Knowledge Representation Technique

Logic are formal language with well defined rules for manipulation of representation as well as to draw conclusion

Propositional logic
First order Logic (Predicate logic)
Second order logic

Properties of these KR techniques
1.Representational Adequacy
2.Clear syntax and semantics
3.Inferencial Adequecy
4.Inferencial efficiency
5. Naturalness

Resolution Techniques to derive conclusion

Steps for Resolution

- Convert the given statements in Predicate/Propositional Logic
- Convert these statements into Conjunctive Normal Form
- Negate the Conclusion (Proof by Contradiction)
- Resolve using a Resolution Tree (Unification)

Propositional logic is mathematical system for reasoning

Proposition is variable and connection/relation between them

P:It is hot

Q:It is humid

R :It is raining

connective: And $\wedge$ $\neg$ $\leftrightarrow$

OR $\vee$ $\rightarrow$

P $\rightarrow$ Q can also b e written as $\neg P \vee Q$

If it is hot and humid than it is raining $P \wedge Q \rightarrow R$

First Order logic (Predicate logic)

Predicate logic(object , function and quantifier)
P(x,y.....)
More exprssive than propsitional logic
syntax and semantics are more clear

All students are smart

$\forall x$ Student(x) $\longrightarrow$ Smart(x)

All P's are Q's $\forall x \; P(x) \longrightarrow Q(x)$

Some P's are Q's $\exists x \; P(x) \wedge Q(x)$

conversion to CNF:conjunctive normal form

1:elimnate implcation sign $\longrightarrow$
2.eliminate existential and universal quantifier $\exists$ $\forall$
3.elimnate And $\wedge$

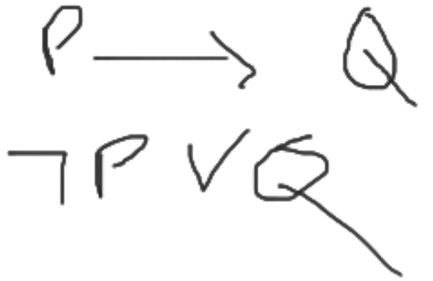
Resolution to nagate conclusion

Resolution

Problem Statement:
1. Ravi likes all kind of food.
2. Apples and chicken are food
3. Anything anyone eats and is not killed is food
4. Ajay eats peanuts and is still alive
5. Rita eats everything that Ajay eats

Prove by resolution that Ravi likes peanuts using resolution.

Solution:

