Value of Information and Control

Computer Science cpsc322, Lecture 35

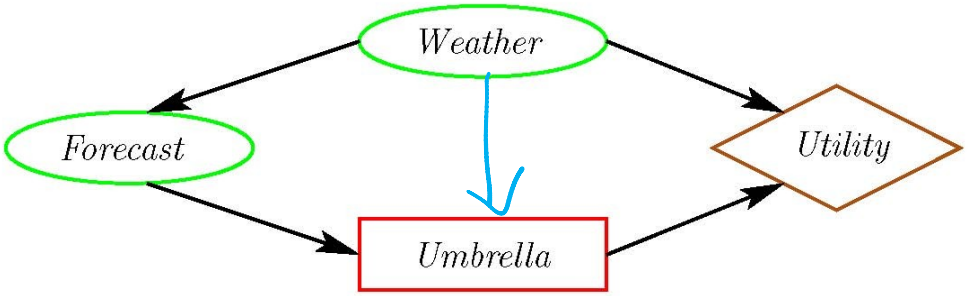
(Textbook Chpt 9.4)

April, 14, 2010

Lecture Overview

- Value of Information
- Value of Control
- Course Summary

Value of Information



- What would help the agent make a better *Umbrella* decision?

- The value of information of a random variable X for decision D is:

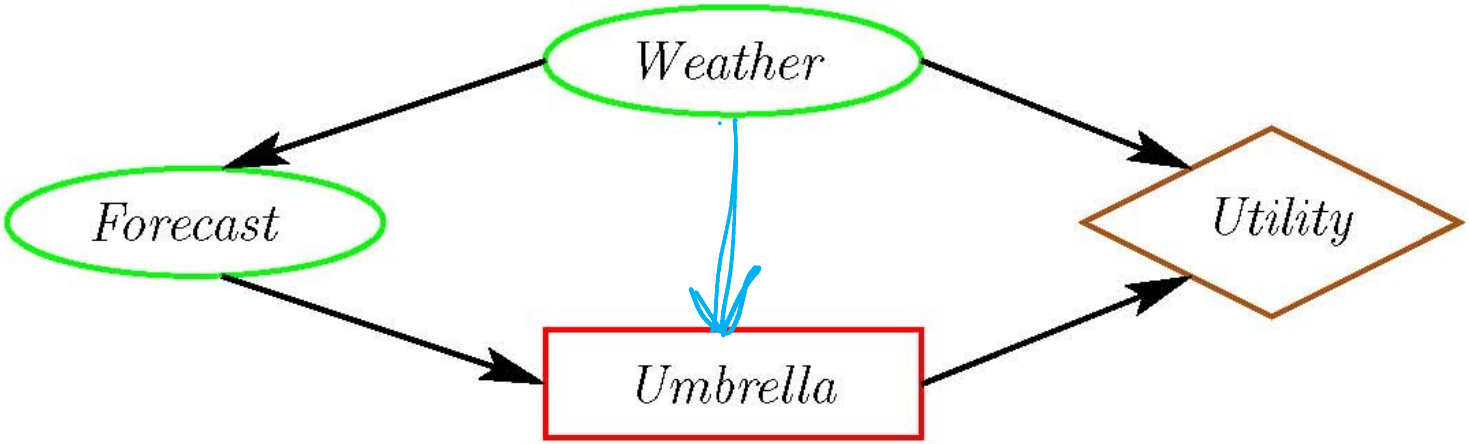
$EU(\text{Knowing } X) - EU(\neg\text{Knowing } X)$

the utility of the network with an arc from X to D **minus** the utility of the network without the arc.

- Intuitively:
  - The value of information is always ≥ 0
  - It is positive only if the agent changes the policy

Value of Information (cont.)

