

Computers and Law

Lecture 1

Introduction

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Indirect Applications

Organizations

Law Offices

Law Enforcement Agencies

Legislatures

Indirect Applications

Communication

Scheduling

Accounting

Document Preparation

These applications provide indirect support for legal organizations as they do for non-legal organizations.

Law-Related Applications

Law Enforcement

- Criminological Databases

- Evidential Analysis

Individuals

- Forms and information from Governmental agencies

- Status checking, e.g. building permits

- Tax Preparation, e.g. Macintax and TurboTax

Generally, laws are implicit in the specification or implementation of such applications.

Explicit Representations of Law

Text-Based Tools

Storage and retrieval of legal texts
e.g. Lexis, Westlaw, GLIN

Semantic Information Processing Tools

Semantic Representation of Law
Automated Legal Reasoning
Monitoring and Enforcement

Our primary interest in this course is with representations of laws in a form that machines can manipulate and utilize.

Explicit Representation of Law

Textual Representations of Law

The vast majority of online legal information (e.g. cases, statutes, analysis) is encoded in the form of free-form text.

The *good news* is that such information can be stored cheaply and reliably and search can be done online rather than manually.

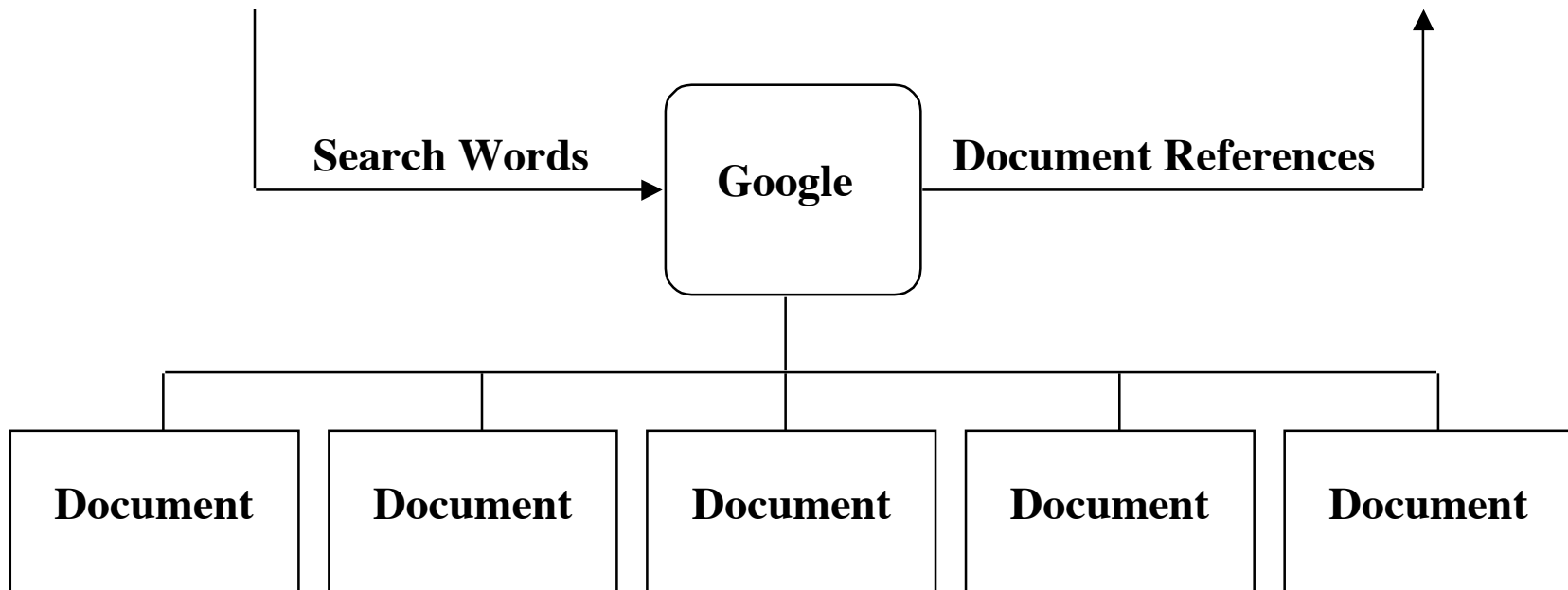
Westlaw®

LexisNexis™

Global Legal Information Network

The *problem* with this approach is that it provides inadequate search and does not support automated analysis.

Syntactic Search Engines



Too Many Results

Query:

Who is older -- Jane or John?

Search Words:

John

Jane

older

Document Fragments:

..John is older than Jane...

Jill wants to know whether John is older than Jane...

*..John is older than Jill...
...Jim is older than Jane...*

Too Few Results

Query:

Is it the case that John is older than Jane?