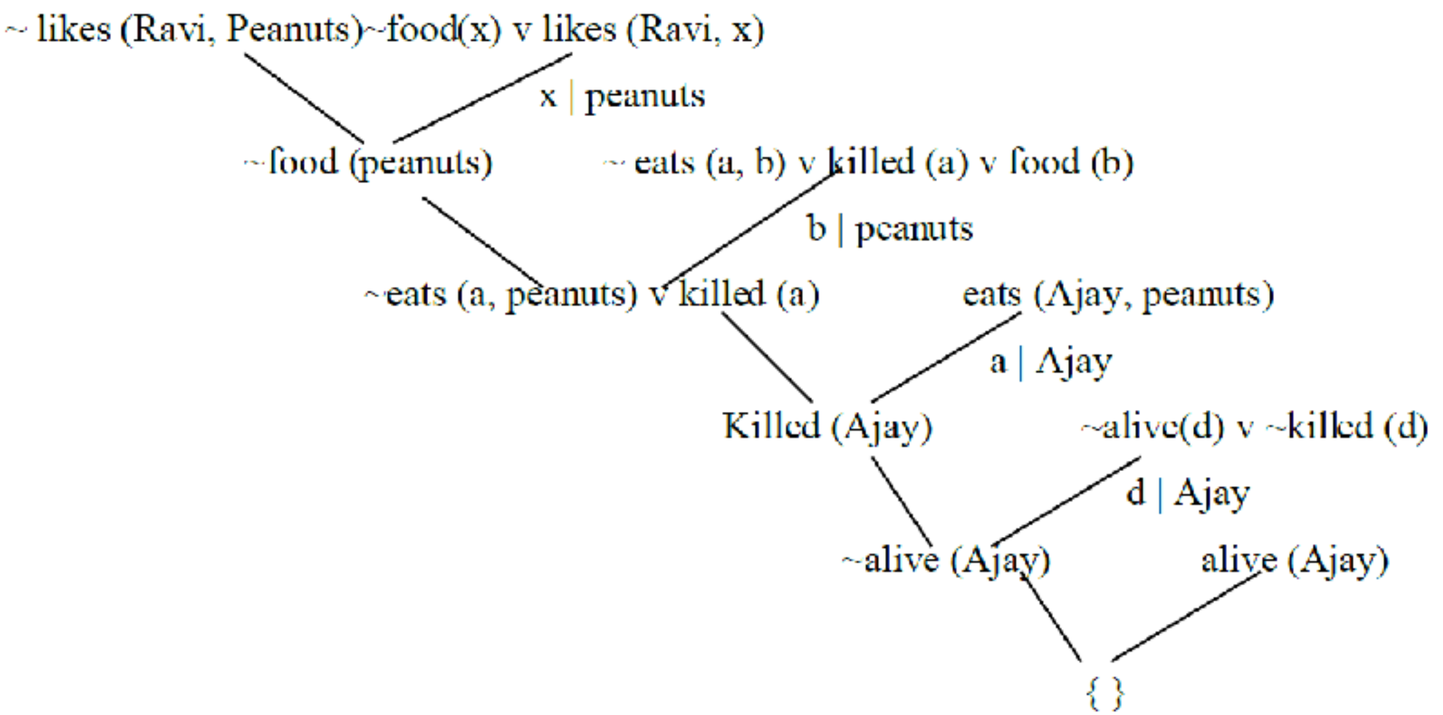


Step 1: Converting the given statements into Predicate/Propositional Logic
i. ∀x : food(x) → likes (Ravi, x)
ii. food (Apple) ^ food (chicken)
iii. "a : "b: eats (a, b) ^ killed (a) ® food (b)
iv. eats (Ajay, Peanuts) ^ alive (Ajay)
v. "c : eats (Ajay, c) ® eats (Rita, c)
vi. "d : alive(d) ® ~killed (d)
vii. "e: ~killed(e) ® alive(e)
Conclusion: likes (Ravi, Peanuts)

Step 2: Convert into CNF
i. ~food(x) v likes (Ravi, x)
ii. Food (apple)
iii. Food (chicken)
iv. ~ eats (a, b) v killed (a) v food (b)
v. Eats (Ajay, Peanuts)
vi. Alive (Ajay)
vii. ~eats (Ajay, c) V eats (Rita, c)
viii. ~alive (d) v ~ killed (d)
ix. Killed (e) v alive (e)
Conclusion: likes (Ravi, Peanuts)

Step 3: Negate the conclusion
~ likes (Ravi, Peanuts)

Step 4: Resolve using a resolution tree



https://www.cs.utexas.edu/users/novak/resosol.html

All SGSITS
students are
intelligent

1.All people who are not poor and are smart are happy.
2.Those People who read are not stupid.
3.John can read and is healthy.
4.Happy People have exciting life

1. $\forall x : \neg Poor(x) \wedge smart(x) \longrightarrow happy(x)$
2. $\forall x : read(x) \rightarrow \neg stupid(x)$
3. $read(John) \wedge healthy(John)$
4. $\forall x : Happy(x) \longrightarrow Exciting(x)$

$\neg stupid(x) = smart(x)$

1. $poor(x) \vee \neg smart(x) \vee happy(x)$

2. $\neg read(x) \vee smart(x)$

3 a $read(John)$ b) $smart(John)$

4 $\neg poor(John)$

5 $\neg happy(x) \vee exciting(x)$

Some people has exciting life: $\exists x: exciting(x)$