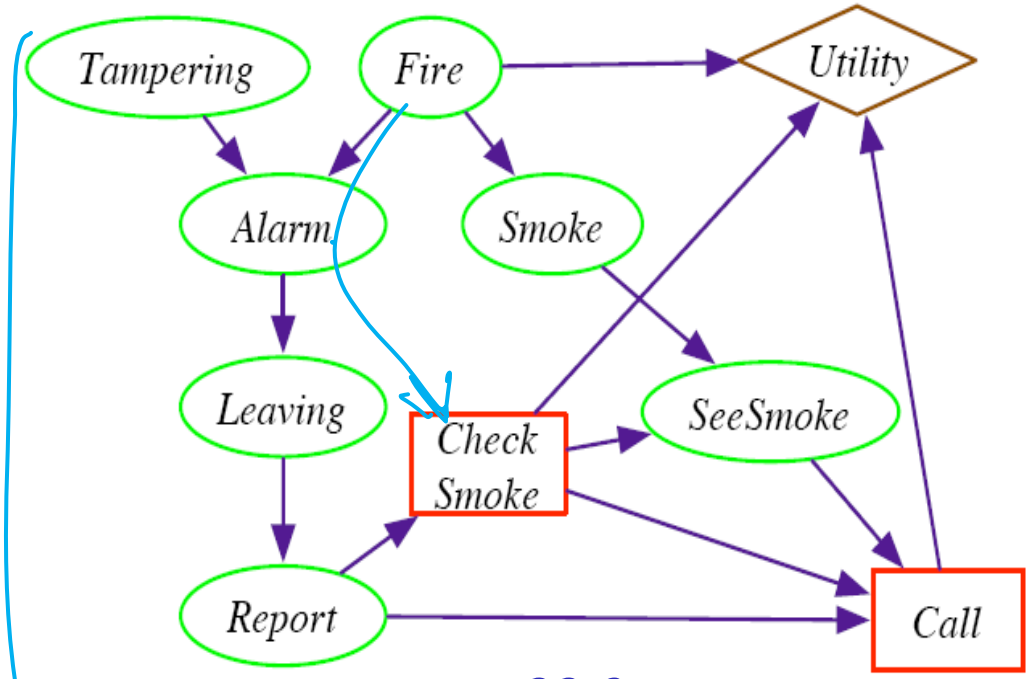
- The value of information provides a bound on how much you should be prepared to pay for a sensor. How much is a **perfect** weather forecast worth?



- Original maximum expected utility: 77
- Maximum expected utility when we know Weather: 91
- Better forecast is worth at most: 14

Value of Information

- The value of information provides a bound on how much you should be prepared to pay for a sensor. How much is a **perfect** fire sensor worth?



- Original maximum expected utility: -22.6
- Maximum expected utility when we know Fire:
- Perfect fire sensor is worth: 20.6

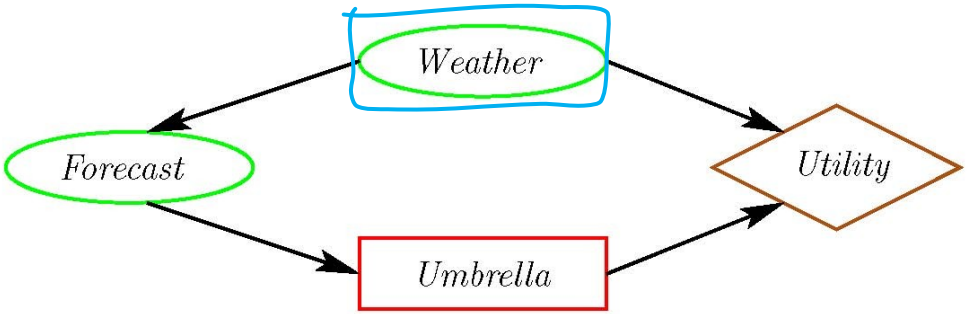
-2 - (-22.6)

AIspace

Lecture Overview

- Sequential Decisions
  - Optimal Policy
  - Variable Elimination
- Value of Information
- **Value of Control**

Value of Control



- What would help the agent to make an even better *Umbrella* decision? To maximize its utility.

