

Logical Representation of Legal Knowledge

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Contents

- Model of Legal Reasoning
 - Legal reasoning = Deductive reasoning?
 - Analysis of legal reasoning
 - How to represent legal knowledge.
 - How to use legal knowledge.

What is Legal Knowledge?

- System of Law
 - The Constitution of Japan
 - Penal Code
 - Civil Code
 - Commercial Code
 - Code of Civil Procedure
 - Code of Criminal Procedure

Legal Knowledge & Provisions

- Legal knowledge = provisions ?

“Don’t enter this park with a dog”

Deductive Reasoning	rule:	prohibited_to_enter(X,Y,P)
		person(X), dog(Y), park(P).
	facts:	person(tom). dog(blackie). park(hibiya)

Conclusion: prohibited_to_enter(tom,blackie,hibiya)

Problems of Legal Rules

- The deductive reasoning is too simple to solve actual legal problems.
 - Legal rules are ambiguous.
Scope of rules.
 - Legal rules are not consistent.
Conflicting rules.
 - Legal rules don't contain commonsense knowledge.

Example of a Hard Case

prohibited_to_enter (X) vehicle(X)

Can an ambulance enter the park?
==> Ambulance Case

Can a baby carriage enter the park?
==> Baby Carriage Case

Interpretation of Ambulance Case

- Two Interpretations
 - (A) This rule is always effective.
So, an ambulance is prohibited to enter the park.
 - (B) In the case of emergency, the rule is ineffective.
So, an ambulance is allowed to enter the park.

Legal Criteria of Ambulance Case

- Which interpretation is superior to the others?
 - It depends on viewpoint (criteria).
 - (1) To keep the principle.
 - (2) To apply the rule flexibly.
- (1)>(2)? (1)<(2)?

Interpretation of Baby Carriage Case

- Two interpretations
 - (A) This rule is applied to all vehicle.
So, the baby carriage is prohibited to enter the park.
 - (B) This rule is applied only to the vehicle which runs fast.
So, the baby carriage is allowed to enter the park.

Legal Criteria of Baby Carriage Case

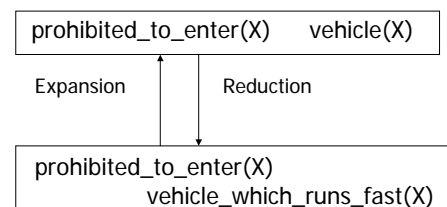
- Viewpoint (criteria)
 - (1) Interpret the meaning of “vehicle” as it is.
 - To keep the principle
 - (2) Interpret the meaning of “vehicle” considering the aim of the rule.
 - To keep the pedestrian safe.
- (1)>(2)? (1)<(2)?

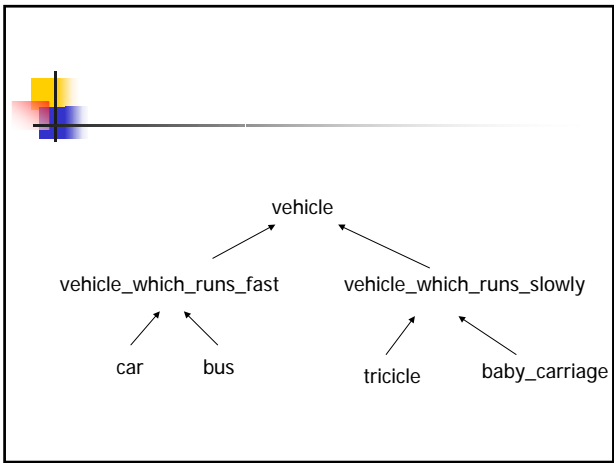
Model of Legal Reasoning

- 1st: Interpret legal rules on various viewpoints.
knowledge of making interpretation
- 2nd: Apply interpreted rules to facts and draw conclusions.
- 3rd: Select the best conclusion based on the value judgment.
knowledge of value judgment

Interpretation of Legal Rules(1)

- Expansion & Reduction





Interpretation of Legal Rules(2)

- Case Based Reasoning
 - prohibited_to_enter(tom's_car)
 - tricycle(tom's_car)
 - baby_carriage ~ tricycle
 - prohibited_to_enter(mary's_carriage)
 - baby_carriage(mary's_carriage)

