

**PROLEG:An Implementation of  
the Presupposed Ultimate Fact Theory  
of Japanese Civil Code by PROLOG Technology  
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1. Introduction:Juris-informatics
2. Japanese Presupposed Ultimate Fact Theory (JUF Theory)
3. PROLEG: (PROlog based LEGal reasoning support system)
4. Conclusion

# Introduction: JURIS-INFORMATICS

Ultimate purpose of the research:

Applying Informatics/AI techniques to legal domain to establish new research area I would like to call *juris-informatics*.

- Currently, AI and Law community seems to narrow their interests.
- So, we would like to extend the scope of research between informatics and law by putting a new name for this research.
- We would like to simulate the success of bio-informatics by giving impact to law domain using IT technology.

Background:

- Rapid society change (especially related with IT development)
- Processing large legal data
- (In Japan), slow litigation process (especially in intelligent property litigation)

# My Background

- I entered the law school in University of Tokyo and learned law in 2006-2008 using NII's off-the-job-training program(I, however, paid the tuition fee...) and obtained the title of “juris doctor” (actually MsC level).
- During learning at the law school, I found that the ultimate fact theory of civil code taught in the law school is closely related with “negation as failure” in logic programming.
- I developed a language called PROLEG (PROlog based LEGal reasoning support system) based on the above idea aimed at assisting law students and lawyers.
- I have been a steering committee member of workshops on juris-informatics (JURISIN). We have held eight JURISIN workshops in 2007-2014.

# Reasoning Steps in Civil Code Litigation

1. Fact Finding Phase
2. Subsumption Phase
3. Judgement Phase

## Fact Finding Phase

- A judge decides the truth value of facts in the considered case. Facts should contribute to judgement using evidence.
- Evidence itself is also a fact so we need to decide the truth value of evidence.
- We need evidential reasoning as well as reasoning from basic facts.
- Note that the truth value might be undefined (non-liquet).

For example, suppose a judge would like to decide whether there was an agreement about purchase of goods or not. If a plaintiff gave some basic facts such as email exchanges which can derive the fact of agreement, a judge will take into account of this base fact to decide whether there was an agreement.

## Subsumption Phase

- A judge makes a correspondence between specific facts and legal concepts.
- The truth value of specific facts is reflected to the truth value of concrete legal concepts.

For example, suppose a judge decides the truth value of agreement for the purchase of goods is true. Then, this agreement corresponds with “establishment of contract” in a legal term so the truth value of establishment of contract is true.

## Judgement Phase

- According to the truth value, a judge decides which legal rights or obligation exists.
- However, the truth value is three valued so some judgement could become “undefined” in a deductive logic and in this case, a judge cannot make a deductively correct decision.
- In litigation, a judge cannot allow to give a judgement of “I do not know” and is forced to make a decision.

To solve this undefined situation, **the Japanese Presupposed Ultimate Fact Theory** is invented.

## Introduction: JUF theory

- **The Japanese Presupposed Ultimate Fact Theory** (called “*Yoken-jijitsu-ron*” in Japanese, JUF theory, for short, in this presentation), has been mainly developed by judges in the Japanese Legal Training Institute.
- This is an interpretation of civil law from the judge’s view in order to handle the uncertainty in the court because of a lack of enough evidence.
- This theory has not been attracted by university scholars in law departments in Japan for years, but thanks to the Japanese Judicial System Reform, this theory started to be taught in law schools and interest in this theory has grown.



## Introduction: JUF Theory(continued)

- When I learned this theory, it surprised me very much that judges made such a rigorous framework without knowing mathematical formalizations.
- We propose a representation of legal knowledge which is more friendly of JUF theory to lawyers than a logic program and simultaneously executable by a meta-interpreter written in PROLOG.

## Note about the JUF theory

- The JUF theory is a theory of determination of conclusion used by judges under incomplete information **after both parties finish their activity in the proceedings.**
- The JUF theory divides conditions of legal rules into two categories; for one of which a plaintiff has a burden of persuasion and the other of which a defendant has a burden.
- **The JUF theory is not a theory of argumentation**, but both parties should obey the JUF theory to win the case, and the activities of both parties resembles an argumentation.
- Our (maybe too exaggerated) claim: **the activities at court are not argumentation, but persuasion activities toward judges (at least in Japan).**

## Working Example

- A plaintiff made a lease contract for his house between him and the defendant.
- The defendant let his sister use a room.
- The plaintiff claimed the contract was ended by his cancellation of the contract because of the defendant's sublease without permission.
- In turn, the defendant attacked the plaintiff's claim that his subleasing a room to her does not cause any abuse of confidence with the plaintiff because the time of use was very short.
- In turn, the plaintiff attacked the defendant's counter-argument that the defendant abused the confidence with the plaintiff because there were neighbors' complaints about noise from piano lessons during subleasing.

