

Many-valued semantics for information representation

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Introduction

- Using classical logic to represent the information usually calls for a complex frame or model.
- Here, we consider another method for information representation by using many-valued semantics.
- We will show that we can express the information like preference, knowledge, e.t.c., clearly by our semantics.

Single-layer semantics

- Sometimes, the definition of true and false is ambiguous.
- In the Gödel logic and the fuzzy logic, the values are considered as a range from 0 to 1.
- For example, we can express the preference as following figure:



- ❑ 1 means that the agent loves it, while 0 stands for agent hates it.
- ❑ 0.5 stands for not care, therefore, if the value is bigger than 0.5 means the agent likes it while smaller than 0.5 means the agent dislikes it.
- ❑ Another way is that, we can define the bound of like and dislike, e.g., 0.8 and 0.2, then:

$v \leq 0.2$	$0.2 < v < 0.8$	$v \geq 0.8$
agent dislikes it.	agent doesn't care it.	agent likes it.

It means that we can also consider it as a finite-valued semantics.

- Note that although we consider the semantics as fuzzy logic or Gödel logic, our aim is to provide different satisfied relation, since in such logics only the value 1 is considered as valid.

Multi-layer semantics

- One layer semantics can only express the state of single agent.
- As a multi-layer semantics, we consider the value as a tuple (v, a_1, \dots, a_i) ,
 - v shows the truth value, e.g., true or false.
 - a_i shows the states of agent i , e.g., the knowledge states.

A	v	a_i
knowledge state	classical value (true or false)	whether agent i knows the truth value of A
awareness	classical value (true or false)	whether agent i aware of A or not
legal and ethical	whether it ought to be the case A or not	the reason why agent i obeys A or not A (legal or ethical)

Merits

- We can express the states of all agents in one value without using complex frame.
- Each agent is considered as independent so we can only take care of a group of agents. Moreover, if we want to take care of the objective value like true or false, we can ignore the states of agents, i.e., just force on the first element v .
- We can give different results of conjunction, disjunction, e.t.c, with different reading of the states.
- The multi-layer semantics can be easily translated into normal many-valued semantics, therefore we can employ other studies to our semantics directly.

Conclusion

- We introduce some many-valued semantics for information representation.
- We give some example using our semantics and provide the merits of our semantics.
- We need to take care of the readings of formulas because sometimes they are different from natural language.