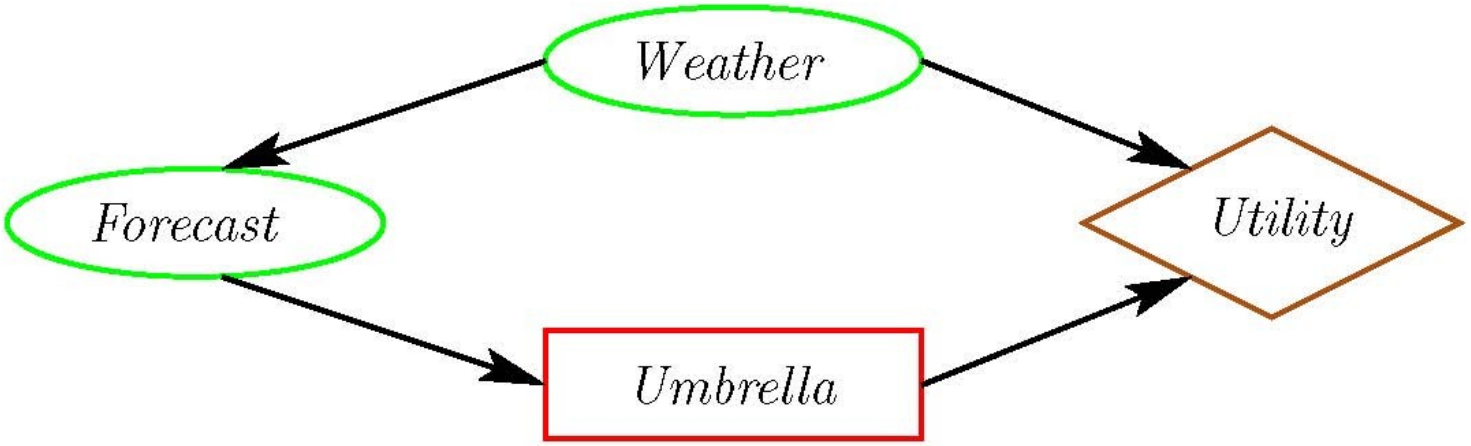
Weather	Umbrella	Value
Rain	true	70
Rain	false	0
noRain	true	20
noRain	false	100

- The value of control of a variable X is :

the utility of the network when you make X a decision variable **minus** the utility of the network when X is a random variable.

