciprocity (of positive form): "Treat others (only) as you consent to being treated in the same situation."
- Confucius' Golden Rule (of negative form): "Never impose on others what you would not choose for yourself."

and may be said to be ethical in contrast with Dung's background idea on the acceptability.

Next we turn to another construction of syncretic argumentation since there are cases where lattice homomorphism does not exist. We devise the new notions: the lattice fusion operator and fusion lattice that are induced through the lattice product, and can be considered as providing a natural way to syncretize the difference of epistemic states of propositions. Figure 2 shows an example of the fusion lattice constructed from two lattices: $\mathcal{TWO}$ and $\mathcal{FOUR}$, via. their product. The fusion lattice provides for agents a common argumentation field where agents can start syncretic argumentation using their knowledge bases with annotation specified in the fusion lattice. Our approach to fusing lattices has such advantages as majority principle, order preserving and commutativity.

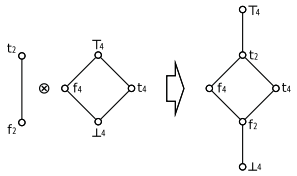


**Figure 2: Fusion of** $\mathcal{TWO}$ **and** $\mathcal{FOUR}$

Agents have to live in the multi-cultural computer-networked virtual society as well as humans living in the multi-cultural society. This implies that agents also get involved in arguing about issues of mutual interest on the basis of their own belief and knowledge. But, if they insisted only on their epistemology, we would lose chances to interact or communicate with each other. The enterprise in this paper is an attempt to avoid such a cul-de-sac appearing even in argument-based problem solving.

The general golden rule has its roots in a wide range of world cultures. The human history accepts it as a universal standard with which we resolve conflicts among different civilization and culture. Although the Golden Rule has had its critics on the one hand, the key element of it is that a person attempting to live by this rule should treat all people, not just members of his or her in-group, with consideration and compassion. It, therefore, is reasonable for us to employ it and formalize the syncretic argumentation under the general golden rule as the rationale of our attempt. Our bi-directional homomorphism between different annotations and the fusion lattice approach could realize the key and may be said to be the general golden rule itself in the syncretic argumentation. We hope that the syncretic argumentation could lead to overcome and bridge the gulf of incommensurability among different cultural agents, and result in fair and equal argumentation without unilateral imposition.

## 2. REFERENCES


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