Document fragments:

..John is more advanced in years than Jane...

..Jane is younger than John...

...John is the father of Jane...

No Integration

Query:

Is it the case that John is older than Jane?

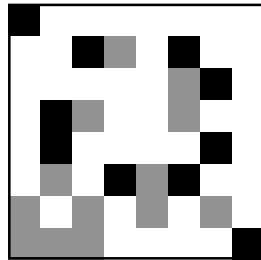
Documents:

...John is older than Jill...

...Jill is older than Jane...

Form versus Content

Syntactic View



Those who will not reason
Perish in the act;
Those who will
not act Perish for that
reason.

Semantic View



*Those who will not reason
Perish in the act;
Those who will not act
Perish for that reason.*

Semantically Structured Information

Free Form Text

Easy to use but limited capability
Too few answers, too many answers
Impossible to integrate effectively



Semantically Structured Information

Taxonomy, Attributes, Typed Values
Powerful search possible
Integration possible



Adding semantic tags allows machine to understand so it can search and integrate in meaningful ways.

Semantically Structured Data

Much data is now being recorded online in the form of databases and files in standard structured formats, such as tab-delimited text and XML.

manager

John	Ken
John	Kelly
Jill	Mary
Jill	Mike

office

John	MJH222
John	Cedar12
Jill	MJH222
Jill	420-032
Ken	MJH224
Kelly	Cedar14
Mary	MJH223
Mike	420-034

gender

John	male
John	male
Jill	female
Jill	female
Ken	male
Kelly	female
Mary	female
Mike	male

Semantically Structured Law

In addition, there are a number of proposals for representation of laws based on this data, e.g. Legol and Legal XML.

manager(x,y) □ office(x,z) □ office(y,z) □ □ legal

Automated Legal Reasoning

Legal Reasoning

One consequence of semantically structured representation of data and laws is the possibility of automated reasoning about laws and their applications.

- * Possible to prove that a specific activity is in violation with statute.
- * Possible to prove that one law and another are inconsistent or overlapping in general.

Fragments of Information

The red block is on the green block.

*The green block is somewhere **above** the blue block.*

*The green block is **not** on the blue block.*

*The yellow block is on the green block **or** the blue block.*

*There is **some** block on the black block.*

Conclusions

The red block is on the green block.

The green block is on the yellow block.

The yellow block is on the blue block.

The blue block is on the black block.

The black block is directly on the table.

Reasoning By Pattern

All Accords are Hondas.

All Hondas are Japanese.

Therefore, all Accords are Japanese.

All borogoves are slithy toves.

All slithy toves are mimsy.

Therefore, all borogoves are mimsy.

All x are y.

All y are z.

Therefore, all x are z.

Unsound Reasoning Pattern

Pattern

All x are y.

Some y are z.

Therefore, some x are z.

Good Instance

All Toyotas are Japanese cars.

Some Japanese cars are made in America.

Therefore, some Toyotas are made in America.

Not-So-Good Instance

All Toyotas are cars.

Some cars are Porsches.

Therefore, some Toyotas are Porsches.

Deduction - Sound

Logical Entailment/Deduction:

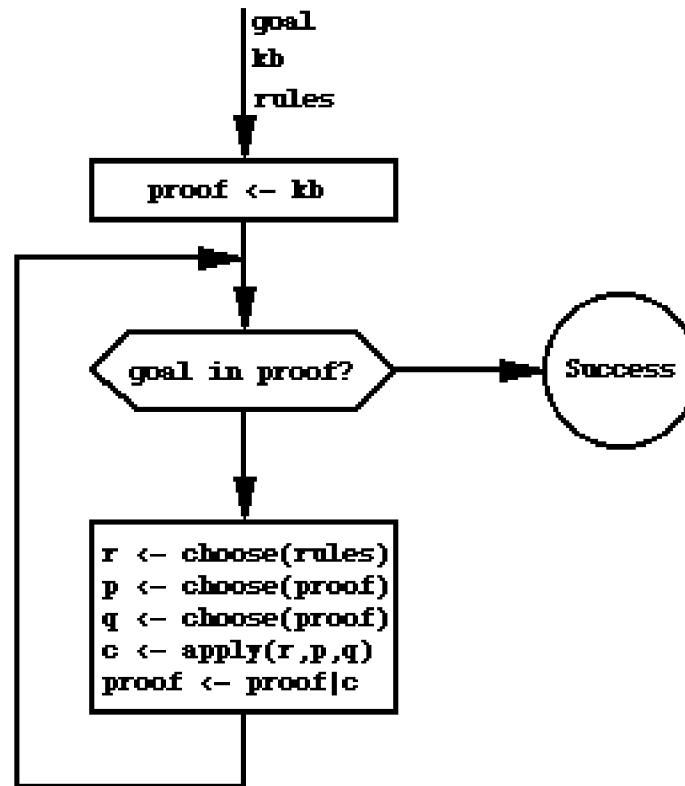
Does not say that conclusion is true in general
Conclusion true *whenever* premises are true

Leibnitz: *The intellect is freed of all conception of the objects involved, and yet the computation yields the correct result.*

Russell: *Math may be defined as the subject in which we never know what we are talking about nor whether what we are saying is true.*

Good News: There is a finite set of patterns that generate all logical conclusions from any premise set!