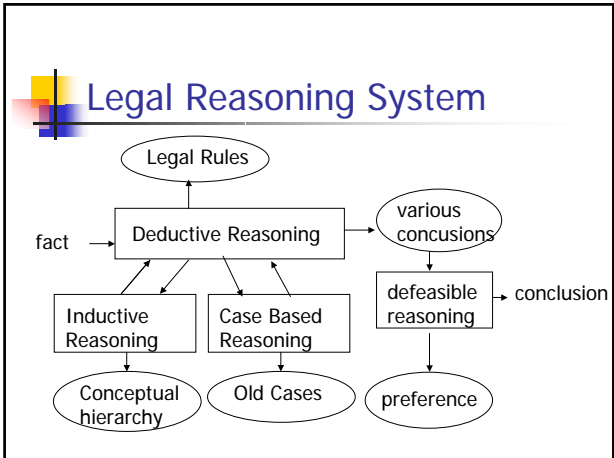
Selection of the Best Conclusion

r1: prohibited_to_enter(X) vehicle(X)
 r2: allowed_to_enter(X)
 vehicle_which_runs_slowly(X).
 r3: vehicle(X) baby_carriage(X)
 r4: vehicle_which_runs_slowly(X)
 baby_carriage(X)
 fact: baby_carriage(mary's_carriage)

- r1 > r2 principle > safety

Model of Legal Reasoning

- Interpretation of Legal Rules
 - Inductive reasoning
 - Analogical reasoning
- Deduction
 - Deductive reasoning
- Selecting the Best Conclusion
 - Defeasible reasoning

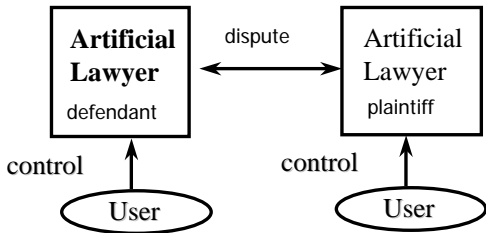


Architecture of Astroboy

- Architecture of Astroboy is appropriate to realize legal reasoning.
 - Electronic brain = inference
 - Heart = Value Judgment

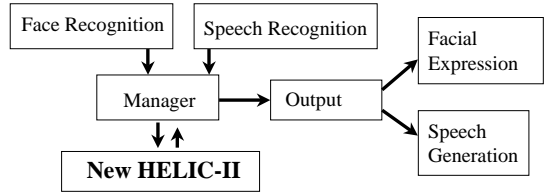
New Helic-II [Nitta]

Automatic Disputation System



Mr. Bengo [Nitta]

- Mr. Bengo = New Helic-II + Multimodal User Interface



Mr. Bengo (demo)



Example of Criminal Case (1)



Example of Criminal Case(2)



Example of Criminal Case(3)



Example of Criminal Case(4)



Example of Criminal Case(5)



Example of Criminal Case(6)



Penal Code

- 218: crime_of_abandonment_by_a_person_responsible(X)
a_person_responsible(X,Y),
abandon(X,Y).
- 219: crime_of_abandonment_by_a_person_responsible_resulting_in_death(X)
a_person_responsible(X,Y),
abandon(X,Y), death(Y),
caused(abandon(X,Y), death(Y)).

Disputation

Jane's Crime

Crime of abandonment by a person responsible?

Crime of abandonment by a person responsible resulting in death?

It depends on causality between abandonment and the baby's death.

Similar Old Case (1)

- Urata Case
Urata strangled her husband.
He fainted away.
Urata misunderstood he was dead.
She abandoned his body on the beach.
He died from suffocation of sands.
- Prosecutor ==> crime of homicide
Urata ==> crime of death by negligence

Similar Old Case (2)

- Jane Case Urata Case
 abandoned
 misunderstood
 died of unexpected reason

 traffic accident <==> strangling

Case Based Reasoning

- As Urata case is similar to Jane case, there is causality between abandonment and death. As a consequent, Jane is punished by the crime of abandonment by a person responsible resulting in death.
- By referring to old case, an interpreted rule is created.

Summary

- Legal reasoning is modeled as the combination of several inference mechanism. ==> Extended LP
- Legal Knowledge
 - Provisions
 - Interpretation (Old Cases, conceptual hierarchy)
 - Value Judgment (Priorities among criteria)