## Working Example(continued)

To handle the above case, we take into account the Japanese Civil Code Article 612,

- item 1 states that a lessee may not assign the lessee's rights or sublease a leased thing without obtaining the approval of the lessor, and
- item 2 states that if the lessee allows any third party to make use of or take profits from a leased thing in violation of the provisions of the preceding paragraph, the lessor may cancel the contract.

However, according to the Supreme Court case rule, item 2 is not applicable in exceptional situations where the sublease does not harm the confidence between a lessee and a lessor, and therefore the lessor cannot cancel the contract unless they prove the lessee's abuse of confidence.

# Reasoning by the JUF Theory for Working Example

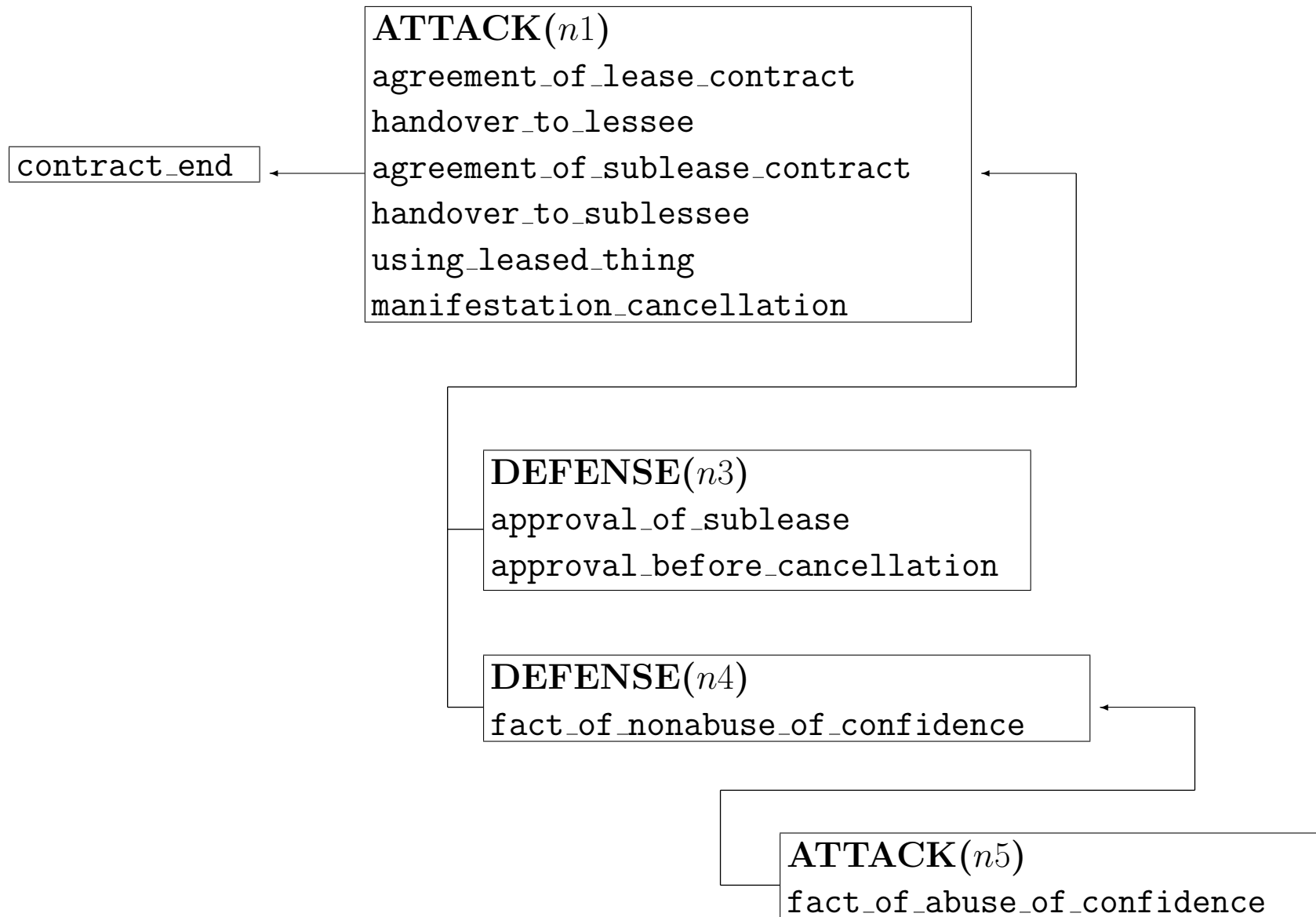
According to the JUF theory,

- To get a desired conclusion, based on item2, the plaintiff must firstly show that:
  - The contract with the defendant was established.
  - The contract ended because of the sublease to the defendant's sister.
- The desired conclusion for the plaintiff is obtained without proving other conditions (such as non-permission) if there were no counter-arguments,

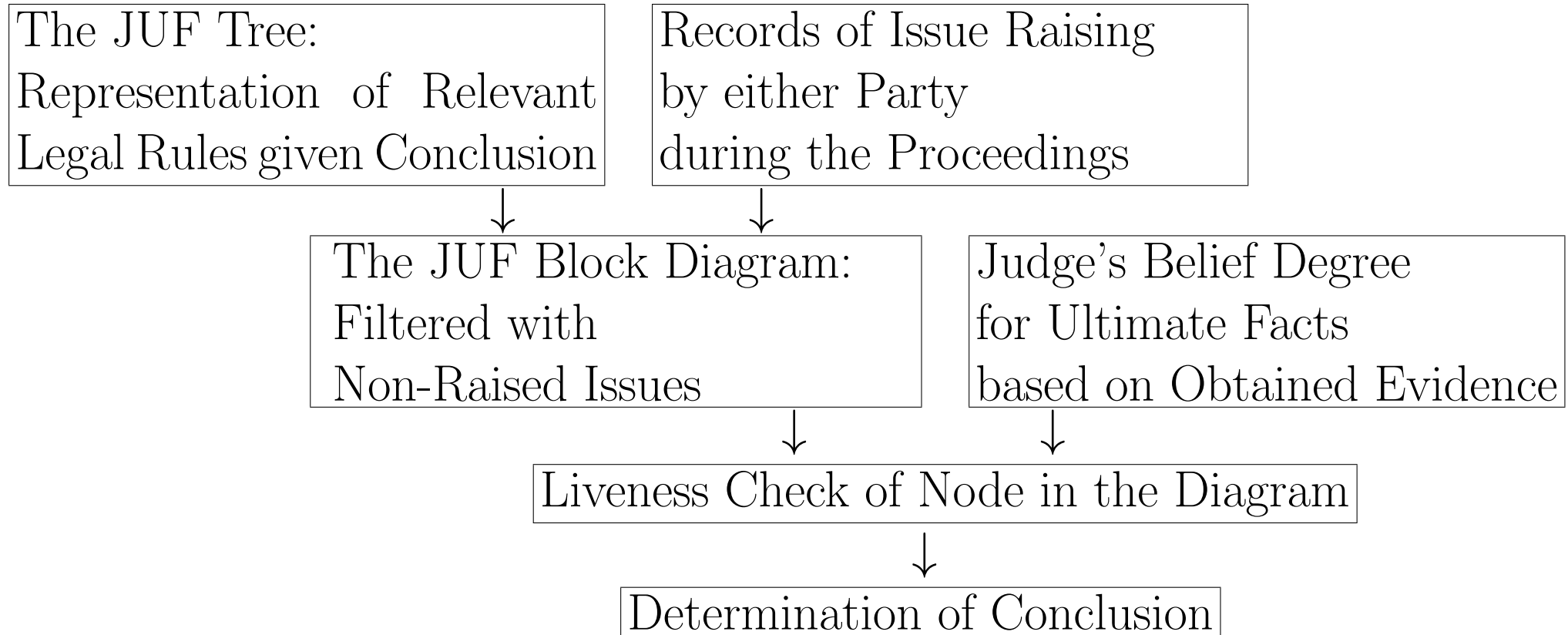
## Reasoning by the JUF Theory for Working Example(continued)

- However, according to the JUF theory, if one of the following counter-arguments is proved by the defendant, the desired conclusion is not obtained.
  - The plaintiff gave the defendant permission by item 1.
  - The defendant did not abuse the confidence of the plaintiff according to the above Supreme Court case rule.
- However, according to the JUF theory, even if there are some facts related to a non-abuse of confidence, the plaintiff can challenge defendant's counter-argument if the plaintiff gave other facts related to the abuse of confidence.

