Deciding the model's features for a logic of information

Jonathan Spring
UCL
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Motivation

We weren't satisfied with the existing logics of information

Luciano Floridi. 2011. The philosophy of information . Oxford University Press.
Keith Devlin. 1995. Logic and information. Cambridge University Press.
Jon Barwise and Jerry Seligman. 1997. Information flow: the logic of distributed systems. Cambridge University Press.
Seligman 1991. Perspectives: A relativistic approach to the theory of information. Ph.D. Dissertation. The University of Edinburgh.

Motivation for the Motivation

If we can reason about (semantic) information formally, we can probably help decide which information you should get, use, and prioritize
Useful for (examples):
- Investigations
- Automation
- Deciding among logics or models

But This is Thorny

"This particular article documents 130 definitions of data, information, and knowledge formulated by 45 scholars, and maps the major conceptual approaches for defining these three key concepts."

– Chaim Zins. 2007. Conceptual approaches for dening data, information, and Knowledge. Journal of the American society for information science and technology 58, 4 (2007), 479-493.

So How to Pick?

Blind spots

Overly narrow focus
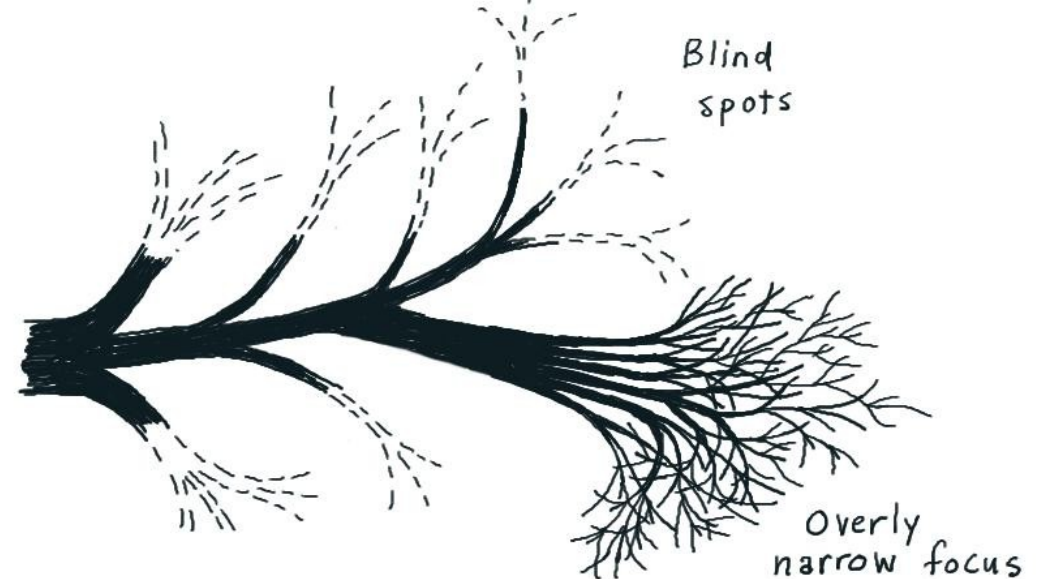
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Prioritize our goal

- Decision making during a forensic investigation

Select features such that this is achievable

Why Can't I be Super Clever and Pick All the Features?

A short trip to the history of maths and logic
- Russell and Whitehead tried to put all the features into their set logic (early 1900s)
Unfortunately:
- Gödel
- Wittgenstein

Must focus on our goal – Human decision support

Decision theory is its own field
- Generally works on "utility" to the agent
  - Let's try to work backwards to there, so I can be lazy and use existing decision theory

Information to Utility?

That's actually also it's own field already
- "Value of Information"
  - Jeffrey M. Keisler, Zachary A. Collier, Eric Chu, Nina Sinatra, and Igor Linkov. 2014. Value of information analysis: the state of application. Systems and Decisions Environment 34, 1 (2014), 3-23.
  - Ronald Howard. 1966. Information value theory. IEEE Transactions on Systems Science and Cybernetics, 2, 1 (1966), 22-26.

Translate:
Information to Information?

"Information" is notoriously over-loaded
Reduction of uncertainty ≠ Semantics
- VoI operates on reduction of uncertainty
- Situations and humans work on meanings

Insight

Treat semantic information as the difference between (conceptual) models
Treat VoI as the reduction in uncertainty by using one conceptual model vs. another for predictions
- This makes terms commensurate, but we still don't have a logic

And now I need to know what "models" means...

There are actually three kinds
- Logic
- Maths
- Conceptual

Data warrants Models$_{MC}$

Models are developed from data by humans
• Avoid long tangent on how exactly

A logic of data as a resource for building models (and thus information) would give us a chain from a formal logic to decisions!

Relevant features of Data

- Observables about phenomena (Bogen and Woodward 1988)
  - So data are in the language they're observed in
  - Prior information logics treat info as existing in the world, so this is a departure point
- Data elements can be combined
  - But combinations are idiosyncratic
    - i.e., a general commutative binary operation

Impact on Model$_L$ Features

- Resource logic matches with the dynamics we want to represent in data
- However, resource logic generally doesn't represent transfer of elements to or from an agent
  - Epistemic logic addresses this

What to do about "in a language"

Prior information logics include one of:
- context
- "situation"
- "level of abstraction"

Which was often clumsy or unspecifiable in practice
I'm not sure a logic can formally capture it adequately
- Need to be handled by people making the models?

Questions?

Thanks