Automated Reasoning



Analogical Reasoning

Much legal reasoning is analogy on a current case to a previous case.

Analogical Reasoning is not sound.

A wire is like a pipe.

Resistance in a pipe decreases quadratically with diameter.

So, resistance in wire decreases quadratically with diameter.

Now try price.

How do we justify analogical conclusions?

Types of Reasoning

- (1) Deductive: application of laws to data and analysis of laws to detect inconsistencies and overlap
- (2) Analogical: similarity comparison of cases to previous cases to establish precedents

Automatic Monitoring and Enforcement

Situated Examples

In some cases, data from sensors can help individuals in complying with applicable regulations.



Modes of Use

Monitoring and Enforcement

Monitoring and Compliance

Computer-Mediated Activity

Increasingly, our activities are mediated through computers:

governmental websites

electronic commerce



Generalized Law

Governmental Regulations

Business Rules

Contracts

Personal Ethical Rules

Rules of Thumb

History

Early Themes

Jurimetrics

Loevinger: Jurimetrics: The Next Step Forward, 1949.

Computers and Law

Lucien Mehl: “Automation in the Legal World”, Conference on Mechanisation of Thought Processes, Teddington, 1958.

Buchanan, Headrick: Some Speculation About Artificial Intelligence and Legal Reasoning, 1970.

J. Meldman: A Preliminary Study in Computer-Aided Legal Analysis, 1975.

More Themes

Logical Representation and Reasoning

L. Thorne McCarty: Taxman, Harvard Law Review, 1977.

M. Sergot, R. Kowalski: British Nationality Act, 1986.

Automated Case-Based Reasoning

Anne Gardner: An AI Approach to Legal Reasoning, 1984.

Ashley, Rissland: A Case-Based Approach to Modeling Legal Expertise, 1984.

Open Texture (“*No vehicles in the park.*”, “*principal residence*”)

Kathryn Sanders: Representing and Reasoning About Open-Textured Predicates, 1991.

More Themes

Deontic Logic (“No person *should* park on the sidewalk.”)

G. vonWright: Norm and Action, 1963.

R.J. Wieringa, J.-J.Ch. Meyer: Applications of Deontic Logic in Computer Science: A Concise Overview.

Argumentation

Thorne McCarty: Some Arguments About Legal Arguments”, 1997.

Automated Compliance and Enforcement

Conferences and Journal

International Conference on Logic, Informatics, Law, 1981.

First *International Conference on AI and Law* in 1987
organized by Carole Hafner and Don Berman. Biennial.

Journal of Artificial Intelligence and Law (JAIL), 1992.

Education

P. Brest, T. Heller, R. Mnookin: Stanford Law School seminar on AI and Law, 1984.

E. Rissland: Harvard Law School seminar, 1985.

D. Berman and C. Hafner: Northeastern, 1987.

Organizations

Guy Vandenburghe: Computer/Law Institute, Vrije Universiteit, 1985.

Carole Hafner and Don Berman: Center for Computer Science and Law, Northeastern, 1987.

International Association of AI and Law, 1991,
<http://www.iaail.org/>

Law in Computer Science

Computer Science/Information Science

Computers and Computer-Driven Devices

Information

Representation

Processing

Traditional Emphasis on Behavior

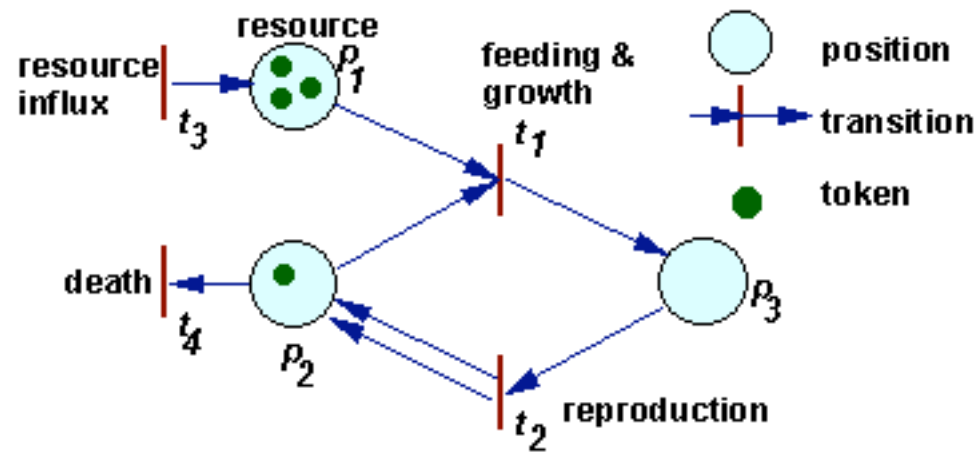
Single “agent”