Value of Control

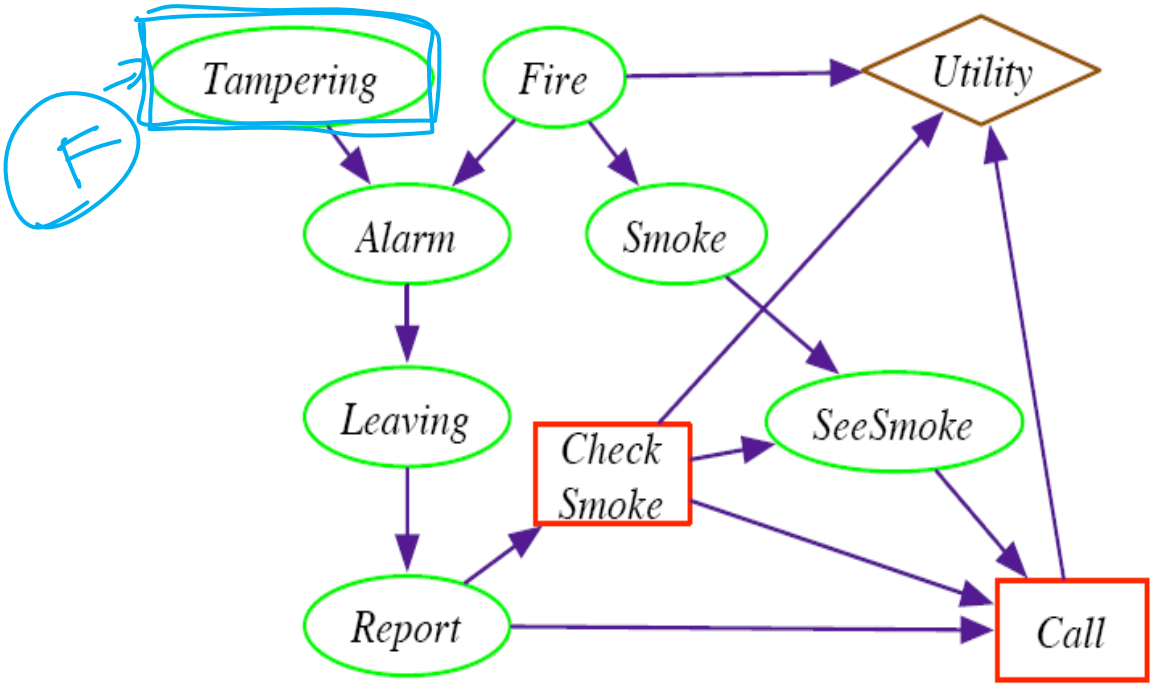
- What if we could control the weather?



- Original maximum expected utility: 77
- Maximum expected utility when we control the weather: 100
- Value of control of the weather: 23

Value of Control

- What if we control Tampering?



- Original maximum expected utility: -22.6
- Maximum expected utility when we control the Tampering: -20.7
- Value of control of Tampering: 1.9
- Useful to estimate how much it is worth to add…..

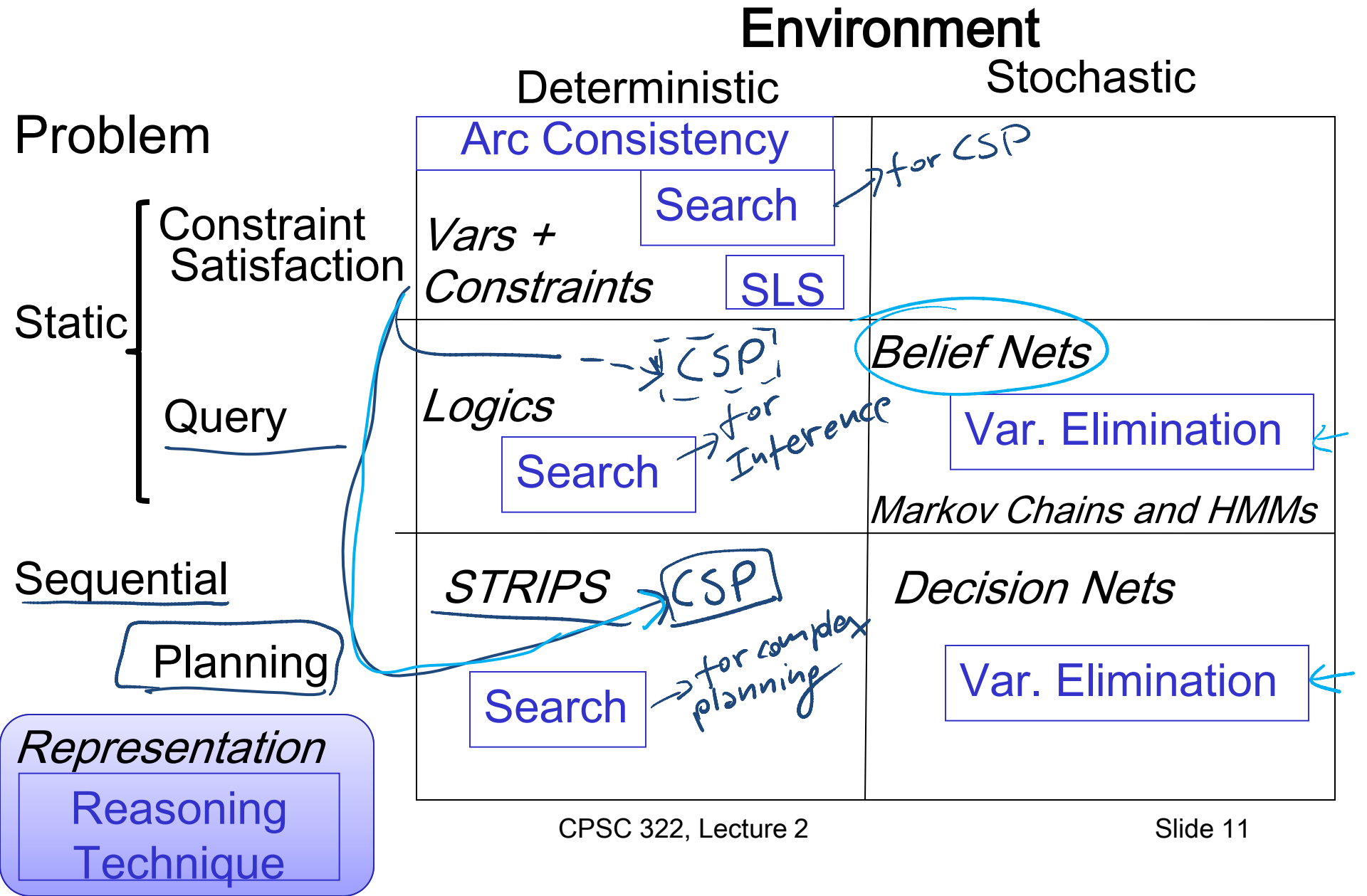
security to assure that tampering is always = F