# Diagrammatic Representation of the Working Example



# Overview of PROLEG Architecture





# PROLEG

## (PROlog based LEGal reasoning support system)

- We implement the JUF theory by using logic programming technology.
- We call the system PROLEG (PROlog based LEGal reasoning support system).
- PROLEG rulebase consists of the following expression.
  - A **rule** of the form of Horn clauses (without negation as failure):  
 $H \Leftarrow B_1, \dots, B_n.$
  - An **exception** is an expression of the form  $exception(H, E)$  where  $H, E$  are atoms each of which is the head of rule.  
This expresses a **rebuttal** of  $H$  by  $E$ .
- PROLEG factbase consists of the records of activities and judge's confidence over basic facts.
- The above expressions fit lawyer's understanding of civil code nicely.

# Reflexion of Lawyers' Reasoning: Rule Format

Ito (Main Investigator of JUF theory as a lawyer)'s *openness* theory for JUF theory

- He divides ultimate facts in a condition of a rule into two categories; one category corresponds with facts which normally lead to the conclusion of a rule and the other category corresponds with facts which represent exceptional situation.
- Ito argues that a fact in the latter category is regarded as “open” so that the truth value is not decided until the counterpart explicitly prove the fact. Therefore, A judge only considers facts in the former category in order to draw a conclusion.

## Reflexion of Lawyers' Reasoning: Rule Format(continued)

- We could formalize about by logic programming with “Negation as Failure”, but the semantics may not be understandable for lawyers.
- Instead of direct representation of JUF theory in logic programming, we use a meta-term to re represent the JUF theory.
- We introduce “**exception**” predicate which takes two arguments, the former of which is the head of default rule and the latter of which is an exception of the rule.
- We introduce *intermediate concept* which aggregates some ultimate facts or intermediate concepts in order to summarize meaningful sets of these or if some concepts will be used for a higher level concept.

## Reflexion of Lawyers' Reasoning: Rule Format(continued)

cancellation\_due\_to\_sublease <=  
effective\_lease\_contract,  
effective\_sublease\_contract,  
using\_leased\_thing,  
manifestation\_cancellation.

effective\_lease\_contract <=  
agreement\_of\_lease\_contract,  
handover\_to\_lessee.

effective\_sublease\_contract <=  
agreement\_of\_sublease\_contract,  
handover\_to\_sublessee.

## Reflexion of Lawyers' Reasoning: Rule Format(continued)

```
exception(cancellation_due_to_sublease,  
          get_approval_of_sublease).
```

```
exception(cancellation_due_to_sublease,  
          nonabuse_of_confidence).
```

```
get_approval_of_sublease <=  
  approval_of_sublease,approval_before_cancellation.
```

```
nonabuse_of_confidence<=  
  fact_of_nonabuse_of_confidence.
```

# Demonstration

# Conclusion

Contributions: Proposal of PROLEG system

- which reflects lawyers' reasoning about law where exceptions are ignored unless it is explicitly stated.
- which handles legal actions at the court facts such as allegation, evidence production, plausibility and admission.

## Future Works

- We would like to pursue a legal knowledge representation which is more natural language-like syntax to enhance readability.
- We would like to pursue to develop a system which shows diagrammatic representation of reasoning in JUF theory.

### Ultimate Future Works:

- Implementing the full JUF theory in logic programming and making a support system for lawyers and an education system for law students.
- Restructuring of civil code from logic programming perspective.



## Conclusion on Juris-informatics

- I found that there are many opportunities to apply informatics/AI techniques to legal reasoning besides the above work which have not been explored because of the academic gaps between informatics/AI field and law.
- I believe that we should promote this kind of activity (letting researchers in informatics entering other field to get PhD or MsC) to make a great success of amalgamating informatics and other fields.