Multiple “agents” - distributed systems

Programming Languages

```
public void recursion(double k, int m, Graphics tempg)  
  {if (m == 1) forward(k, tempg);  
    else {for (int i = 1; i <= myModel.numberOfTurns; i++) {  
          turn(myModel.theTurn(i - 1));  
          recursion(k / myModel.segments, m - 1, tempg);}  
  turn(myModel.theTurn(myModel.numberOfTurns));}
```

Petri Nets



Law

Traditional Emphasis on Behavior

Multiple “agents”

Single “agents”

Computers are dullards, do nothing unless told

People are active, do things unless stopped

Emphasis, therefore, on constraints.

But some laws prescribe action rather than forbidding action.

Recipes

FRESH CORN SOUP

This soup is particularly delicious when made with sweet white corn. Serve it as an appetizer or with an avocado and orange salad for a luncheon or a light dinner.

1 teaspoon corn oil
1 small onion, chopped
1 small fresh Poblano chili* or Anaheim (California) chili*, chopped
4 garlic cloves, chopped
1 teaspoon ground cumin
6 ears corn
1 3/4 cup canned unsalted chicken broth
1 1/2 cups (about) low-fat milk
Chopped fresh cilantro

Heat oil in heavy large saucepan over medium-high heat. Add onion, chili, garlic and cumin and sauté until onion and chili are tender, about 10 minutes.

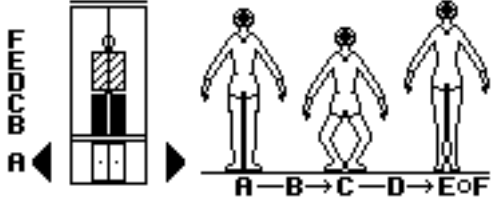
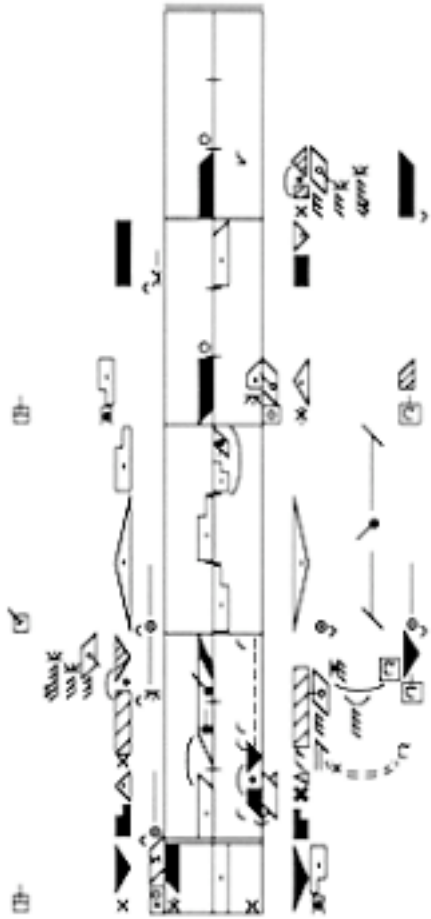
Cut corn kernels from cobs. Add corn to pot. Stir in chicken broth. Cover and simmer over medium-low heat until corn is very tender, about 45 minutes or less. Transfer to processor and purée. Add enough milk to thin to desired consistency. Return to pot; stir to heat through (do not boil). Season to taste with salt and pepper. Ladle into bowls; garnish with cilantro and serve.

Serves 4.

Musical Scores



Labanotation



Law

All are concerned with constraints on behavior.

Is law different in any way from these others? How so?

Computer Science in Law

Legal Setting

Functions of Law:

Codify mores.

Help people predict consequences of their actions.

Help people anticipate the actions of others.

Functions of Legal Profession

Help people comply with and exploit the law.

Legal Technology for Legal Professional

Help advocates and mediators deal with disputes.

Help enforcement agents understand applicable regulations.

Help lawmakers analyze regulations and formulate new legislation.

Clients Not Lawyers

Technology should help everyone, not just professionals.



Help affected individuals find regulations that govern their behavior and comply with and/or exploit those regulations.

<http://logic.stanford.edu/classes/cs204/>