Learning Goals for today's (and Mon) classes

You can:

- Represent **sequential decision problems** as decision networks. And explain the **non forgetting property**
- Verify whether a **possible world satisfies a policy** and define the **expected value of a policy**
- Compute the **number of policies** for a decision problem
- **Compute the optimal policy** by Variable Elimination
- Compute value of **information** and **control**

Cpsc 322 Big Picture



After 322 .....

340

→ Machine Learning

→ Knowledge Acquisition

→ Preference Elicitation

322 big picture

Mostly

14 422

	Deterministic	Stochastic
CSPs	*Vars + Constraints* Techniques to study SLS Performance	
Query	*Logics* → *First Order Logics* → *Temporal reasoning* → *Description Logics*	*Belief Nets* More sophisticated reasoning *Markov Chains and HMMs*
Planning	*Hierarchical Task Networks* *Partial Order Planning*	*Markov Decision Processes and Partially Observable MDP* More sophisticated reasoning

Where are the components of our representations coming from?

The probabilities?

The utilities?

The logical formulas?

From people and from data!

Applications of AI

TA Evaluation Forms

Please, evaluate only TAs you have interacted with for this course

Teaching Assistants

MSc

- **Hammad Ali** hammada@cs.ubc.ca

PhD

- **Kenneth Alton** kalton@cs.ubc.ca *(will be starting Jan 18)*

PhD

- **Scott Helmer** shelmer@cs.ubc.ca

MSc

- **Sunjeet Singh** sstatla@cs.ubc.ca

Announcements

- **Fill out Online Teaching Evaluations Survey.**
- **It closes on Apr 17th**

- **FINAL EXAM:** Mon Apr 19, 12:00-3:00 pm DMP 310 (NOT regular room)

6-8 pts ~20 pts

Final will comprise: 10 -15 short questions + 3-4 problems

- Work on all **practice exercises** VISTA assessments
- While you revise the **learning goals,** work on **review questions** - I may even reuse some verbatim ☺
- **Come to remaining Office hours!** I am offering two hours on Fri (10-12)